AGENDA

Three Rivers Community Plan Update
Community Meeting
PLEASE NOTE MEETING LOCATION AND TIME CHANGE
Monday January 11, 2016 6:00 P.M.
Three Rivers Veterans Memorial Building
43490 Sierra Drive
Three Rivers, CA

... service with pride.

Resource Management Agency

1. Welcome and Introduction.
2. Project Status, Information and Discussion of Special Topics Review Schedule.
    (a) Special Topics Review Schedule 2015-16.
    (b) December 14, 2015 Summary Meeting Notes.
    (c) Agenda Information.
3. Discussion of Special Topics.
    (a) Flooding (FEMA/Primary and Secondary Flood Plain Zoning).
    (b) Emergency Preparedness and Access.
4. Other Topics as Related.
5. Topics for the Next Meeting.
    (a) Development on Slopes.
    (b) Development Standards.
6. Next Steps.
7. Adjournment: Next Meeting February 8, 2016 at 6:00 P.M.

Three Rivers Community Plan Website address:
http://www.tularecounty.ca.gov/rma/index.cfm/planning/three-rivers-community-plan-update/

2. Project Status, Information and Discussion of Special Topics Review Schedule.

(a) Special Topics Review Schedule 2015-16.

Three Rivers Community Plan Update
Special Topics Review Schedule
Three Rivers Veterans Memorial Building
43490 Sierra Drive
Three Rivers, CA

... service with pride.

Resource Management Agency

December 2015- April 2016 (Meetings 7:00 P.M. to 9:00 P.M.)

In order to address key special review topics, we have set a strict schedule to review the following topics to facilitate the preparation of the Draft Three Rivers Community Plan Update. Discussion materials associated with each special review topic will be posted in advance of each meeting. As with all of our community plans, public input is of paramount importance. Comments received from the community will be considered while developing local planning policies for the Three Rivers Community Plan Update.

December 14, 2015
Land Use Plan Update
Transportation and Circulation Plan Update

January 11, 2016
Flooding (FEMA/Zoning)
Emergency Preparedness and Access

February 8, 2016
Development on Slopes
Development Standards

March 14, 2016
Noise
Water Quality and Quantity

April 11, 2016
CEQA Appendix G Considerations

Three Rivers Community Plan Website address:
http://www.tularecounty.ca.gov/rma/index.cfm/planning/three-rivers-community-plan-update/

(b) December 14, 2015 Summary Meeting Notes.

Three Rivers Community Plan Update Meeting Notes-December 14, 2015

We appreciated the excellent feedback that we got from the community members who attended the meeting. The following is a summary of some of the major points that were communicated to staff during the meeting:

- There was a general consensus expressed that the proportion and existing distribution of land uses where adequate to accommodate future growth in the community.
- There was an interest in developing a town center concept in the village market area that would consider opportunities for a mixed-use land use concept including a community center with a mixture of residential and commercial uses with a walkability component.
- The concept of a community park with restroom facilities was raised at the meeting was generally supported. There was discussion on whether the park would contain an active recreation component such as a playground (tot-lot) or function more as a passive area for walking.
- There was general interest in examining a commercial area that would be a cohesive commercial business district roughly between the Three Rivers post office and the Chamber of Commerce areas along SR 198 including pedestrian facilities.
- There was interest expressed regarding zoning and development standards relating to building heights, determining an appropriate scale of square footage in certain areas to maintain community character, and looking at some type of architectural design standards.
- There was interest expressed in appropriate lighting standards to promote dark skies. Staff indicated that any topics regarding development or design type considerations would be discussed as part of the development standards agenda item at the February 8, 2016 meeting.
- There is interest in developing a bicycle pedestrian path along SR 198 the community and also a bicycle/pedestrian path on North Fork Dr. Staff indicated that it is important to note that any type of bicycle and pedestrian facility proposed along SR 198 would be coordinated with Caltrans and that the ultimate authority to determine whether or not that type of project would be feasible would rest with Caltrans regarding any improvements on SR 198.
- There were concerns expressed regarding flood prone areas on the western edge of the Three Rivers UDB along SR 198 and on South Fork Drive just southeast of Heidi Drive.
- There was interest expressed in constructing a left turn lane from westbound SR 198 to Old Three Rivers Drive, including enhanced safety striping and intersection lighting.

(c) Agenda Information.

AGENDA INFORMATION

Three Rivers Community Plan Update
Community Meeting
Monday January 11, 2016 6:00 P.M.
Three Rivers Veterans Memorial Building
43490 Sierra Drive
Three Rivers, CA

3. Discussion of Special Topics.

(a) Flooding (FEMA/Primary and Secondary Flood Plain Zoning).

1. Tulare County Flood Control Master Plan.

Background/Overview:
The flood control Master Plan is an element of the Tulare General Plan. It includes area wide engineering studies to provide a basis in planning for specific flood control projects. This Element of the General Plan addresses issues particularly related to flood control along natural watercourses in Tulare County. The plan indicates that adequate waterway capacities should be maintained through control of land development, consistent with storm runoff rates which can be expected.

The Tulare County Flood Control Master Plan also contains historical dates on flooding, including locally prepared maps of areas subject to flooding, and sites that have been repeatedly damaged by flooding. Historical information about flood hazards from the United States Army Corps of Engineers (USACE) is also included in the Flood Control Master Plan as noted in its selected bibliography on page 58. According to the Army Corp of Engineers Cal EMA now controls authorship of any studies used to process flood information from the USACE by 1986.

Considerations: Are there flooding or stormwater drainage concerns that need to be identified in the Three Rivers Community Plan Update? What type of studies, public works improvements or maintenance programs would be feasible and appropriate to address community concerns regarding flood control management?

2. Flood Damage Prevention Ordinance.
3. FEMA/FIRM Summary (Zones, Descriptions, Flood Risk, Encroachment, and Mitigation).
4. FEMA FIP Requirements.
5. Tulare County Zoning Districts F-1 Primary Flood Plain Zone and F-2 Secondary Flood Plain Combining Zone (Descriptions, Flood Risk, Encroachment, and Mitigation).
6. General Plan Policies (Flooding).

Background/Overview:

"Official floodplain maps are maintained by the Federal Emergency Management Agency (FEMA). "Floodplain" or "flood-prone area" means any land area susceptible to being inundated by water from any source. "Base Flood" is the flood having a one percent chance of being equaled or exceeded in any given year. "One-hundred-year flood" or "100 year flood" has the same meaning as "base flood." "Special flood hazard area" is the land in the floodplain subject to a one percent or greater chance of flooding in any given year. "Floodway" means the channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot. The floodway is delineated on the Flood Boundary Floodway Map, on maps adopted by the State Reclamation Board when acting within its jurisdiction, and on the County Zoning Map (signified by the F-1 Primary Flood Plain Zone). The F-2 Secondary Flood Plain Combining Zone which is intended for application to those areas of the County which lie within the fringe area or setback of the flood plain and are subject to less severe inundation during flooding conditions than occur in the F-1 Zone.

FEMA determines areas subject to flood hazards and designates these areas by relative risk of flooding on a map for each community, known as the Flood Insurance Rate Map (FIRM). These areas are designated as Zone A, AO, A1-A30, AE, A99, or AH on the FIRM. A 100-year flood is considered for purposes of land use planning and protection of property and human safety. The boundaries of the 100-year floodplain are delineated by FEMA on the basis of hydrology, topography, and modeling of flow during predicted rainstorms.

The County of Tulare has taken steps to be a part of the National Flood Insurance Program (NFIP), which means the County of Tulare agreed to manage flood hazard areas by actively adopting minimum regulatory standards as set forth by Federal Emergency Management Agency (FEMA). The National Flood Insurance Program (NFIP) is administered by the (FEMA) to offer flood insurance to properties located in special flood hazard areas (SFHAs). Information about the NFIP, is available at the following website: www.fema.gov. As part of the county's participation in the NFIP, individuals are eligible to obtain flood insurance. Information regarding flood control in Tulare County is available at the County of Tulare Resource Management Agency at the following website: http://www.tularecounty.ca.gov/rma/index.cfm/public-works/engineering/flood-control/. On June 16, 2009, Tulare County adopted the new Digital Flood Insurance Rate Maps (DFIRMs). Information is available to determine if a property is located in a SFHA by using the following FEMA Map Service Center link as follows: https://msc.fema.gov/portal.

Considerations: The Three Rivers Community Plan update process will utilize the official FEMA Floodway maps, the Tulare County Flood Control Master Plan the County Flood Damage Prevention Ordinance, the County Zoning Map (signified by the F-1 Primary Flood Plain Zone and F-2 Secondary Flood Plain Combining Zone), and policies from the Tulare General Plan along with other data to evaluate potential flood hazards and provide recommendations in the community plan regarding flood control management.

What questions are there regarding the existing regulations and how they are applied? Are there other considerations in addition to these regulations that need to be evaluated? Are there other policy considerations in addition to the General Plan Policies that that need to be evaluated?

7. Agency Responsibilities and Coordination (County of Tulare, FEMA, Reclamation Board/Central Valley Flood Protection Board , California Fish & Wildlife, Army Corps of Engineers).

Background/Overview: Local, state, and federal agencies with responsibility for flood protection include; California Department of Water Resources, US Department of Interior, Geological Survey, Corp of Engineers, Department of the Army, Tulare County Flood Control District, Tulare County RMA Planning Division, Three Rivers Soil Conservation District, Natural Resource Soil Conservation Service Department of Agriculture, Division of Soil Conservation State of California, Bureau of Reclamation, Southern San Joaquin Valley Flood Control and Water Conservation Association, California Regional Water Quality Control Board, Central Valley Region, California Department of Conservation, Kings River Conservation District, California Water Resources Control Board, and the Kaweah Delta Water Conservation District.

Considerations: Are there questions regarding the standards and procedures of each jurisdiction responsible for flood control management?

3. Discussion of Special Topics.

(b) Emergency Preparedness and Access (County of Tulare OES)

1. Tulare County Disaster Preparedness Guide (2011).

Background/Overview: Tulare County's Office of Emergency Services (OES) is the County's emergency management agency, responsible for coordinating multi-agency responses to complex, large-scale emergencies and disasters within Tulare County. The Office of Emergency Services is the conduit for information and resource coordination between the State of California and the local governments of Tulare County (the Tulare Operational Area), as defined in California's Standardized Emergency Management System (SEMS). The County OES has prepared a Disaster Preparedness Guide to help prepare County Residents in the event of an emergency or disaster.

Considerations: Emergencies and Disasters include but are not limited to the following situations: Wildfire, Severe Weather and Storms, Influenza, Earthquakes, Dam Failure, and Hazardous Materials. Emergency Response and Preparedness involves the following considerations: Protection / Prevention, Preparedness, Response, Recovery, and

mitigation. What aspects of emergency operations planning and response are important to address in the Three Rivers Community Plan Update, i.e.: Emergency Operations Planning and Response, Flood and Fire Hazards Prevention, Emergency Access (Ingress, Egress, Evacuation Procedures, Shelter-In-Place), Community Signage and Address Signage?

2. Tulare County Operational Emergency Operations Plan Overview/General Plan Policies (Fire, Flood, and Emergency Response/ SRA Fire Safe Regulations)
3. Tulare County General Plan Health and Safety Element.

These items are included for reference regarding existing plans, policies, and programs for emergency response and preparedness.

3. Discussion of Special Topics.

(a) Flooding (FEMA/Primary and Secondary Flood Plain Zoning).

1. Tulare County Flood Control Master Plan.
2. Flood Damage Prevention Ordinance.
3. FEMA/FIRM Summary (Zones, Descriptions, Flood Risk, Encroachment, and Mitigation).
4. FEMA FIP Requirements.
5. Tulare County Zoning Districts F-1 Primary Flood Plain Zone and F-2 Secondary Flood Plain Combining Zone (Descriptions, Flood Risk, Encroachment, and Mitigation).
6. General Plan Policies (Flooding).
7. Agency Responsibilities and Coordination (County of Tulare, FEMA, Reclamation Board/Central Valley Flood Protection Board , California Fish & Wildlife, Army Corps of Engineers). (Discussion).

3. Discussion of Special Topics.

(b) Emergency Preparedness and Access (County of Tulare OES)

1. Tulare County Disaster Preparedness Guide (2011).
2. Tulare County Operational Emergency Operations Plan Overview/General Plan Policies (Fire, Flood, and Emergency Response/ SRA Fire Safe Regulations)
3. Tulare County General Plan Health and Safety Element.

3. Discussion of Special Topics.

(a) Flooding (FEMA/Primary and Secondary Flood Plain Zoning).

1. Tulare County Flood Control Master Plan.

TULARE
COUNTY
FLOOD
CONTROL
DISTRICT

FLOOD CONTROL MASTER PLAN

FOR THE COUNTY OF TULARE CALIFORNIA

TULARE
COUNTY
FLOOD
CONTROL
DISTRICT

FLOOD CONTROL MASTER PLAN

FOR THE COUNTY OF TULARE CALIFORNIA

Letter of Transmittal

MURRAY, BURNS & KIENLEN
Consulting Civil Engineers

Angus Norman Murray, C.E.
Joseph I. Burns, C.E.
Donald E. Kienlen, C.E.

Jerry J. Elliott, C.E.

V. Vann *M.E. Waldron*
R.S. Dodds *G. Phillips*

THE SPINK CORPORATION

Robert C. Hall, C.E.
Duane T. Thompson, C.E.

SIERRA HYDROTECH

Jack F. Hannaford, C.E.
Richard H. Bush

MURRAY, BURNS & KIENLEN Consulting Civil Engineers
600 Forum Building 1107 Ninth Street Sacramento, California

THE SPINK CORPORATION 720 F Street Sacramento, California

June 4, 1971

Honorable Board of Supervisors
Tulare County Flood Control District
County Civic Center
Visalia, California 93277

Gentlemen:

In accordance with an agreement dated June 23, 1970, as awarded, we are pleased to transmit our proposed Flood Control Master Plan for Tulare County, together with the Hydrology Appendix.

Throughout the period our work was in progress we received outstanding cooperation and assistance from every quarter in Tulare County. County officials at all levels, managers and engineers of municipalities, water and soil conservation agencies and numerous individuals assisted in many ways. We found everyone with whom we worked deeply concerned with the flood problems of the County and the related portions of Fresno, Kern and Kings Counties.

The specific data and advice so willingly given were indispensable to production of this Master Plan. We trust it will provide a sound basis for decision making and action to reduce or eliminate flooding in the County.

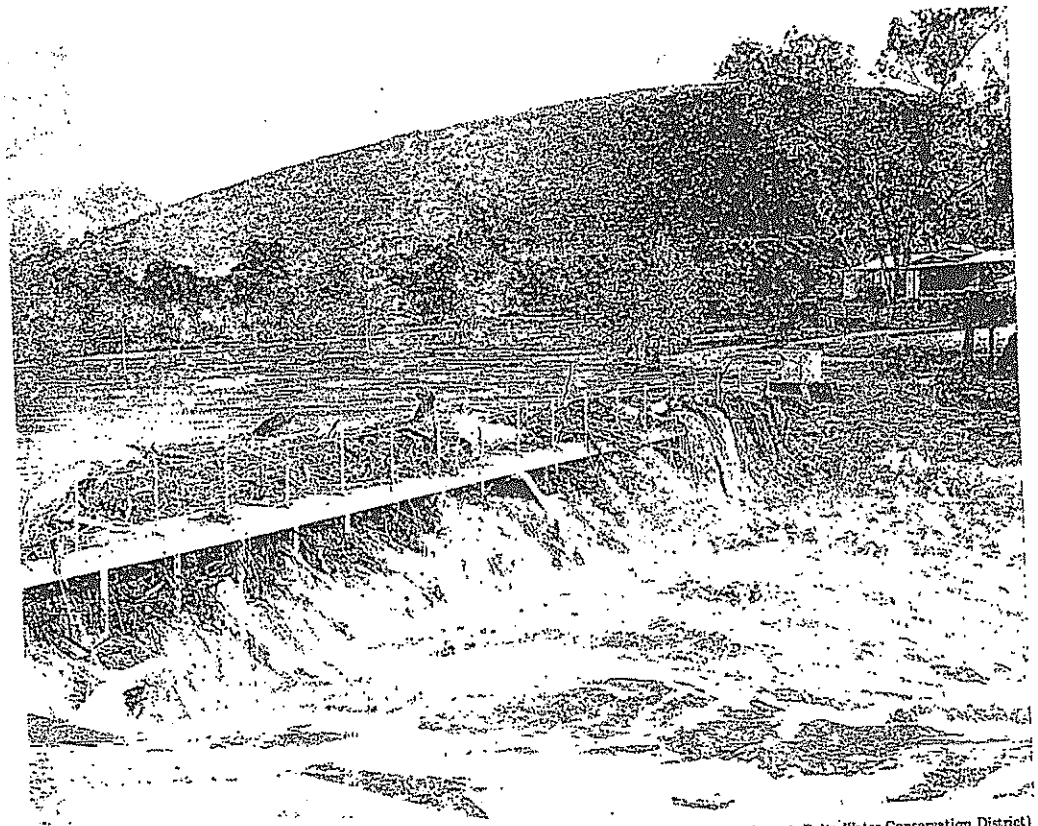
We will be pleased to discuss the Master Plan and underlying studies with you and the Planning Commission.

MURRAY, BURNS and KIENLEN

By: Joseph I. Burns
Joseph I. Burns

THE SPINK CORPORATION

By: Robert C. Hall
Robert C. Hall



McKays Point on the Kaweah and St. Johns Rivers during the 1966 floods

(Photo: Kaweah Delta Water Conservation District)

TULARE COUNTY FLOOD CONTROL DISTRICT

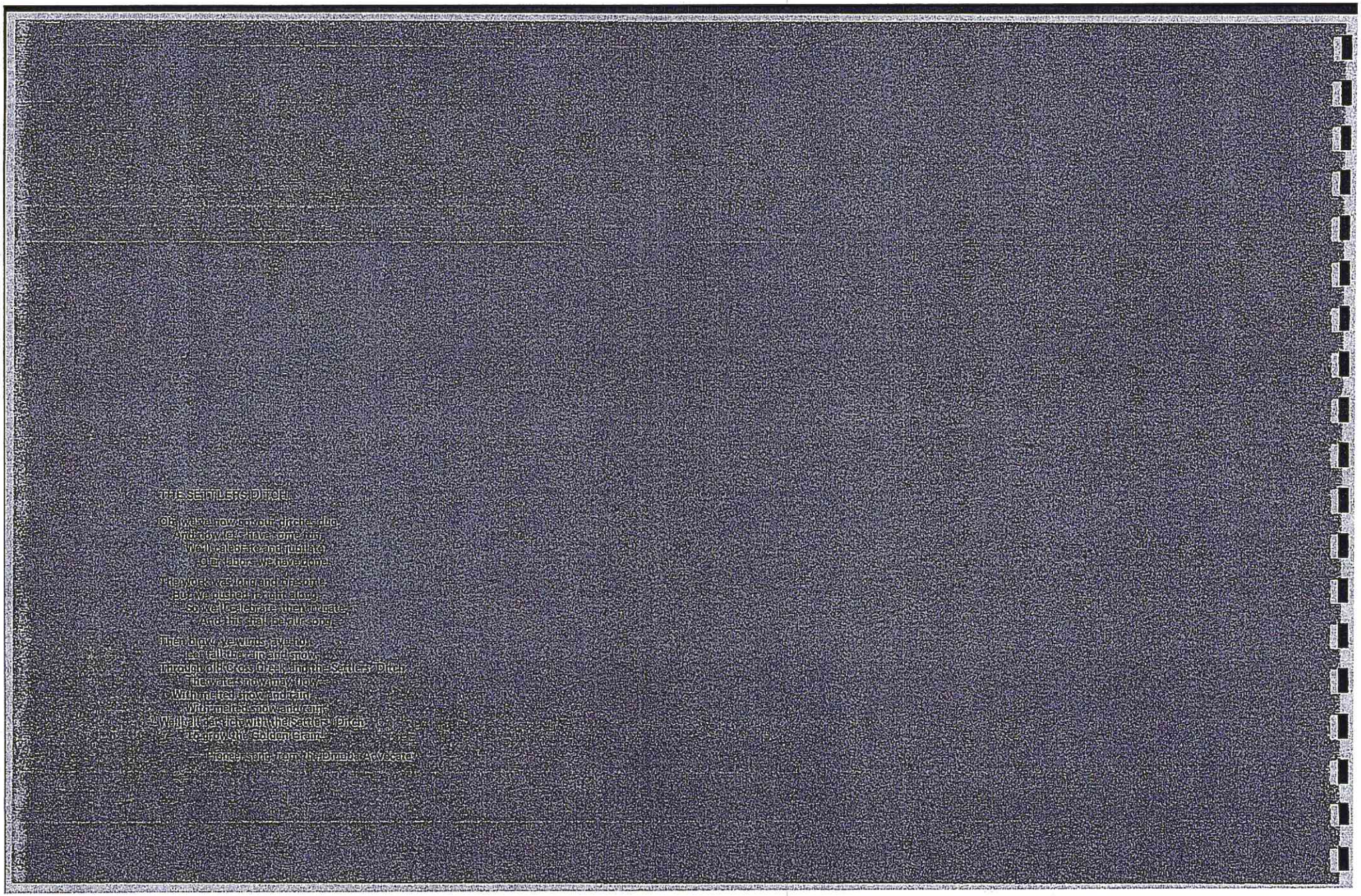
Board of Supervisors

Raymond J. Muller, Chairman
Fred A. Batkin
Charles J. Cummings
Robert E. Harrell
Donald M. Hillman

L.B. Augustson, Road Commissioner and Director of Flood Control Activities
Jack L. Carlsen, Flood Control Engineer

TABLE OF CONTENTS

1 INTRODUCTION



INTRODUCTION

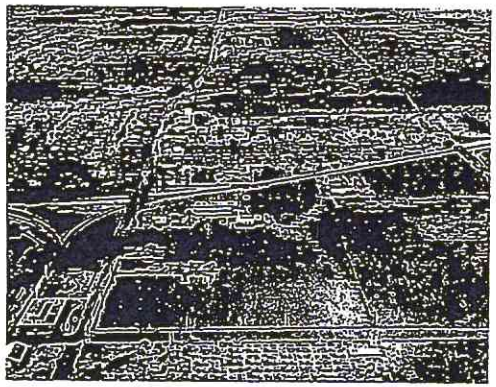
Flooding on the valley floor and along natural water courses of the area now encompassed by Tulare County has occurred for thousands of years as a result of the topography and weather conditions. Geologically, the east side of the southern San Joaquin Valley is formed by the gentle slope of the massive alluvial fans built up of material eroded from the Sierra Nevada by four major rivers, the Kings, Kaweah, Tule and Kern. As these rivers emerged from the foothills of the Sierra, they deposited the sediment they carried, forming fans, and then dispersed across the valley floor, each stream dividing into many channels or distributaries. As the Kings River alluvial fan developed, it extended far enough across the valley to interrupt the south to north drainage toward the Sacramento—San Joaquin Delta, forming the basin in which Tulare Lake is located. At one time the lake covered as much as 700 square miles. The Kings River established its present channel down the southeast side of its fan so that it flowed into the lake along with the waters of Cottonwood—Cross Creek (which circles the toe of the Kaweah fan), the St. Johns River, Mill Creek, Packwood Creek, Cameron Creek and Elk Bayou system (distributaries of the Kaweah), Tule River, Deer Creek, White River, Poso Creek and the Kern River.

FLOODING IN THE TULARE BASIN

In the state-of-nature conditions which existed prior to 1850 in what is now Fresno, Tulare, Kings and Kern Counties, high flows produced by winter rainstorms and snowmelt in the Sierra were sometimes dissipated throughout the complex channel system of the valley floor, and at other times found their way into Tulare Lake, entering the lake in varying amounts each year. As a result, the lake level rose and fell under the influences of varying inflows and summer evaporation. At times the lake rose to a high enough level to overflow to the north toward the San Joaquin River; however, only during periods of successive wet years were the streams of Tulare Basin tributary to the Sacramento—San Joaquin Delta and the sea.

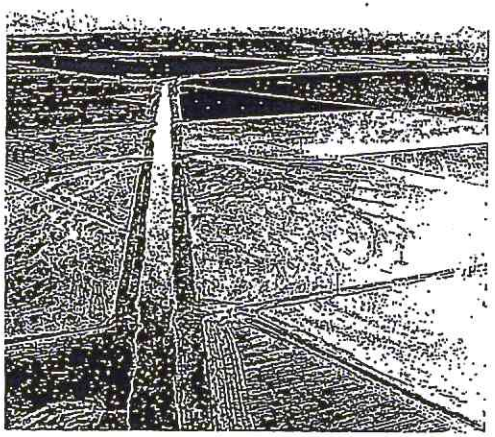
Man has changed all this. About 1850, waters of the four major streams began to be diverted for irrigation purposes. Snowmelt runoff of the Basin streams and also of the San Joaquin River, instead of uselessly flowing into Tulare Lake or the sea, became the very foundation of the region's economy as extensive canal systems were built to distribute water of these streams throughout what has become one of the most productive agricultural areas in the world. Storage reservoirs were built on the Kings, Kaweah, Tule and Kern Rivers, regulating snowmelt so it could be better utilized for irrigation and also providing substantial protection against high runoff from winter rainfall in the Sierra. Major canal systems and numerous ditches flow north-south following the line of the foothills and circling the alluvial fans, thus cutting across the natural drainage pattern. When flood flows overtop the banks of the channels in reaches of inadequate capacity, spreading out over the valley slope as they did historically, they may pond against the embankments of north-south trending canals (and roads and railroads) or flow along the embankment until they reach a crossing. Or the flood waters may back up behind such obstacles until they overtop a canal bank, then flow down the canal to aggravate flooding elsewhere downstream.

Other man-made channels run from east to west, acting as part of the distributary systems of the major streams. Consequently, flood flows may take an unpredictable path through the extremely complicated interconnected systems of natural and man-made channels. Moreover, many of the channels of streams originating in the foothills were altered, moved, constricted or even obliterated in the process of agricultural development of the fertile valley-floor lands and urban development along the water courses, so that flood waters simply spread out over the adjacent area. Thus, small foothill watersheds, as well as major rivers, contribute flood water during intense rainstorms.



▲ Flooding in northeastern Porterville 1969
(Photo: Farm Tribune, Porterville, Calif.)

▼ Cottonwood Creek west of Friant-Kern Canal 1969
(Photo: Kaweah Delta Water Conservation District)

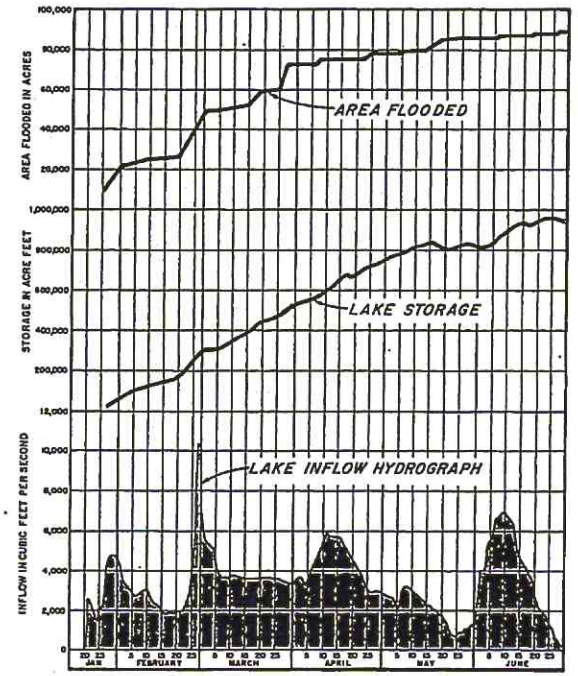


FLOODING IN TULARE COUNTY 1966 AND 1969

Consideration of flood problems in Tulare County must encompass an area wide enough to include portions of Fresno, Kings and Kern Counties. Water originating in the foothills of southern Fresno County may flow overland or along man-made obstructions or follow canals to cause damage in Tulare County. In the south, Rag Gulch, for example, causes damage in both Kern and Tulare Counties. Further, water originating in the foothills of Tulare and Fresno Counties may ultimately cause damage in Kings County. Even existing reservoirs on the major streams are not large enough to free residents of the four-county area from damaging flood runoff from those streams. In December 1966, rainfall was so intense over the watershed of the Tule River that it produced uncontrolled spill at Success Dam. Flows of the Kaweah and Tule Rivers (and occasionally even the Kern) which cannot be controlled by the reservoirs and distribution systems will ultimately end up in the Tulare Lake area, along with flows from unregulated foothill streams in excess of the volume which can be dispersed through percolation, channel storage, etc.

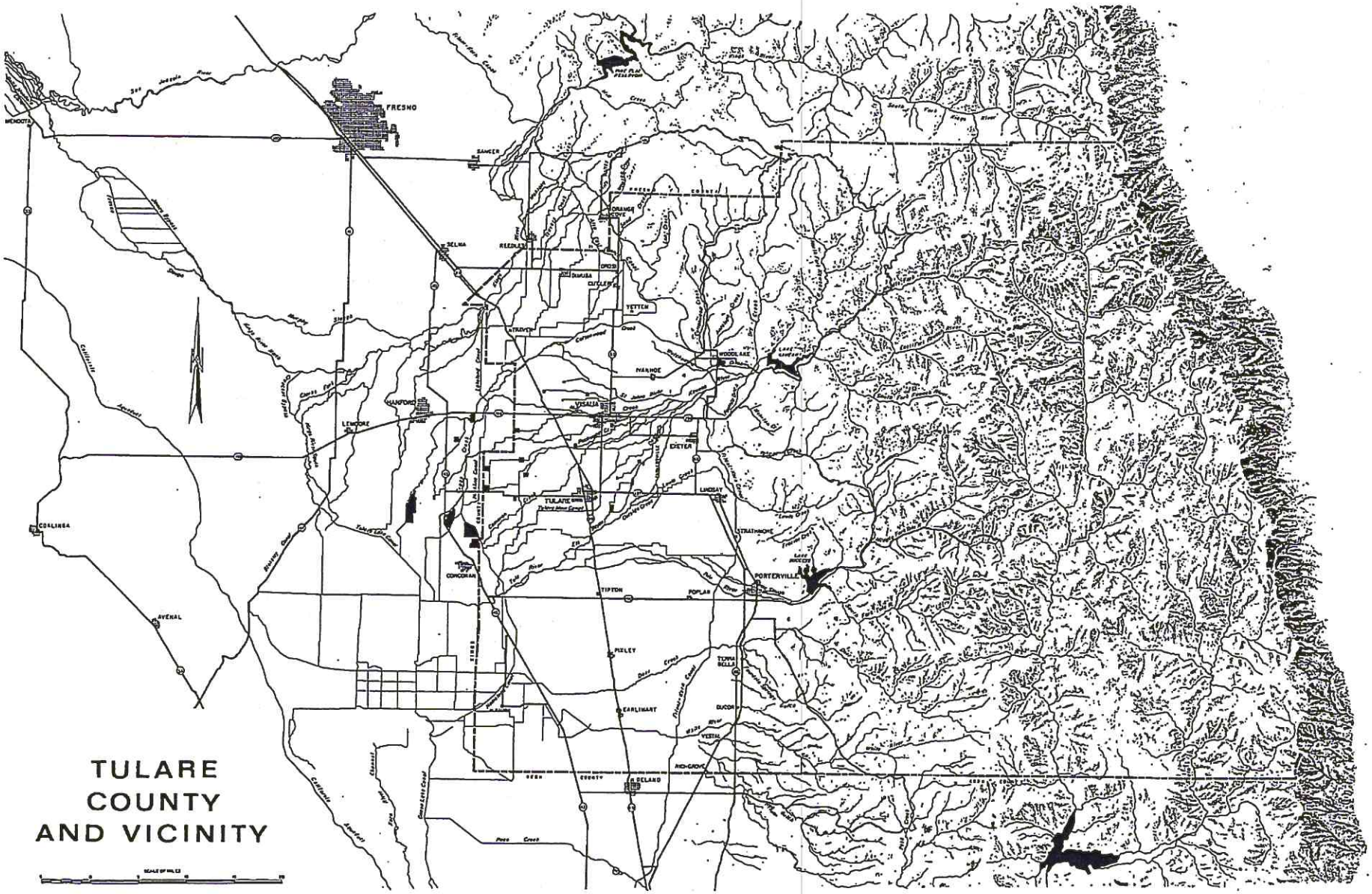
In the winters of 1967 and 1969, snowfall was so great that the resulting runoff could not be controlled completely and great volumes of water poured into Tulare Lake and flooded agricultural land. The chart shows the rate of inflow, the volume of water accumulated and the area flooded in Tulare Lake as a result of the January-June 1969 runoff. Although the flooded area steadily diminished in late 1969 and during 1970, 26,800 acres in the lake bed were still under water in April 1971.

Man's memory of rain-floods is notoriously short. However, the floods of December 1966 and January-February 1969 are recent and illustrate what could be repeated next year, or in any future year. It is certain they will be repeated or exceeded sooner or later. The map of flooding in Tulare County shows those areas which were inundated during the 1966 and 1969 rain-floods. Some 100,000 acres in Tulare County were flooded in 1969, disrupting travel and communications and resulting in about $16,000,000 worth of damage to farms, homes, businesses and publicly owned facilities. Had it been possible to implement the structural and operational changes for control of runoff which are presented in this Master Plan, flooding would have caused no more than minor inconvenience in the areas of southern Fresno, Tulare, northern Kern and eastern Kings Counties shown on the map.



Tulare Lake Flooding 1969


LAKE KAWEAH
DRY CREEK
LAKE SUCCESS
SAND CREEK
COTTONWOOD CREEK
FRIANT-KERN CANAL
TULE RIVER
DEER CREEK
PORTER SLOUGH
POPLAR
EXETER
LINDSAY
STRATHMORE
PORTERVILLE
TULARE
VISALIA
DINUBA
SANGER
REEDLEY
DELANO
KINGSBURG
HANFORD
LEMOORE
CORCORAN
WOODVILLE
EARLIMART
TIPTON
CROSS CREEK
KAWEAH RIVER
KINGS RIVER
WHITE RIVER
FOUNTAIN SPRINGS
SOUTHERN PACIFIC RAILROAD
TULARE COUNTY
1966 FLOODING—DRY CREEK, TULE RIVER, KAWEAH RIVER, TULARE LAKEBED
1969 FLOODING



TULARE COUNTY AND VICINITY

This report presents a Flood Control Master Plan for Tulare County and the portions of Fresno, Kings and Kern Counties where flooding problems are related to those in Tulare County. It includes significant meteorologic, hydrologic, geologic and topographic factors important to flooding in the area and the effect of man's activities on distribution of flood waters. Although engineering studies for this report are area-wide in scope, they are in sufficient detail to provide a basis for the further study which will be necessary in planning specific flood control projects.

The report includes:

1. Estimates of peak flows and flood volumes which may occur on each watershed on the average of once in 25 and 50 years.
2. Concepts for control of floods originating on each watershed.
3. A summary of programs and procedures of Federal and State agencies which do or might participate in financing, planning or construction of flood control works.
4. Suggested mechanics through which detailed planning, construction or operation and maintenance might be carried out by Tulare County Flood Control District in cooperation with other local public agencies.
5. Suggested boundaries of zones which might be formed for the limited purpose of accomplishing the required detailed planning.
6. Suggestions as to control of development in flood-prone areas and protection of waterway capacities in some areas.

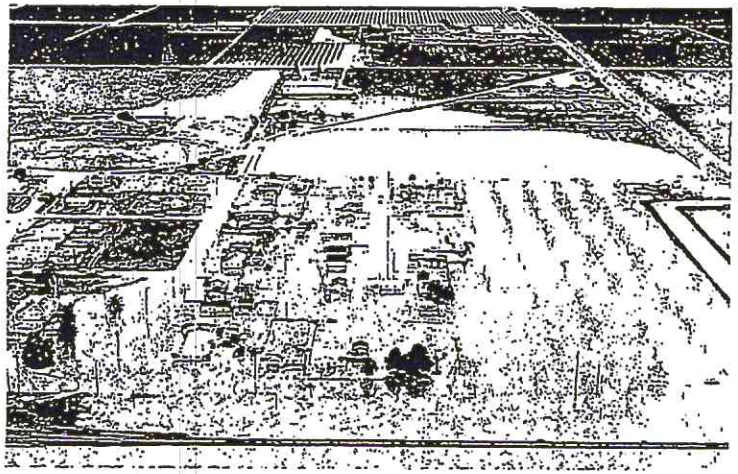
Summary, Conclusions & Recommendations

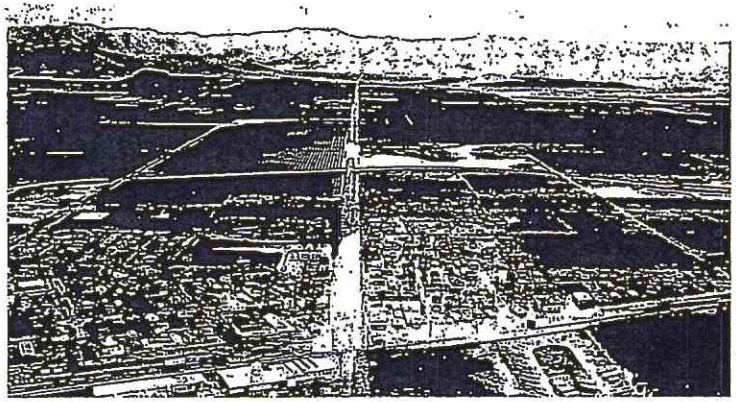
It is concluded that physical works can be constructed and operated to control flooding such as that which occurred in 1969; detailed study will have to be given to each runoff source to determine the engineering and economic feasibility of suggested works and to define areas benefitting from their operation. In some cases it will be necessary to control development in flood-prone areas where physical measures are impractical or uneconomic. In some cases also, steps should be taken to protect waterway capacities before they are reduced through land development. Tulare County now has a General Plan which has been and is being followed so far as concerns future development in the County and it is believed that this Flood Control Master Plan should become a part of that General Plan.

It is recommended that:

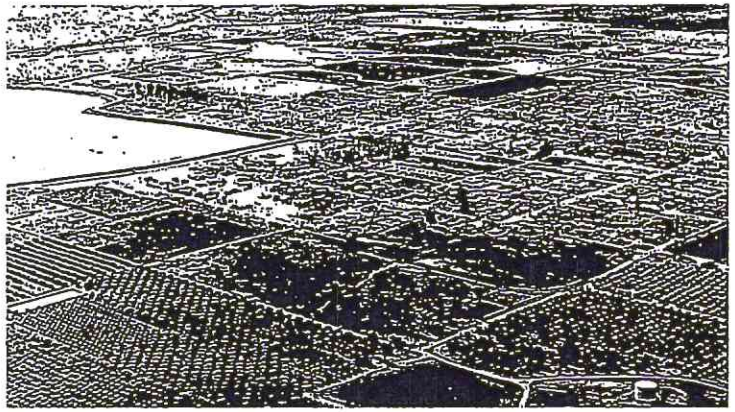
1. Tulare County Flood Control District take the leadership in exploring effective means of securing coordinated efforts to solve flood problems in the four-county area.
2. Where other agencies cannot plan and construct works to reduce flooding, Tulare County Flood Control District, in cooperation with water-distributing agencies in the four-county area and with the Supervisors of adjacent counties, should conduct detailed planning studies and construct projects for control of flooding.
3. Where physical works to control flooding are impractical or uneconomic, developments in flood-prone areas should be controlled under ordinance to minimize damage and possible loss of life during floods of magnitudes reasonably to be expected.
4. Adequate waterway capacities should be maintained through control of land development, consistent with storm runoff rates which can be expected.

Flooding in East Orosi, 1969
(Photo: U.S. Corps of Engineers and Kaweah Delta Water Conservation District)



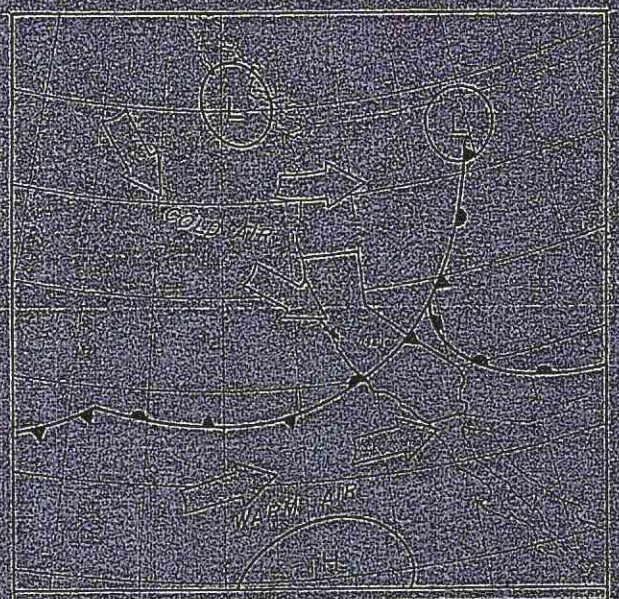


Frazier Creek flooding in Strathmore, 1969
(Photo: Farm Tribune, Porterville)

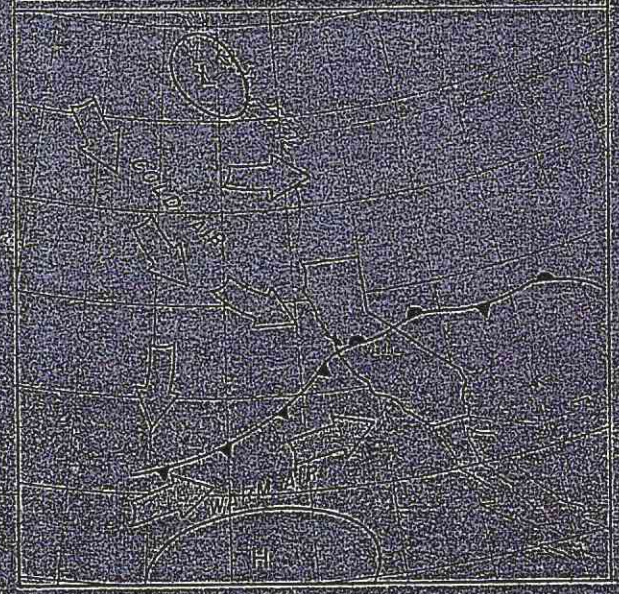


1969 flooding in Woodlake from
Antelope Creek and Antelope Mountain runoff
(Photo: Kaweah Delta Water Conservation District)

FLOOD HYDROLOGY



WEATHER MAP
AT 1000 PST
DECEMBER 6, 1966



WEATHER MAP
AT 1000 PST
DECEMBER 6, 1966

II FLOOD HYDROLOGY

Hydrology is the science which deals with the occurrence of water on and in the earth. Hydrology involves or is related to other earth sciences, including meteorology, geology and oceanography and to the topography of the earth itself. Flood hydrology, as the name suggests, involves analyses of the meteorologic, geologic and topographic factors which produce relatively high runoff in stream systems. Flood hydrology also is concerned with hydraulics — the science of fluids in motion — in that flood waters may be stored in, released from and conveyed through natural channels and hydraulic structures. Sediment hydrology is a specialized phase of hydrology that deals with erosion, movement, and deposition of sediments in flowing streams.

Any plan for control of flooding in Tulare County must begin with hydrological analyses of floods. A separate Appendix to this report presents detailed information on the hydrology of the area, including the technical approaches employed to develop anticipated flood peaks and volumes.

METEOROLOGY

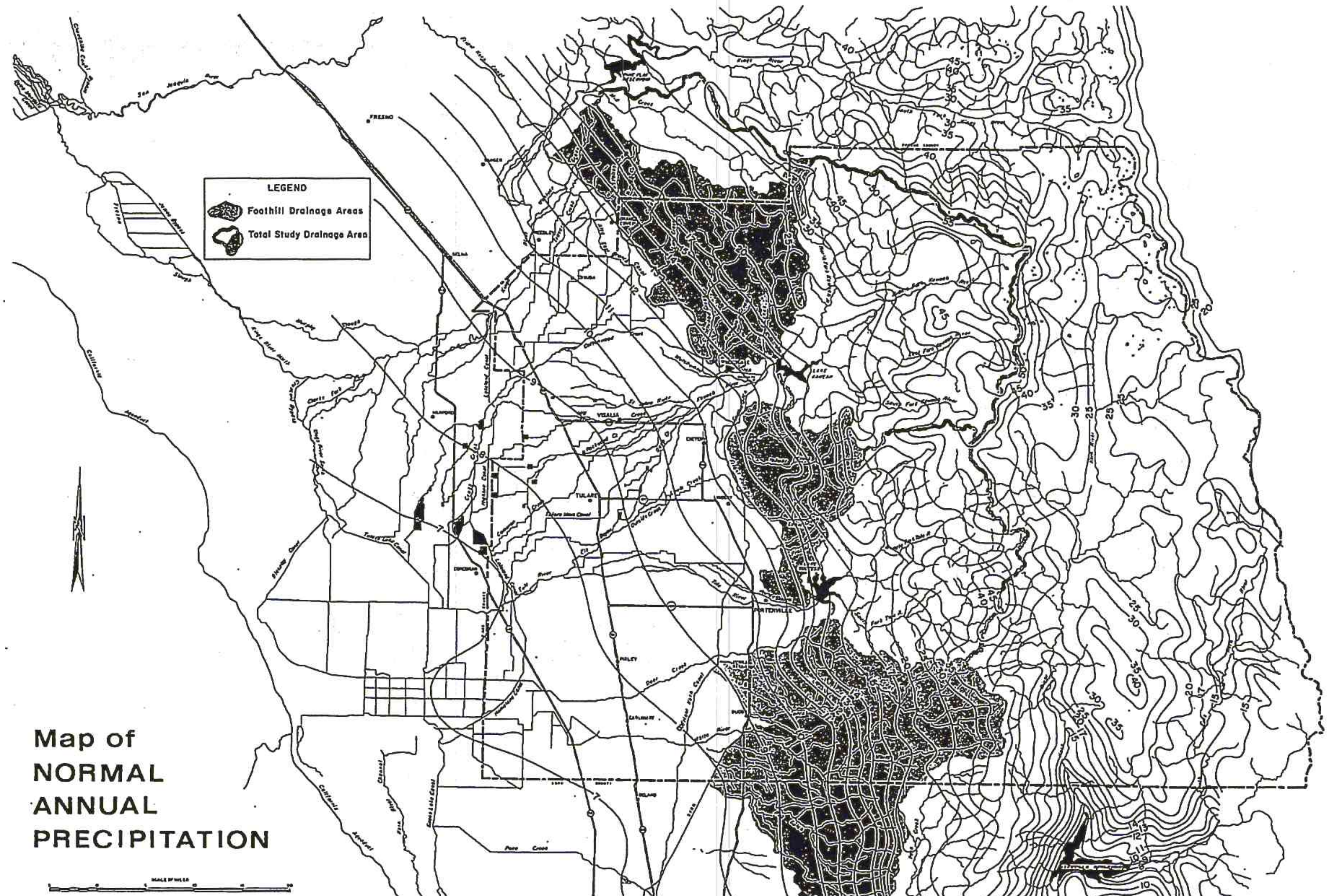
The changeability of the weather has been commented on since the dawn of recorded history. It varies hourly, day to day, month to month, season to season and year to year. Weather systems may bring precipitation and at times the precipitation brings runoff of such intensity and duration that flooding results. Weather patterns are almost continuously changing, but those producing heavy precipitation over the upper San Joaquin Valley have definable characteristics.

Fall rains which mark the start of the storm season may begin from mid-September to December and occur with a southward migration of the polar jet stream — the westerly wind of maximum velocity in the upper atmosphere. This southward swing brings the path of easterly movement of weather fronts into the Central Valley from the Pacific Northwest. Strong fronts may move swiftly or slowly or remain almost stationary, and duration of precipitation in a particular storm will depend on the rate of movement.

The amount of precipitation occurring in a given storm in the Pacific Coast States depends on the moisture content of the air mass, which usually is greatest when warm moist air originating near Hawaii moves eastward in conjunction with a strong flow of cold air from Alaska moving in a cyclonic pattern of west to south to east. Precipitation results when this moist air rises rapidly either because of the internal dynamics of the storm itself (frontal lifting) or as it is driven against and over a topographic barrier such as the Coast Ranges or the Sierra Nevada (orographic lifting).

The location of rain-floods varies with the path of the storm; in December 1955 such a storm struck Northern California and Southern Oregon, while in late January and early February 1969, two successive such storms entered California farther to the south. In 1955, record flows occurred in California-Oregon streams north of Sacramento; in February 1969 very high flows occurred in streams south of Merced, including those in the foothill watersheds in and near Tulare County.

These rain-producing weather patterns may occur at any time from November to April, but are most likely to cause flood runoff in December and January. Throughout the November-April period cold fronts move across the Sierra Nevada at irregular intervals and also produce precipitation, principally in the form of snow. This gradual accumulation of snow usually reaches its greatest depth (in terms of inches of water) in early April when the westerly winds in the upper atmosphere begin to move northerly again toward Canada. Thereafter, and until the next southward migration of the polar jet stream, weather fronts continue to move across California, but they contain minimal moisture with the result that the May-September period is characteristically dry. Sporadic thunder storms in the high Sierras do produce precipitation during the summer, but such storms are of little significance in terms of flood damage caused.



Map of NORMAL ANNUAL PRECIPITATION

PRECIPITATION AND RUNOFF

Individual storms may produce rain, snow, or both, depending on storm characteristics, elevation and temperatures. Temperatures in the air mass generally cause precipitation to occur as snow at higher elevations. Precipitation at lower elevations — and most of the flood-producing drainage areas in Tulare County are at relatively low elevations — occurs as rain. Both forms of precipitation are involved in the planning of flood control measures.

The map shows by isohyetals (lines of equal precipitation) the variation in average — or as the meteorologists and hydrologists say —, normal annual precipitation from one location to another in Tulare County and adjacent areas. Along the valley floor near the western boundary of the County normal annual precipitation varies from 7 to 10 inches. At the crests of the Kaweah and Tule River watersheds normal annual precipitation varies from 35 inches in the south to about 55 inches in the north. At the eastern boundary of the County the normal is about 15 inches to 30 inches. A single storm may deposit half a year's "normal" precipitation at any one point; two or three storms in succession may produce total precipitation over a single drainage area amounting to double the "normal" precipitation over the same area; a period of years may go by during each of which only a fraction of a "normal" year's precipitation occurs in the County. Partly because the County had not developed as fully as it has today, but even more because annual and monthly precipitation was below "normal," periods of several years have gone by with literally no flood damage in Tulare County.

No one can predict very far in advance when the next rainstorm will occur — even less, which particular watershed will receive heavy precipitation. Barring a change in the climate of the earth, such storms will occur and will produce rainfall over the drainage areas which are the sources of runoff flooding Tulare County.

Runoff from snow accumulation is the product of gradual melting over time which produces relatively low, non-damaging peak flows. Generally, snowmelt runoff from the high elevation basins occurs at the time of year and at peak flow rates which can be managed without extensive damage in Tulare County. However, large accumulations of snow can yield immense volumes of water which result in flood damages in terminal areas such as Tulare Lake.

The time of occurrence, intensity (amount of precipitation in a given time) and duration of precipitation in individual storms are important factors affecting peak rates and volumes of runoff. The second of two successive rainstorms over a drainage area, even if the same amount of rain fell at the same rate and in the same pattern of distribution, will cause a greater volume of runoff at higher peak rates of flow than the first storm would because the drainage area would already be saturated.

DRAINAGE AREAS

Other significant factors affecting peak rates and volumes of runoff are topography, geology and watershed ground cover. One of the most important of these factors is topography — the elevation, shape, slopes and orientation (south-to-north, east-to-west, etc.) of the drainage area.

The Map of Drainage Areas on the following page shows the boundaries of the 50 separate drainage areas or sub-drainage areas which produce the runoff important to flooding of Tulare County and its adjacent areas. Runoff from each of these drainage areas produces flooding or may contribute to flooding of the areas shown on the map in the Introduction. The western or downstream boundary of each drainage area or sub-drainage area is a point where runoff from the drainage area may concentrate, or where, for the purpose of developing flood control concepts for the watershed and downstream areas, it is assumed to concentrate. Each drainage area and sub-drainage area shown is numbered. Note that some of the larger drainage areas are designated by more than one drainage area number. For example, Cottonwood Creek is identified by three drainage area numbers, 22, 23 and 24. Drainage Area 22, which has its point of concentration at Friant-Kern Canal, includes the total upstream area including Areas 23 and 24. Similarly, Area 23, which has its point of concentration at Elderwood, includes Area 24. Thus, where a drainage area contains more than one number, the numbered area farthest downstream includes all sub-drainage areas upstream.

The table which follows presents the drainage area number for each area shown on the map and identifies briefly the stream or drainage system. Also, for each drainage system, the area and normal annual precipitation are shown together with the peak flow in cubic feet per second (cfs) estimated to occur on the average of once in 25 and 50 years. Finally, for ready comparisons, the table shows, for each location where a record of flow is available, the peak flow which occurred during the floods of December 1966 and January-February 1969 and the amount of peak flow recorded prior to December 1966 together with the date of occurrence. All these data are factual except, of course, the 25- and 50-year peak flow estimates, which are based on application of established hydrological techniques to available data as explained more fully in the Appendix.

FLOOD FREQUENCIES OR RETURN PERIODS

The peak flows for 25- and 50-year return periods shown in the Table of Drainage Areas are of value in gaging the relative magnitude of peak flows on different streams. They are useful to the engineer in comparing the economic merits of providing a given degree of flood protection with the costs of the improvements. However, peak flows for given "return periods" should not be misunderstood or misused. Peak flow "return period" means that the given flow may be exceeded (or have a "return period") of once in 25 years on the average and another larger peak flow may have a return period of once in 50 years on the average. As time passes and more experience is gained, flows which are now estimated to have return periods of 25 and 50 years may change. One individual in Tulare County remarked after the 1969 floods, "I've lived here over 40 years and in the last 15 I've seen three once-in-100-year floods." It is important to remember "return period" does not imply that there will be a given number of years *between* flood events. It only means that over many years such a flood will occur *on the average* the number of years designated. For example, a "once-in-10-year flood" will occur on the average 10 times in 100 years. Three of these times may be in successive years or occur in a very short time period or there may be many years between such events.

The degree of flood protection to be provided from flows of a particular stream is a matter of policy as well as engineering and economic considerations. For example, if the benefits (average annual damages prevented) to an urban area are greater than the annual cost of protecting the area against floods having a once-in-100-year frequency of occurrence on the average, the project might be undertaken — even if a higher ratio of benefits to costs would result from protecting against smaller floods occurring once in 50 years on the average. Beyond this, of course, is the question of damages not susceptible of evaluation, such as actual or potential loss of life, personal loss of livelihood and possible detrimental social impacts.

There are only broad guides which can be offered in connection with use of flood frequencies in planning. The developing nature of Tulare County and its adjacent areas would tend to weigh on the side of providing protection against floods having return periods of once in 50 or more years on the average. It is recognized, however, that in some cases — especially where urban or industrial properties are involved and widespread and intangible effects may occur — protection against less frequent floods may be justified. Where judgment as to future development indicates, and hard economic facts support, once-in-25-year protection may be all that should be undertaken.

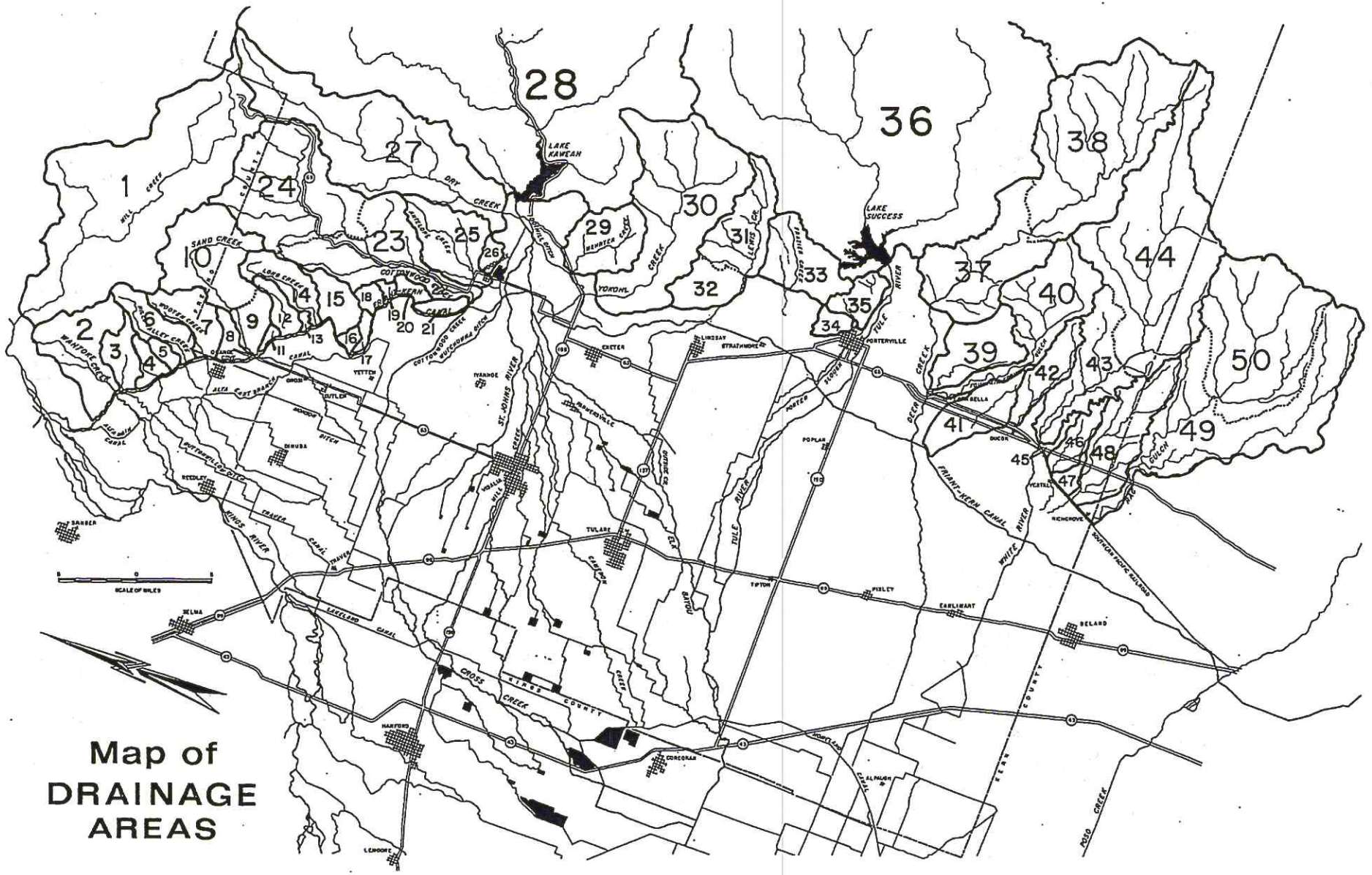

28
36
38
27
1
24
LAKE KAWEAH
DRY CREEK
30
29
31
LAKE SUCCESS
44
37
40
23
25
26
10
SAND CREEK
32
33
35
34
39
42
43
50
2
3
4
5
6
7
8
9
12
14
15
18
19
20
21
11
13
16
17
41
45
46
48
47
49
PORTERVILLE
EXETER
IVANHOE
YETTEM
WOODLAKE
LINDSAY
STRATHMORE
ORANGE COVE
DINUBA
TULARE
TULARE LAKE
TIPTON
PIXLEY
EARLIMART
DELANO
RICHGROVE
WELDON
HANFORD
CORCORAN
LEMOORE
KINGS COUNTY
TULARE COUNTY
KERN COUNTY
SCALE OF MILES
Map of
DRAINAGE
AREAS

Table of Drainage Areas, Precipitation and Peak Discharges

No.	Location	Drainage (Sq. Mi.)	Normal Annual Precipitation (Inches)	Peak Discharge – cfs				
				Return Period		1956 Flood	1969 Flood	Maximum Previous Flood
				25-Year	50-Year			
1	Mill Creek nr. Piedra	127	24.7	—	—	11,000	9,860	1955 – 6,000
2	Wahtoke Creek at Friant-Kern Canal	21.5	15.4	1,080	2,400		1,760(a)	
3	Citrus Cove Drainage at Friant-Kern Canal	8.3	14.3	680	970			
4	Granite Hill Drainage at Friant-Kern Canal	3.6	13.8	380	540			
5	Surprise Creek at Friant-Kern Canal	2.3	13.8	270	390			
6	Hills Valley Creek at Friant-Kern Canal	10.7	15.6	950	1,360		265(b)	
7	Wootsen Creek at Friant-Kern Canal	11.3	15.2	1,050	1500			
8	Orange Cove Drainage at Friant-Kern Canal	3.7	13.7	380	540			
9	Sand Creek at Friant-Kern Canal	38.8	17.4	3,020	4,220	2,100	3,520	1955 – 1,320
10	Sand Creek nr. Orange Cove	31.6	18.2	2,670	3,820			
11	Curtis Mtn. Drainage at Friant-Kern Canal	1.0	13.2	510	730			
12	Negro Creek at Friant-Kern Canal	5.3	14.1	95	130			
13	Avenue 424 Drainage at Friant-Kern Canal	0.7	13.3	950	1,380			
14	Long Creek at Friant-Kern Canal	11.2	15.4	650	930			
15	Avenue 416 Drainage at Friant-Kern Canal	8.4	13.5					
16	Stokes Mountain-West Drainage at Friant-Kern Canal	1.3	12.4	155	220			
17	Stokes Mountain-South Drainage into Friant-Kern Canal	1.8	12.6	—	—			
18	Stone Corral Canyon Drainage at Friant-Kern Canal	2.7	13.4	300	430			
19	Road 180 Drainage at Friant-Kern Canal	1.0	13.4	135	190			
20	Avenue 384 Drainage at Friant-Kern Canal	2.3	13.2	265	380			
21	Colvin Mountain Drainage into Friant-Kern Canal	2.4	12.4	—	—			
22	Cottonwood Creek at Friant-Kern Canal	88.1	18.4	6,170	8,820	4,650	4,670	1958 – 2,460
23	Cottonwood Creek at Elderwood	83.4	18.8	4,250	6,780	5,420		
24	Cottonwood Creek above Highway 69	52.2	20.9	1,340	1,920		1,050	
25	Antelope Creek at Woodlake	20.7	14.3					
26	Antelope Mountain-Woodlake Drainage at Bravo Lake	3.0	13.2	315	450			
27	Dry Creek nr. Lemoncove	80.4	23.4	7,520	10,700	14,500	5,710	1955 – 6,070
28	Kaweah River at Terminus Dam	561	39.0	—	—	5,740(c)	4,250(c)	1955 – 80,700(d)
29	Mehrten Creek at Foothill Ditch	19.0	13.8	1,070	1,530			
30	Yokohl Creek at Hamilton Ranch	70.6	17.5	3,960	5,660	3,400(e)		
31	Lewis Creek nr. Strathmore	18.3	15.9	1,270	1,820	1,900(f)	1,480	
32	Lewis Creek at Road 236	32.1	14.7	1,850	2,650			
33	Frazier Creek ½ mile East of Road 256	18.1	12.9	1,010	1,440			
34	Lewis Hill Drainage at Porterville	3.6	10.8	315	450			
35	Rocky Hill Drainage at Porter Slough	7.9	11.6	515	740			
36	Tule River at Success Dam	393	31.0	—	—	9,050(g)	3,210(g)	1950 – 32,000(h)
37	Deer Creek at Hungry Hollow	124	22.2	7,730	11,000	6,050		
38	Deer Creek nr. Fountain Springs (Kilbreth)	83.3	25.7	7,300	10,500	5,330	3,340	1943 – 8,000
39	Fountain Springs North Drainage at Deer Creek	19.3	11.1	840	1,200			
40	Fountain Springs Gulch at Deer Creek	35.0	11.8	1,400	2,000			
41	Terra Bella-Ducor Drainage at Friant-Kern Canal	16.9	9.4	610	870			
42	Ducor East Drainage at SPRR	13.9	9.9	540	770		4,560	
43	White River nr. Vestal	120	15.1	4,150	5,950	1,204		1943 – 2,300
44	White River nr. Ducor	92.9	16.5	3,760	5,370			
45	Orris East Drainage at SPRR	1.8	8.9	180	260			
46	Vestal East Drainage at SPRR	7.8	8.8	440	630			
47	Vestal Southeast Drainage at SPRR	2.6	8.3	245	350			
48	Richgrove East Drainage at SPRR	28.4	9.0	905	1,300		2,240(i)	
49	Rag Gulch at SPRR	138	11.4	3,280	4,680			
50	Rag Gulch nr. Villard Ranch	71.2	12.4	2,100	3,000			

(a) Near Centerville
(b) Near Orange Cove
(c) Below Terminus Dam
(d) Near Three Rivers
(e) Near Exeter
(f) Near Lindsay
(g) Below Success Dam
(h) Below Success Dam and prior to regulation by Lake Success
(i) Near Richgrove

FLOOD VOLUMES AND DETENTION STORAGE

Reservoirs for detention of peak flows are desirable structures for control of floods. They are especially desirable in areas like Tulare County where they may perform the storage function now performed by uncontrolled flooding of large areas, thus preventing damage in such areas. Detention reservoirs may also reduce peaks to amounts which can be managed and conserved either through direct irrigation use, diversions to valley-floor detention basins and spreading grounds or percolation to groundwater basins in natural channels for later extraction through wells. Where damsite and reservoir topography and geology permit, higher dams store greater volumes of water and, other things being equal, are more costly. These considerations — and of equal importance in many cases, the economical and safe carrying capacities of downstream channels through which releases must pass after each flood occurrence — are directly involved in the hydrological and economic aspects of protecting areas downstream of a detention site.

Hydrologically, too, the relationship between the volume of water in a flood and the peak flow of that flood may vary a great deal. The most direct such variation can be seen in a comparison of snowmelt and rain-floods. The mean daily flow in cubic feet per second on the day the peak snowmelt flood occurs is practically the same as the peak flow on that day; the mean daily flow on the day a peak rain-flood occurs is a fraction of that peak flow. Snowmelt flooding is primarily important in the Tulare Lake area and would be even more serious if large diversions were not made to irrigation systems diverting from Kaweah and Tule Rivers; such flooding can be reduced further, principally by augmenting the volume of storage space available for Kaweah and Tule River runoff. Rain-floods also require storage space for their control by detention reservoirs, but relatively small space can reduce large peak flows dramatically.

Hydrologic studies for this report have developed estimates of the volumes of water occurring on each of the watersheds for return periods of 25 and 50 years and for 1-, 2-, 3- and 5-day maximum volumes during rain-floods. Development of the estimates is presented in the Appendix. These estimates of volumes provide bases for calculating the approximate *minimum* amount of storage required for controlling rain-floods of these frequencies on each of the watersheds where topographic conditions suggest that dam and reservoir sites may exist. In Chapter 3, these *minimum* amounts of storage are described and are related to differing rates of releases for the reservoirs, since further detailed studies will be required for each stream to balance the size and cost of detention reservoirs against capacity and cost of channels conveying regulated flows.

A fixed outlet opening, which probably is desirable for small detention reservoirs intended to control rain-floods of unpredictable occurrence and accordingly designed for assured automatic operation, cannot discharge water at the same rate when the reservoir is partially full as when it is full. For this study the average release rates during a flood period have been assumed to be 75 percent of the selected maximum release. Thus, in the concepts presented in Chapter 3, if a downstream channel is considered to have a capacity of 100 cfs, the reservoir volume shown for a given flood is that necessary to control releases to an average of 75 cfs.

The capacities shown in Chapter 3 for reservoirs to control rain-floods are predicated on the assumption that a dam and reservoir could be constructed at the suggested location. Obviously, in some cases, topographic and geologic considerations may dictate that a dam be located higher on the watershed than the suggested site. In such cases, to allow for runoff from the watershed area below the upstream damsite while maintaining the same degree of control as indicated for the suggested location, it may be necessary to make smaller releases from the upstream site; this will require a proportionately larger reservoir capacity at the upstream site.

Sediment-hydrology has not been considered in the studies leading to this report. In many of the Tulare County watersheds, soil mantle is relatively stable and even intense precipitation does not produce large sediment movement. In other cases, there is evidence that significant quantities of silts, sand, gravels and other debris are moved. Sediment storage space may be needed in the detention basins suggested in Chapter 3 for two reasons: to maintain the basin capacities needed to control floods and to permit maximum sediment settlement in those cases where releases must enter canal systems for disposal. In the course of detailed study of individual streams, consideration should be given to their sediment-producing potential.

The debris-removal function of detention reservoirs is especially significant for major canal systems in Tulare County, including the Alta Irrigation District's East Branch Canal, the Bureau of Reclamation's Friant-Kern Canal and the Consolidated Peoples Ditch—Outside Creek system, which are capable of conveying large quantities of water from Kings, San Joaquin and Kaweah Rivers. The canal systems convey water from north to south along the foothill contours and thus cross many of the east-to-west streams. They frequently receive flood waters because of their location and structural characteristics at these stream crossings. In some cases (usually involving small drainage areas) they are deliberately designed to accept flood waters.

Operators of many of these major north-to-south canal systems understandably are reluctant to accept substantial quantities of cross-drainage into their canals for operational reasons, because of potential increases in liability, and because of increased operating costs which result from sediment input to the canals. Operational factors, including annual maintenance shut-down, usually at the height of the rain-flood season, are particularly significant on Friant-Kern Canal.

OTHER FUNCTIONS OF RESERVOIRS

Reservoirs providing flood protection to downstream areas frequently are useful for other purposes, such as regulating stream flows for irrigation, power production, and maintenance of minimum flows for fishery preservation and enhancement. Where minimum water levels can be maintained during the spring, summer and fall months — especially where water temperatures and quality are satisfactory for fishing — recreational opportunities are available and are exploited heavily.

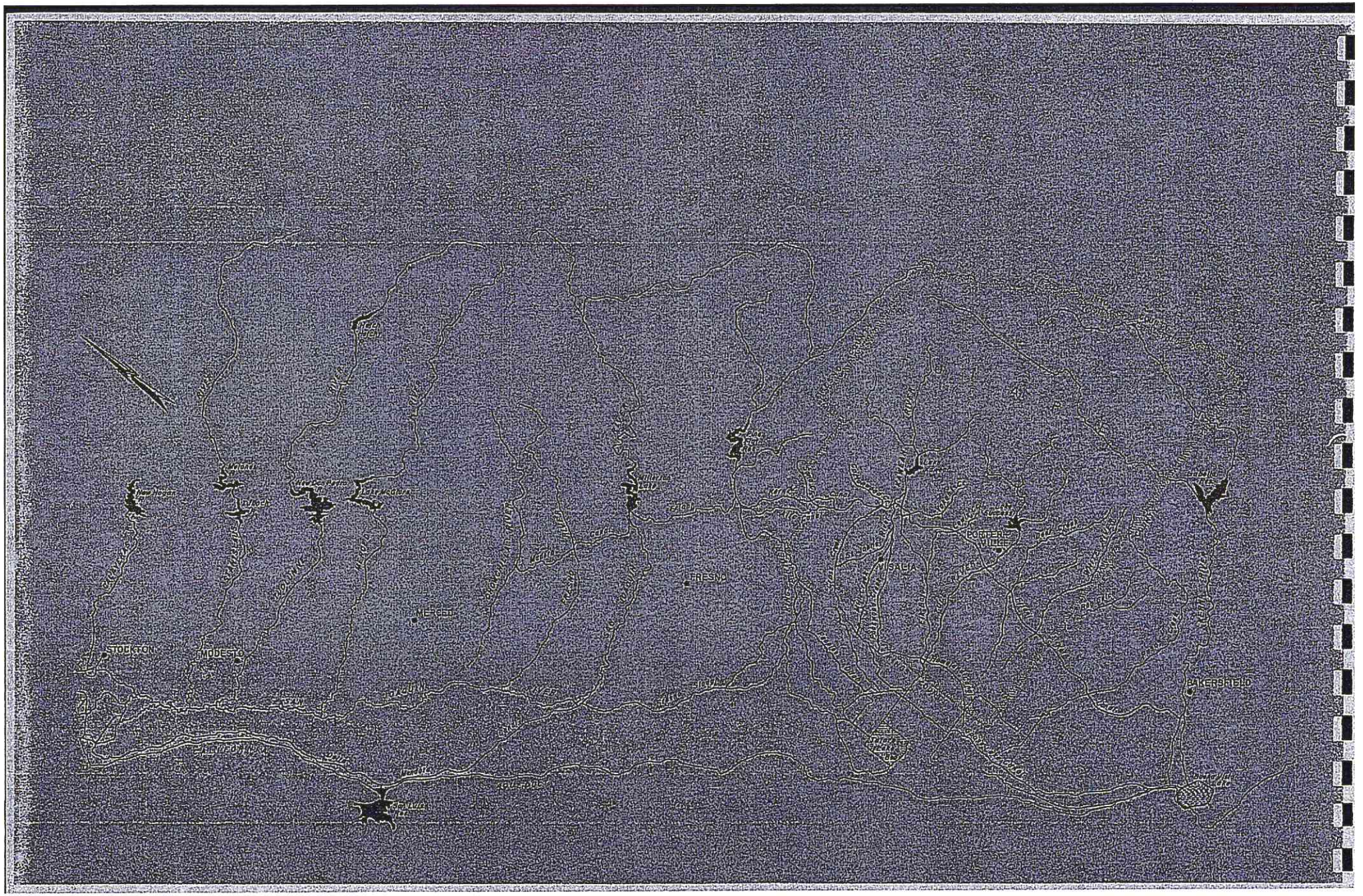
Reservoirs serving such multiple purposes generally involve compromises. A single-purpose flood control reservoir will be empty except when storing water which would cause downstream damage. A single-purpose irrigation or power reservoir will be as full as inflows permit consistent with meeting downstream irrigation needs or demands for power output. A single-purpose recreation reservoir will be as full as possible throughout at least the main part of the recreation season.

Except for reservoirs regulating the principal Tulare Basin streams, most of the detention reservoirs suggested in this report offer little opportunity for multiple-purpose development. This situation is primarily due to the runoff characteristics of the area, although water rights limitations have some significance. Stream flows are not sufficiently regular to permit economic operation of power plants. Deliberate inclusion of reservoir space for irrigation purposes is of doubtful value on most of the foothill watersheds because of sporadic runoff which may be negligible in amount over periods of two or more years in succession.

Reservoir storage space for flood control purposes must be available from about November 1 to about April 1 to control rain-floods. Water supplies after April 1 on most of the foothill streams are quite unreliable; thus, rain-flood space generally cannot be filled after the rainy season as is possible on streams where snowmelt runoff may occur during the April-July period.

Maintenance of minimum water levels for recreation at the foothill sites also appears impractical due to unreliable flows after April 1. It is possible, in the case of one or two of the potential reservoirs, that some recreational use (golf courses, parks) could be made of the reservoir land since inundation will occur only during the rainy season. This possibility should be studied in connection with further planning, especially on the larger detention basins.

FLOOD CONTROL CONCEPTS III


STOCKTON
MODESTO
MERCED
FRESNO
VISALIA
PORTERVILLE
BAKERSFIELD

FLOOD CONTROL CONCEPTS

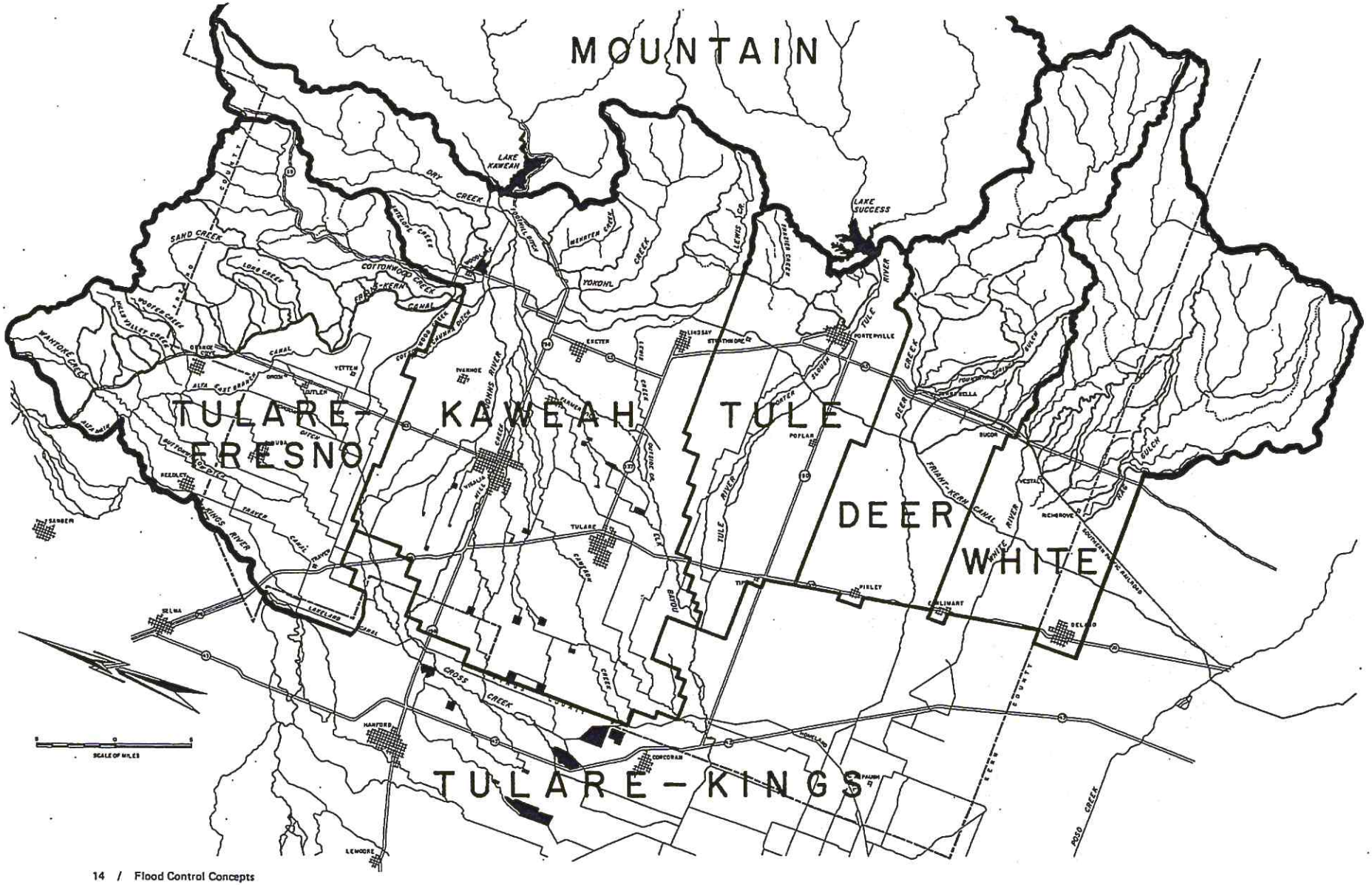
III

Flood control concepts for Tulare County must take into account the hydrology, geography and topography of a wider area than the County itself. To some extent, the entire Tulare Lake Basin and the San Joaquin River to and including the Delta are involved with Tulare County flood problems and their solution. Basin-wide studies currently under way can, and should, lead to increases in flood storage capacity on the Kings, Kaweah, Tule and Kern Rivers with a view to reducing inflows to Tulare Lake from those streams and of minimizing flows of Kings River to the San Joaquin River at Mendota, especially at times the latter river is in flood. Studies also are being made of possible introduction of Kern River flood flows into the California Aqueduct. These measures, if consummated, will produce benefits chiefly during snowmelt floods. However, additional storage space at Lakes Success and Kaweah may enable releases from those reservoirs to be reduced during rain-floods, thus facilitating disposal of rain-flood flows originating on the foothill watersheds in Tulare County. The concepts presented herein accordingly assume that a regional approach, rather than a single-county approach, is taken toward the flood problems of Tulare County. Institutional relationships necessary to such a regional approach will require further exploration, but such relationships should be established to advance the common good. The regional approach must be at two levels, one of which recognizes the long range need for minimizing inflows to Tulare Lake and the other dealing with the local drainage areas in Tulare County and the portions of Fresno and Kern Counties treated in this report. Some of the floodwaters which produce damage within Tulare County originate in Fresno County on the north and Kern County on the south. Also, waters passing through Tulare County cause flooding in Kings County and may eventually come to rest in Tulare Lake. Reduction of damages from flooding in Tulare County may require physical measures in Fresno County and such measures may benefit lands in that County. Reduction of flood damages in portion of Kings County will require properly designed physical works in Tulare County — and in some cases in Fresno County. Lands in both Kern and Tulare Counties can benefit from projects in the Rag Gulch watershed, most of which is in Kern County. Thus, county governments and many of the local districts and landowners in Tulare, Fresno, Kern and Kings Counties have common interests in control of flood flows in the general area.

Flood damages can be minimized either through physical works, control of development in flood-prone areas or a combination of the two. Physical works may involve channel improvement to convey larger quantities of storm water without damage, detention reservoirs or a combination of improved channels and reservoirs. Detention reservoirs, if partially or wholly filled during a winter storm, must be emptied as rapidly as downstream channel conditions permit in order to provide space for control of possible flood runoff occurring in a following storm. Finally, irrespective of the physical works installed for flood control purposes, the flood waters must reach terminal points or areas where their damage potential is at a minimum. Since the San Joaquin Valley, including Tulare County, has insufficient natural water supplies for full development, it is desirable that these flood flows terminate either in direct crop use, in spreading areas, or in valley floor reservoirs from which they can be diverted for later beneficial use or percolation to the groundwater basins.

Flood control concepts for Tulare County and the related Fresno, Kern, and Kings County areas also must recognize the extensive canal systems which traverse the region in a complex and frequently interconnected network. The region relies heavily on groundwater pumping during dry seasons and dry cycles. Much of the surface supply originating in the region is used directly for irrigation and, when irrigation requirements are at a minimum, for spreading to induce recharge of underground aquifers. Many of the systems are physically capable of, and are, operated to distribute what otherwise would be damaging flood flows to areas where they can be used for irrigation or groundwater recharge. During many severe storms, however, the systems are not capable of providing these benefits and may, in fact, enlarge the area inundated by causing water to pond against canal banks or to enter canals and then flow to some point where capacity is inadequate. Nevertheless, these systems, whether consisting of natural or man-made channels, are indispensable elements of any plan for eliminating or reducing flood damage in Tulare County and its neighboring areas.

Water rights must be considered in the development of any flood control project. California case law is replete with water rights litigation flowing out of stream-flow modifications, including possible modifications similar to those outlined in some of the concepts discussed in this Chapter. Each situation is unique in some respects. It is not possible for this or any other report to suggest solutions to all such situations, many of which may not arise at all. It is believed that water rights complications alone will not make impractical any of the flood control concepts presented. Nevertheless, it is suggested that the water rights implications of each of the concepts, and of alternates which may be considered, be reviewed as a part of detailed study of each stream system.


MOUNTAIN
TULARE-FRESNO
KAWEAH
TULE
DEER
WHITE
TULARE-KINGS
LAKE KAWEAH
LAKE SUCCESS
SAND CREEK
DRY CREEK
COTTONWOOD CREEK
POSO CREEK
CROSS CREEK
SCALE OF MILES

FLOOD CONTROL UNITS

For purposes of presenting flood control concepts, a portion of the four-county area is divided into units. The unit boundaries encompass areas whose flood problems in general are closely related either by source, conveyance or ultimate disposal of flood flows or by physical plans for control. To some extent, however, boundaries of the units are arbitrary in that flooding problems are not so related; in these cases boundaries are adopted for convenience only in presenting the concepts. Some of the units could be subdivided — especially for purposes of identifying areas benefitting from specific improvements.

TULARE-KINGS UNIT

The eastern boundary of Tulare-Kings Unit forms the western boundary of the other five valley-floor units and is assumed to extend westerly to include all of the area potentially subject to flooding in Tulare Lake. The Unit is identified as a separate unit because flood flows originating in the other units may enter it and, depending on their occurrence and magnitude, may increase water management and flooding problems in western Tulare and Kings Counties. Unfortunately, it is true that flooding of Fresno, Tulare and Kern County land under present conditions is of some benefit to land in the Tulare-Kings Unit. The common enemy doctrine established by decisions of the California Supreme Court might permit reduction of these upstream flooded areas with resulting increases in flood damages in the Tulare-Kings Unit. On the other hand, the concepts envisaged for the other valley-floor units can, if properly implemented, improve water management and minimize flooding conditions in the Tulare-Kings Unit as compared to those conditions today.

Two key points on the eastern boundary of the Tulare-Kings Unit are the junction of Cottonwood Creek and St. Johns River and the junction of Elk Bayou and Tule River. Below these junctions, the commingled flows of the two pairs of streams cause flood damage in western Tulare County and in Kings County.

TULARE-FRESNO UNIT

Tulare-Fresno Unit covers the area generally north of the Kaweah River irrigation service area and includes the Wahtoke Creek and other small drainage areas north of Cottonwood Creek as well as Cottonwood Creek. Flooding conditions in the Tulare-Fresno Unit are influenced significantly by the canal system of Alta Irrigation District. This system discharges water directly to Cottonwood Creek and Kings River through terminal spill facilities. Also, flood flows originating easterly of the Alta East Branch Canal may enter this canal and subsequently flow to points where they escape to flow overland to Cottonwood Creek. Any plan for control of flood flows of Cottonwood Creek must take into account the reduction in flooded areas north of that creek. For these reasons, the Tulare-Fresno Unit includes the drainage area of Cottonwood Creek as far west as the junction of that creek with St. Johns River, a principal distributary of Kaweah River, and also includes the southwest corner of Alta Irrigation District.

KAWEAH UNIT

The Kaweah Unit encompasses the watersheds of Antelope, Dry, Mehrten, Yokohl and Lewis Creeks and all the distributaries of Kaweah River below Terminus Dam. Many of these distributaries terminate at, and may deliver water into, the Tulare-Kings Unit on the west either through St. Johns River on the north or through Elk Bayou on the south. Since the latter channel also carries flood flows originating in the Lewis Creek drainage area and could carry controlled flows originating in the Mehrten and Yokohl Creek drainage areas, the southern boundary of Kaweah Unit includes the drainage areas of Lewis Creek and Elk Bayou as far west as the junction of the Bayou with Tule River. Both Antelope and Dry Creek drainage areas are included in Kaweah Unit since they either do, or under controlled conditions may, influence flows in distributaries of Kaweah River.

TULE UNIT

The Tule Unit consists essentially of the drainage areas of Tule River between Success Dam and the junction of the river with Elk Bayou. It also includes the Frazier Creek drainage area which lies between the drainage areas of Lewis Creek and the Tule River. The hills immediately north and easterly of Porterville enclose a portion of the Tule River drainage area which also is included in the Tule Unit.

DEER UNIT

The Deer Unit consists of the drainage area of Deer Creek and includes the low foothill drainage areas of Fountain Springs Gulch and Terra Bella—Ducor. The western boundary of the Unit is taken at State Highway 99.

WHITE UNIT

The White Unit is the southernmost Unit and includes the drainage area of White River, the Orris, Vestal and Richgrove drainages and the drainage area of Rag Gulch, a stream originating in Kern County which inundates a small area near Richgrove at the south Tulare County boundary.

MOUNTAIN UNIT

The Mountain Unit contains the drainage areas of the Kaweah and Tule Rivers upstream of Terminus and Success Dams.

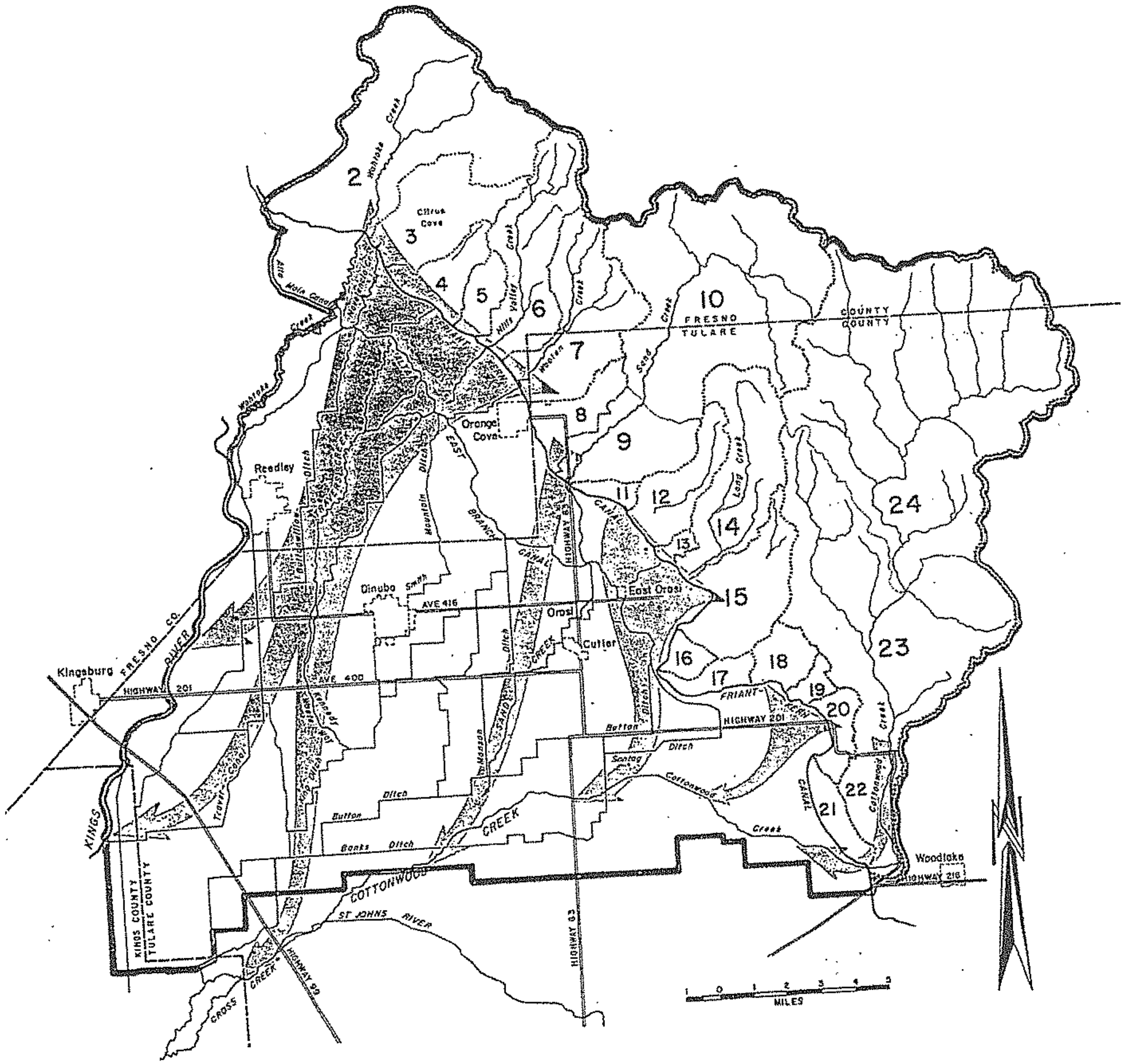
TULARE-FRESNO UNIT

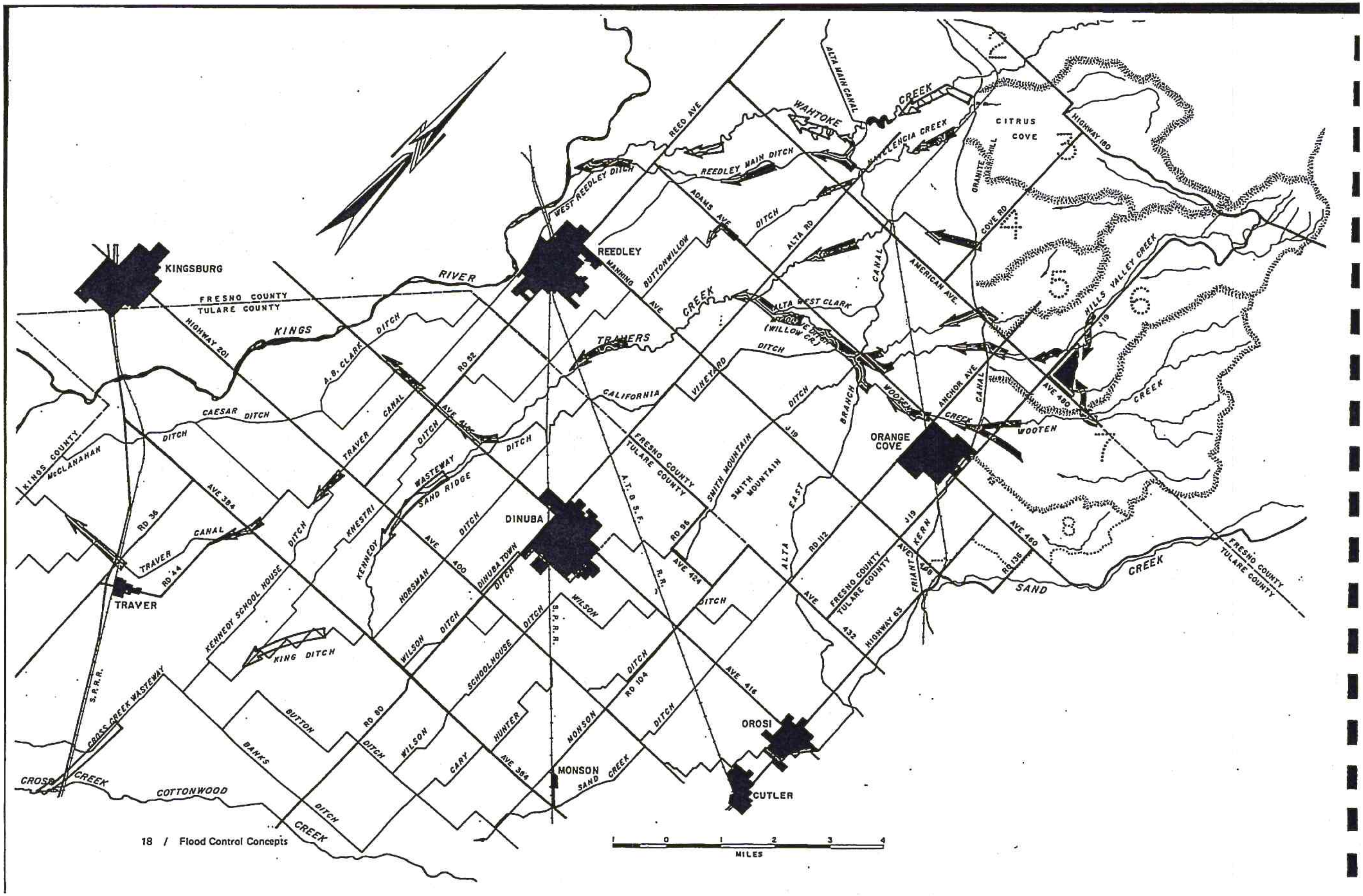
Flood problems in this Unit and their solutions are of concern to landowners in both Fresno and Tulare Counties. Solutions also are of concern to landowners in Kings County since flood flows originating in the Unit may reach that County either through Kings River or the Cottonwood—Cross Creek system. Further studies aimed at implementing the concepts for this Unit accordingly should be approached, if possible, on a bi- or tri-county basis.

Runoff of Wahtoke Creek (Area 2), Citrus Cove (Area 3), Granite Hill (Area 4), Surprise Creek (Area 5), Hills Valley Creek (Area 6), Wooten Creek (Area 7) and Orange Cove (Area 8) produces flooding of Fresno County lands and contributes to flooding in Tulare County. Extensive flooding occurs east of the Friant-Kern Canal and between this canal and the Alta East Branch Canal. To the east of Friant-Kern Canal the flooding results from inadequate channel capacity and, to some extent, obliteration of drainage channels by land development. The flood waters from some of these drainage areas are concentrated by Friant-Kern Canal at siphons or overchutes which enable their flood flows to flow westward toward the Alta East Branch Canal. Flooding between the Friant-Kern and Alta East Branch Canals results from inadequate channel capacity downstream of Friant-Kern Canal crossings and by ponding against the Alta East Branch Canal. The Alta East Branch Canal banks may breach, admitting part of this ponded water to the Canal, in which it will flow southward.

Wooten Creek and Orange Cove drainages also cause direct flooding in Tulare County north and east of the town of Orange Cove by waters which then flow into Fresno County before re-entering Tulare County. Runoff from the drainage areas between Sand Creek (Areas 9-10) and Cottonwood Creek (Areas 22-24) produce flooding which is all within Tulare County.

Basically, the concepts for this Unit would provide for disposal of a maximum of floodwaters in Kings River, with the remainder entering Cottonwood Creek. Flood flows originating in and southerly of Sand Creek drainage area must necessarily be disposed of in Cottonwood Creek due to the distance to Kings River and availability of existing channels. Most of the flows originating in the main drainage area of Wooten Creek and in streams northerly of that creek can be directed through existing or improved channels to Kings River.


2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Citrus Cove
Wahtoke Creek
Hills Valley Creek
Wooten Creek
Sand Creek
Long Creek
FRESNO COUNTY
TULARE COUNTY
Orange Cove
EAST BRANCH CANAL
Mountain Ditch
Reedley
Dinuba
Smith
AVE 416
Orosi
East Orosi
Cutler
AVE 400
Kingsburg
HIGHWAY 201
HIGHWAY 63
FRIANT-KERN CANAL
Button Ditch
Santag Ditch
Cottonwood Creek
Banks Ditch
COTTONWOOD CREEK
ST JOHNS RIVER
HIGHWAY 99
CROSS CREEK
KINGS RIVER
FRESNO CO.
KINGS COUNTY
TULARE COUNTY
Woodlake
HIGHWAY 216
Alta Main Canal
Traver Canal
1 0 1 2 3 4 5
MILES


KINGSBURG
REEDLEY
DINUBA
ORANGE COVE
OROSI
CUTLER
MONSON
TRAVER
KINGS
RIVER
FRESNO COUNTY
TULARE COUNTY
KINGS COUNTY
HIGHWAY 201
HIGHWAY 180
HIGHWAY 63
WAHTOKE
CREEK
ALTA MAIN CANAL
REEDLEY MAIN DITCH
WEST REEDLEY DITCH
REED AVE
ADAMS AVE
ALTA RD
AMERICAN AVE.
COVE RD
CITRUS
COVE
GRANITE HILL
HILLS VALLEY CREEK
WOOTEN
BUTTONWILLOW
MANNING
AVE
TRAVERS
CREEK
ALTA WEST CLARK
(WILLOW CR.)
VINEYARD
DITCH
CALIFORNIA
A.T. & S.F.
R.R.
S.P.R.R.
SMITH MOUNTAIN
ALTA
EAST
RD 112
RD 96
AVE 424
AVE 416
AVE 432
AVE 460
AVE 480
AVE 400
AVE 384
AVE 416
ANCHOR AVE
CANAL
BRANCH
J19
KERN
FRIANT
RD 136
SAND
CREEK
A.B. CLARK
RD 52
TRAVER
CANAL
CAESAR
DITCH
McCLANAHAN
WASTEWAY
SAND RIDGE
KENNEDY
KNESTRI
HORSMAN
DINUBA TOWN
WILSON
SCHOOLHOUSE
HUNTER
CARY
RD 104
RD 80
RD 36
RD 44
KENNEDY SCHOOL HOUSE
KING DITCH
BUTTON
BANKS
CROSS CREEK WASTEWAY
CROSS
COTTONWOOD
MILES
1 0 1 2 3 4

Wahtoke Creek to Wooten Creek

WAHTOKE CREEK (AREA 2)

The channel of Wahtoke Creek between Alta Main Canal and Kings River has a capacity of more than 2,000 cfs. It is reported to have carried 2,000 cfs without damage during the flood of February 1969. Detailed study of Wahtoke Creek channel may reveal that its capacity would have to be increased at a few points between Friant-Kern Canal and Alta Main Canal if flows are introduced from other streams as described below.

The estimated once-in-50-year and once-in-25-year flows of Wahtoke Creek at Friant-Kern Canal are, respectively, 2,400 cfs and 1,680 cfs. These concentrations probably will not occur at these frequencies under present conditions due to ponding east of Friant-Kern Canal. However, flood control measures may be taken in the future to eliminate this ponding; such measures can proceed independently of the concepts discussed below except for possible enlargement of Wahtoke Creek channel at a few points upstream of Alta Main Canal.

CITRUS COVE DRAINAGE (AREA 3)

Channels in Citrus Cove which join to form Navelencia Creek at Friant-Kern Canal may have concentrations of flow of 680 and 970 cfs at the crossing of that canal on the average of once in 25 and 50 years, respectively, if those channels are improved. Some channel improvement of Navelencia Creek is required to carry expected flows in the reach between Friant-Kern and Alta East Branch Canals. Detention storage upstream of the East Branch is considered impractical.

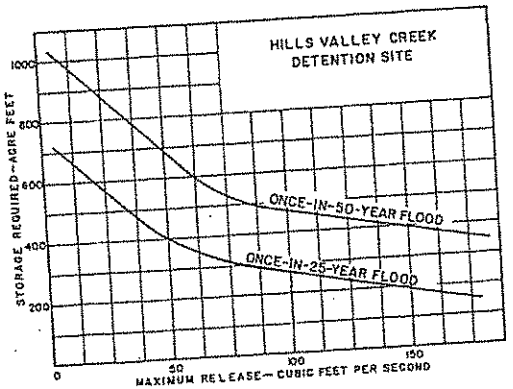
Two alternate concepts are suggested for conveyance of Navelencia Creek flows to Kings River. In one, the creek flood-flow would be diverted as close as possible to the downstream side of the Friant-Kern Canal siphon to Wahtoke Creek for conveyance to Kings River. In the second concept, flows arriving at the Alta East Branch Canal would be distributed by that canal. The Alta East Branch structures would be modified or improved to cause Navelencia Creek water to flow into Buttonwillow Ditch (within its existing or improved capacity) and up the Alta East Branch to Reedley Main Ditch (within the existing or improved capacity of West Reedley Ditch, which can deliver water to Wahtoke Creek). Navelencia Creek flows in excess of quantities which can be diverted to Buttonwillow and West Reedley Ditches would be backed farther up the Alta East Branch Canal to a point where excess water can be spilled directly into Wahtoke Creek. Such a spillway could be located about one-quarter mile north of the Reedley Main Ditch headgate.

The goal of these measures should be to eliminate or minimize the quantity of Navelencia Creek water flowing to the south in the Alta East Branch Canal.

GRANITE HILL DRAINAGE (AREA 4), SURPRISE CREEK (AREA 5), HILLS VALLEY CREEK (AREA 6) AND WOOTEN CREEK (AREA 7)

Granite Hill Drainage and Surprise, Hills Valley and Wooten Creeks are considered together because solutions to the flood problems of all may be related. The basic flood control concept for these drainage areas is the reduction of flood peaks with detention storage where feasible and the collection of releases from detention reservoirs and unregulated flood runoff into Travers Creek for disposal, insofar as possible, in the Kings River.

Flows from Granite Hill Drainage cross Friant-Kern Canal in a culvert and are channelized to the Alta East Branch Canal at the head of Travers Creek. This channel will require improvement to convey even the estimated once-in-25-year flood of 380 cfs. Travers Creek channel appears to have adequate capacity for this flow between Alta East Branch and its crossing with Alta Road.



The channel of Surprise Creek may require improvement if it is to safely convey even the estimated once-in-25-year flow of 270 cfs from Friant-Kern Canal to the Alta East Branch Canal near Adams Avenue. Flows from Surprise, Hills Valley and Wooten Creeks converge on the Alta East Branch Canal near this location. The combined flow of these creeks can be conveyed westward through an enlarged Mt. Olive Ditch (Willow Creek) to Travers Creek at Alta Road.

There appears to be a potential detention reservoir site at the Fresno-Tulare County line in Hills Valley to which flows of Hills Valley and Wooten Creeks could be diverted. Such a reservoir would have a low dike along the north side of Avenue 480 (American Avenue) for a distance of about one-half mile and for a distance of about one mile along the east side of Road J19 (Hills Valley Road). Diversions into the detention area would be made at the north and east ends of the dike with controlled releases being made to the channel of Hills Valley Creek about one-half mile north of the Avenue 480—Road J19 intersection. The reservoir site is presently unimproved.

Coincidental peak flows of Hills Valley and Wooten Creeks at the proposed detention site will be about 1,700 cfs on the average of once in 50 years. A graph for the Hills Valley detention site presents the relationship between required detention basin capacity in acre feet and controlled releases in cfs. For example, a basin having a capacity of about 690 acre feet could control the once-in-50-year combined flow of both creeks to 50 cfs, while a basin of 570 acre-foot capacity could control the once-in-25-year combined flow to 25 cfs. Present uses of the land within the proposed detention basin could continue almost unimpaired under flowage easement arrangements.

Detailed economic studies relating reservoir and release capacities to ability of downstream channels to handle reservoir releases will be needed before the capacities of both can be determined. With some improvement of Hills Valley Creek channel westerly of Friant-Kern Canal it may be possible to deliver low controlled flows into Alta East Branch and through an improved Mt. Olive Ditch (Willow Creek) channel to Travers Creek. It does not appear that Wooten Creek runoff originating south of Avenue 480 will be very large but some channel work will be required between Alta East Branch Canal and the foothill line. Alta East Branch struc-

tures will require modifications to limit canal flows to the south and to direct flow into the improved Mt. Olive Ditch channel through the California Vineyard Ditch or any new channel that may be required to implement this concept.

If it is not possible to secure this storage, channel modifications along Hills Valley Creek, Wooten Creek and Mt. Olive Ditch will become much more difficult as will the lower Travers Creek and Traver Canal problems discussed below. Nevertheless, the concept of conveying as much of the flood flow of these creeks to Travers Creek and Kings River, and of relieving Alta East Branch of their flows, should be followed.

TRAVER CANAL

In 1969 Travers Creek is reported to have carried, without damage, a flow of 1,130 cfs as measured at a point east of Reedley. Traver Canal, which starts at Avenue 416, is the head of various Alta Irrigation District ditches, some of which can convey at least small quantities of water to either Kings River or Cross Creek. Water of Travers Creek after crossing Avenue 416 to the west of Dinuba and entering Traver Canal may flow to the west in the Canal or, in small part, south through Alta system canals to Cross Creek Wasteway. However, neither Traver Canal nor its distributary ditches have capacity adequate to convey the flows of Travers Creek if those flows are augmented by flows (even if regulated) of Wooten, Hills Valley and Surprise Creeks and Granite Hill Drainage. Detailed study of disposal of Travers Creek water crossing the Fresno-Tulare County line should include analyses of two basic disposal routes: direct to Kings River and to Cross Creek. Kings River routing is more desirable because there is more opportunity for percolation in the channel of that river, and routing to Cross Creek does not eliminate completely the flood problem along that creek and in Tulare-Kings Unit. Traver Canal, if extended to Kings River, might be used to convey Travers Creek water to Kings River, but in any detailed study the costs of other conveyance facilities, including pipe, with routes north of Avenue 416 should be analyzed even though much of the area is completely developed to permanent crops.

Any plan for improving distribution of water flowing in lower Travers Creek should include consideration of disposal of drainage water originating in the City of Reedley.

Orange Cove & Sand Creek

ORANGE COVE DRAINAGE (AREA 8)

Considerable ponding now occurs to the southeast of Orange Cove from flood runoff of the area designated Orange Cove Drainage (Area 8). This area drains the low foothills northwesterly of Sand Creek (Areas 9 and 10). Wooten Creek now adds to this ponding, a situation which can be alleviated or eliminated under the concepts described above. There is a small pump now installed in a sump at Avenue 460 which drains water into Friant-Kern Canal; however, it is too small to eliminate the present ponding, with the result that excess water flows across the canal into the City, and then southwesterly across developed land to Alta East Branch in the vicinity of the Orange Cove sewage ponds.

Several alternative drainage schemes, in addition to the Wooten Creek modifications, should be studied to eliminate this ponding. A larger pump could be installed and appears to be practical; however, detailed field surveys may show that the existing small drain along Friant-Kern Canal could convey the relatively small flows involved to the first culvert under the canal southeast of Orange Cove. Flow from this culvert and the culvert about one-half mile farther south, which are drainage collection points for areas to the east, can be conveyed to the Alta East Branch Canal and then southward to Monson Ditch, which can convey the flow to Sand Creek at Avenue 400.

SAND CREEK (AREAS 9 AND 10)

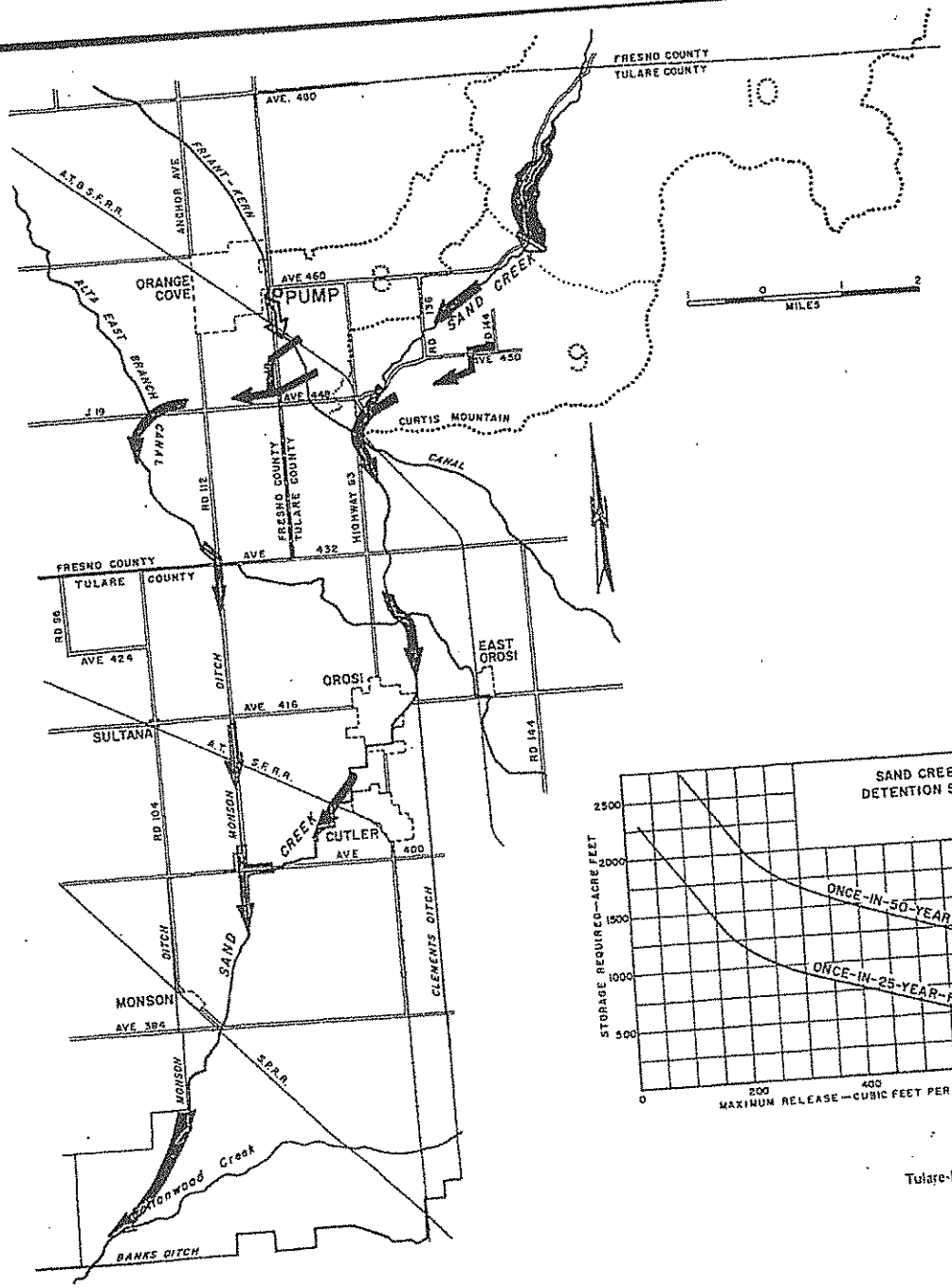
Sand Creek is a major contributor to flooding an area of some 30 square miles east of Road 104 and southerly to Cottonwood Creek. Some of the water flooding this area is carried from the north by the Alta East Branch Canal, but control of Sand Creek, together with the measures suggested previously for more northerly streams, is a key to reduction of flood damage in this area which includes Sultana, Orosi, East Orosi, Cutler and Monson.

A peak flow of 3,520 cfs was recorded in Sand Creek near Orange Cove (about three and one-half miles above its crossing of Friant-Kern Canal) in January 1969. This is almost the once-in-50-year flow of 3,820 cfs. Sand Creek channel needs very little improvement to carry such flows for about one and one-half miles downstream of the Friant-Kern crossing, but below that point capacity of the channel probably is no more than 1,000 cfs. Almost the entire creek channel has been improved and relocated between this point and the vicinity of Cottonwood Creek. Detailed hydraulic study should be made of the channel between Friant-Kern Canal and Cottonwood Creek, but the channel probably cannot be enlarged significantly because of its proximity to Orosi and Cutler. Flows should not exceed more than 500 cfs in this channel upstream of the intersection of Road 112 and Avenue 400 southwest of Cutler. At this intersection it may be advisable to transfer water to Sand Creek from Monson Ditch, which is so located that it can carry water conveyed from the north in the Alta East Branch Canal.

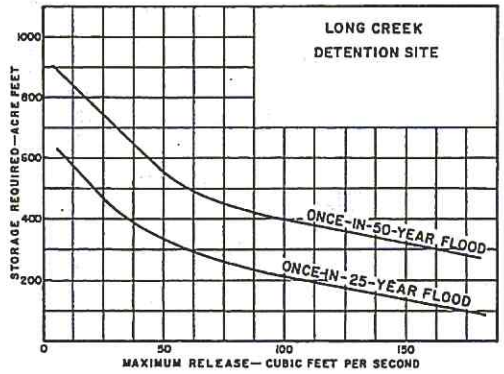
Reduction of anticipated peak flows of Sand Creek by detention east of Friant-Kern Canal is essential. The amount of such storage is directly related to the amount of flow permitted to pass downstream. The relationships between detention basin capacity and controlled releases for once-in-25-year and once-in-50-year flows are presented in graph form. As shown, a basin having a capcity of about 1,300 acre feet could control once-in-50-year flows to 500 cfs.

There are several sites east of Friant-Kern Canal where relatively low dams could be constructed to provide flood storage space of this magnitude. Each of these sites involves different problems of dam volume, foundations, and road relocations and all should be examined in any detailed study of controlling Sand Creek flood flows. The site shown is the one farthest downstream and therefore is the most effective for flood control.

The area between Sand Creek and Curtis Mountain in the vicinity of Avenue 450 is detrimentally affected by flooding and a high groundwater condition. The U.S. Department of Agriculture, Soil Conservation Service, has recommended construction of a drainage ditch commencing at the junction of Avenue 450 and Road 144 and terminating at Sand Creek about one-fourth mile upstream of the Friant-Kern Canal. This drainage ditch will assist in alleviating these problems.



Curtis Mountain to Colvin Mountain



CURTIS MOUNTAIN DRAINAGE AT FRIANT-KERN CANAL (AREA 11)

About ninety percent of the runoff originating in the Curtis Mountain Drainage is now discharged directly into the Friant-Kern Canal through drainage inlets. The balance, which is not significant in terms of flooding, originates in the west end of the area and is dissipated at the railroad crossing of the canal. No flood control works are required for this area.

NEGRO AND LONG CREEKS (AREAS 12 AND 14)

These creeks contribute to flooding in the East Orosi area. Westerly of the culverts conveying their flows under Friant-Kern Canal the channels of both creeks are almost obliterated. Negro Creek may concentrate 510 and 730 cfs at the Canal culvert on the average of once in 25 and 50 years, while Long Creek and its principal tributary, Story Creek, may deliver 950 and 1,360 cfs at the Canal at the same average return periods. These peak flows should be reduced to the minimum capable of being carried in existing or improved ditches between Friant-Kern and Alta East Branch Canals. If Alta East Branch is relieved of flows originating north of East Orosi under the concepts described previously, Button Ditch, extended directly south from Yettem, may be utilized to convey regulated flows of Negro and Long Creeks to Cottonwood Creek.

Regulation of Negro and Long Creeks may be possible and should be given detailed study. The flow of Negro Creek originating above about elevation 950 may be divertable to a reservoir site on Long Creek immediately downstream of its junction with Story Creek. Another reservoir site capable of controlling diverted Negro Creek water and Long Creek water exists on Long Creek above the mouth of Story Creek. As shown in the graph of the relationship between reservoir capacity at the lower site and controlled releases, about 740 acre feet of storage could control the combined once-in-50-year peak flow of Negro, Long and Story Creeks to about 25 cfs. The resulting releases would have to be conveyed past the Friant-Kern Canal to the Alta East Branch Canal.

As an alternative or supplement to such a reservoir, consideration might be given to reducing the size of the Long Creek culvert under Friant-Kern Canal and, with some strengthening of the canal bank, creating added detention storage along the Canal.

The flood runoff from the Negro Creek drainage area not diverted to Long Creek can be collected at the culvert under Friant-Kern Canal south of Avenue 432. Channel work will be required to convey this flow westward to the Alta East Branch Canal northwest of East Orosi.

AVENUE 424 DRAINAGE (AREA 13)

The flood flow from the 0.7 square mile Avenue 424 Drainage may reach peaks of 95 and 130 cfs at 25- and 50-year intervals at Friant-Kern Canal. While there are no data to indicate that 1969 flows from this drainage area inundated land west of Friant-Kern Canal, topography in the vicinity suggests that the runoff may have added to flooding near East Orosi. Utilization of the existing channel and possibly connecting it to ditches which can convey water to Alta East Branch near East Orosi should be studied.

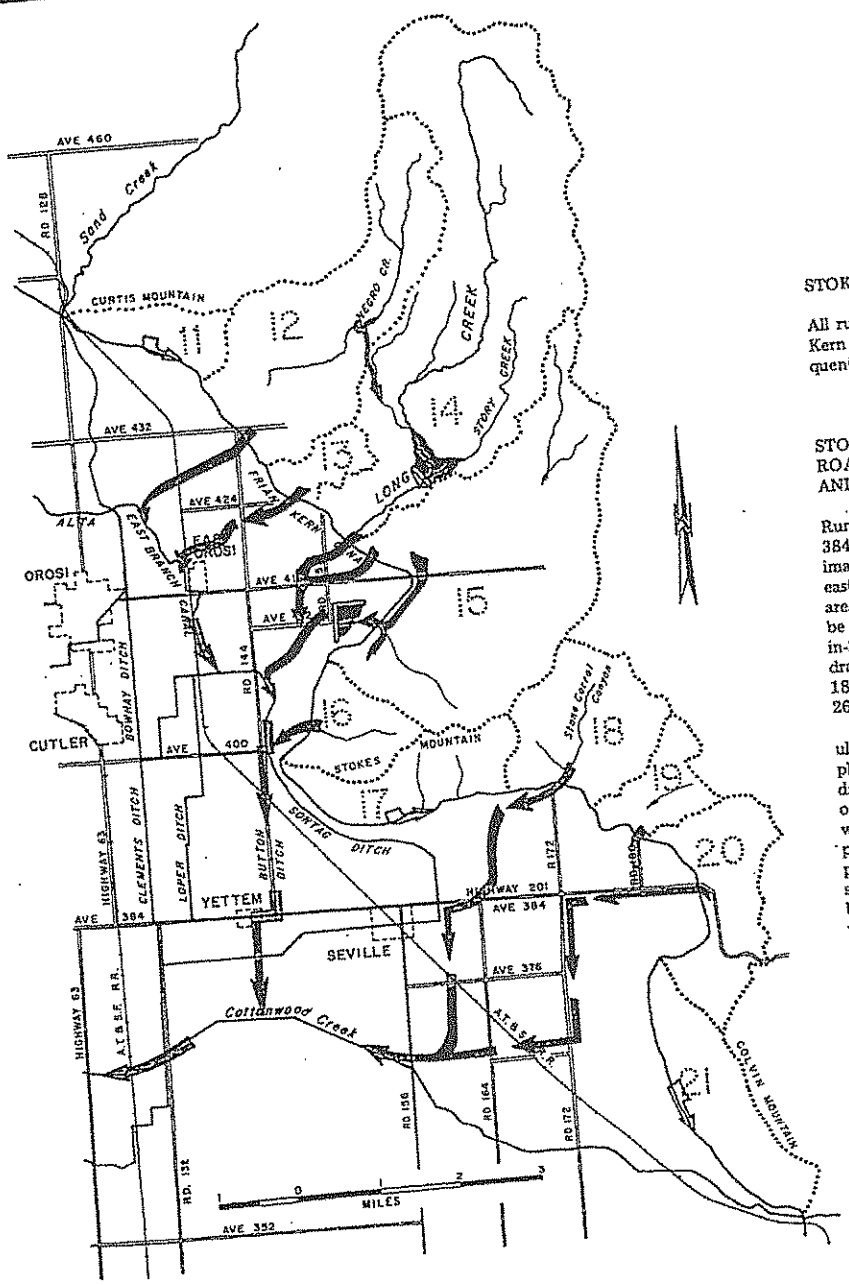
AVENUE 416 DRAINAGE (AREA 15)

Runoff from this 8.4 square mile area, which lies between the crests of Stokes Mountain on the south and east and the Long Creek drainage area on the north, has contributed to flooding west of Friant-Kern Canal. Peak runoff from the area, if concentrated at the canal, could exceed 650 and 930 cfs on the average once in 25 and 50 years, respectively. The area is drained by two large culverts under Friant-Kern Canal, one north and one south of Avenue 416; however, the southern culvert handles runoff from over 95 percent of the area. The Bureau of Reclamation has a right-of-way and maintains a channel from the northern culvert to Avenue 416 and similarly maintains a channel from the southern culvert to Road 152. Beyond the ends of these channels the water courses have been obliterated. Water from the north culvert can be conveyed in an improved roadside ditch along Avenue 416 and joined to the channel conveying Long Creek releases.

Detention storage might be developed on the relatively unimproved land east of Road 152 at Avenue 412 to provide regulation for flows crossing Friant-Kern Canal at the southern culvert. Storage of 375 acre feet can be obtained by constructing a dike about three-fourths of a mile long and to a maximum height of about 12 feet. This detention storage could control once-in-50-year runoff to about 25 cfs, which might be routed with Long Creek releases to Alta East Branch Canal and then down Button Ditch to Cottonwood Creek.

STOKES MOUNTAIN—WEST DRAINAGE (AREA 16)

Runoff from this 1.3 square mile area crosses the Friant-Kern Canal at a culvert about one-fourth mile north of Avenue 400 and may contribute to flooding east of Road 144. There is no defined channel west of the Canal, but consideration should be given to constructing a ditch between the culvert and Alta East Branch Canal.



STOKES MOUNTAIN—SOUTH DRAINAGE (AREA 17)

All runoff from this long narrow drainage area enters Friant-Kern Canal through a number of drainage inlets; consequently no flood control works are required.

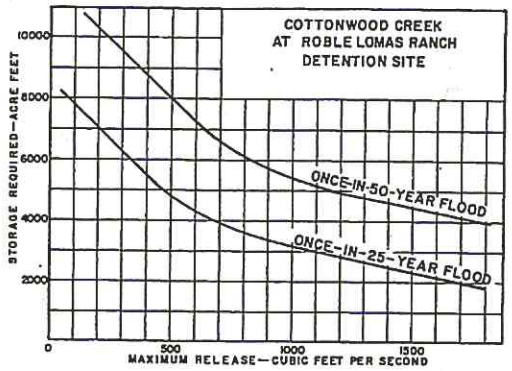
STONE CORRAL CANYON (AREA 18), ROAD 180 DRAINAGE (AREA 19) AND AVENUE 384 DRAINAGE (AREA 20)

Runoff from Stone Corral Canyon, Road 180 and Avenue 384 Drainage areas causes extensive flooding in the approximately 11 square mile area north of Cottonwood Creek and east of Seville. There are no suitable detention sites in the area to regulate the flood runoff; therefore, the flows must be channelized and conveyed to Cottonwood Creek. Once-in-25- and 50-year flows which can be expected from these drainages are: Stone Corral Canyon, 300 and 430 cfs; Road 180 Drainage, 135 and 190 cfs; and Avenue 384 Drainage, 265 and 380 cfs.

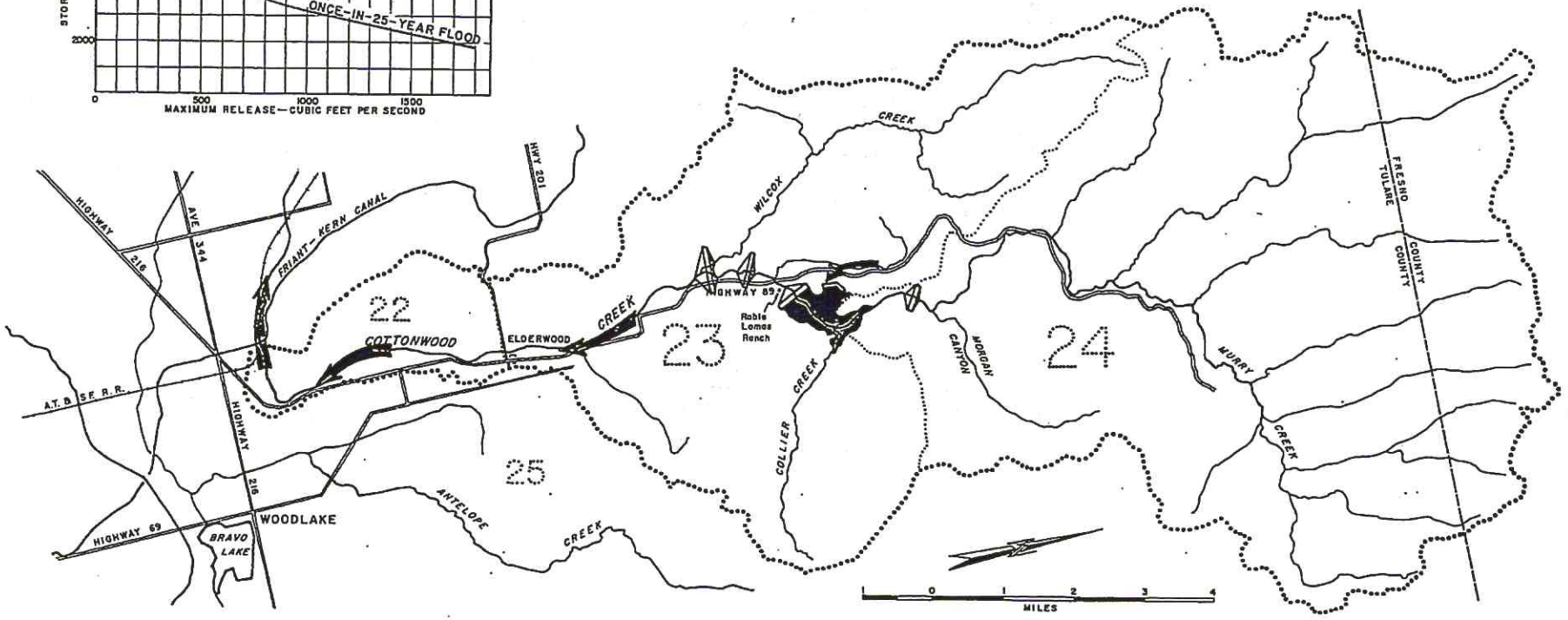
A Public Law 566 Watershed Work Plan has been formulated for this area by the Soil Conservation Service. The plan includes construction of 2.6 miles of open-joint tile drains, 6.4 miles of reinforced concrete pipe, 4.0 miles of open channel and a 230-acre-foot sump adjacent to Cottonwood Creek to ameliorate a high groundwater problem and provide protection against once-in-10-year floods. Under this plan the principal channels would be in approximately the same locations as those shown on the map. The sump would be located to the west of Road 156 and north of Cottonwood Creek.

COLVIN MOUNTAIN DRAINAGE (AREA 21)

This long narrow 2.4 square mile drainage area drains into Friant-Kern Canal through a number of drainage inlets and consequently no flood control works are required.



Cottonwood Creek



ALTA IRRIGATION DISTRICT SYSTEM AND COTTONWOOD CREEK

Prior to discussing flood control concepts for Cottonwood Creek above its junction with St. Johns River, it is appropriate to review the functions of the Alta Irrigation District's system in any plan for control of flooding in the Tulare-Fresno Unit. At present the system provides extensive flood control benefits, epsecially during periods of heavy snowmelt runoff of the Kings and San Joaquin Rivers. It provides these benefits by distributing runoff of the two rivers to farms within the District for direct irrigation and groundwater recharge, thus reducing flood flows along Kings and San Joaquin Rivers and into Tulare Lake. Also, the system probably alters flooding conditions during rain-floods, both within and outside the District boundaries: these alterations are caused by ponding against canal and ditch banks, and by conveyance of water toward the south and west where breaks in canals may produce extensive flooding in combination with flooding from local streams near the breaks. This ponding and flooding provides detention storage which reduces peak flows into Cottonwood Creek, ultimately reducing flows into the Tulare-Kings Unit. Operation, maintenance and reconstruction activities by the District during and after such rain-floods result in increased costs to District landowners.

The physical existence and operational capability of the Alta system should be recognized and utilized fully in any planning for flood control in the Tulare-Fresno Unit. Numerous structural alterations will be required to enable many of the concepts for the Tulare-Fresno Unit to be carried out. Moreover, since significant rain storms may occur on relatively short notice from about November 1 to about April 1 of each season, structure settings should be made and operational procedures established to enable the system to perform flood control functions at any time during the rainy season. The primary operational goal should be to interrupt north-to-south flow in the East Branch Canal at selected points, diverting as much of the canal flow as possible toward the Kings River in order to permit introduction of rain-floods originating easterly of the canal. Of course, peak flows of such rain-floods should be reduced wherever possible through use of detention reservoirs.

During rain-floods much of the tailwater from the Alta system enters Cottonwood Creek above its junction with St. Johns River. The tailwater would be modified in time and amount if the concepts and operational planning described above were implemented. Presently tailwater combines with overland flood flows from the Orosi, East Orosi, Yettem and Monson vicinities, but these latter flows will be modified under the measures previously discussed. However, controlled tailwater will still enter the channel of Cottonwood Creek, joining the St. Johns River at Cross Creek and flowing ultimately into the Tulare-Kings Unit.

The channel of Cottonwood Creek has been improved over the years and levees exist over a part of its length westerly of Friant-Kern Canal. However, these levees are not designed to accommodate inflows from channels and ditches to the north such as Sand Creek; as a result, extensive flooding occurs on both sides of the creek. While much of the flood-prone land along the westerly reaches of Cottonwood Creek is less productive than lands to the east, it is gradually being developed.

Comprehensive planning for Cottonwood Creek should include consideration of the upstream storage discussed below, the necessity of backwater levees along Alta ditches and other channels contributing water from the north, and the effect of flood control measures in the area north of Cottonwood Creek on flows in the Cottonwood Creek—Cross Creek system.

COTTONWOOD CREEK (AREAS 22-24)

The lower reaches of Cottonwood Creek are reported to have a capacity of about 1,200 cfs. Cottonwood Creek at Elderwood has estimated once-in-25- and 50-year peak flows of about 6,170 and 8,820 cfs, respectively. Augmentation of channel capacity west of Friant-Kern Canal sufficient to carry flows of such magnitude is impractical. Also, since elimination of flooding in areas north of the creek through the concepts described previously depends on modifying flood runoff from the north, part of the existing channel capacity west of Seville will be needed to convey the modified flows. Further, as discussed below under the Tulare-Kings and Kaweah Units, flows of Cottonwood Creek and St. Johns River should, insofar as possible, be limited to amounts which will alleviate flooding conditions along Cross Creek in Tulare-Kings Unit. All these considerations dictate need for storage to reduce Cottonwood Creek peak flows at the Friant-Kern Canal crossing. The amount of such reduction will depend on the amount of upstream flood control space provided.

Economic considerations developed in detailed study of the Cottonwood Creek system will be important in determining the frequency and amount of controlled release warranted. Four potential reservoir sites, located three to six miles north of Elderwood, have been identified. Drainage areas tributary to these sites range from 75.6 to 51.4 square miles, as compared to the total drainage area of Cottonwood Creek at Friant-Kern Canal of 88.1 square miles.

A logical storage site appears to be the one located immediately east of State Highway 69 at the Roble Lomas Ranch. In addition to the runoff from the 60.9 square miles of drainage area above the damsite, runoff from the small drainage area to the west of the site could be diverted into the reservoir. Reservoirs lower on the watershed would be more desirable for detention purposes, but may be too costly or otherwise impractical. A graph presents the relationships between storage and releases from a reservoir at the Roble Lomas Ranch site and shows, for example, that storage of about 8,000 acre feet could control once-in-50-year peak inflows to an outflow of about 500 cfs, and that about 10,000 acre feet could control inflows of that frequency to about 250 cfs.

The 17.2 square miles of Cottonwood Creek drainage area below the Roble Lomas Ranch site could contribute peak flows about equal to the capacity of the creek channel immediately west of Friant-Kern Canal. Also, under the previously discussed concepts, it is possible that at times flood runoff from the north may enter Cottonwood Creek at rates of flow higher than occurred during the 1966 and 1969 storms. However, the average coincidence of these two events probably will be less frequent than once in 50 years. Further detailed study of flood control measures in Tulare-Fresno Unit will be necessary to establish the required capacity of the Cottonwood Creek channel.

KAWEAH UNIT

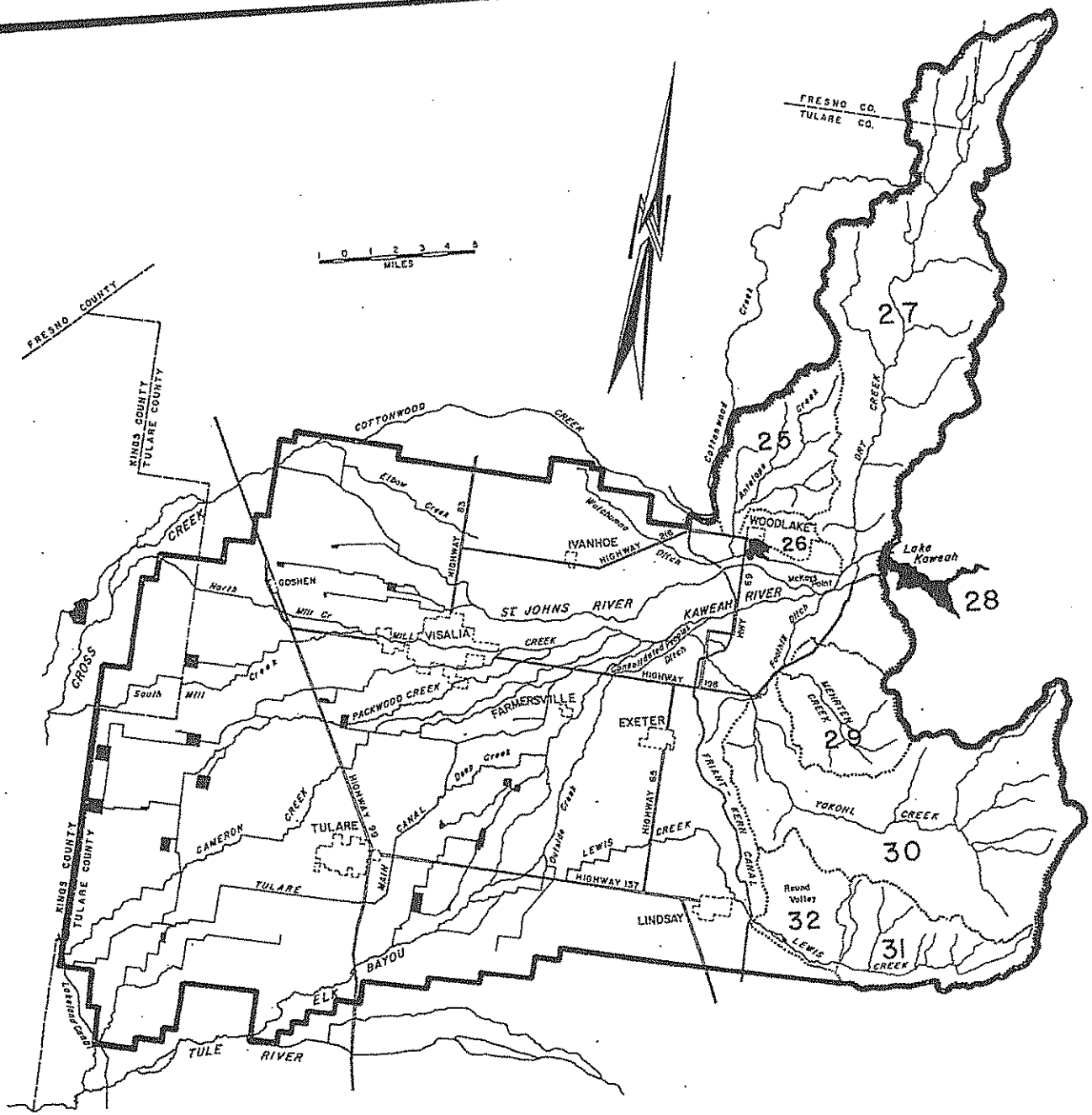
Flood problems in this Unit and their solutions are of concern to landowners in both Tulare and Kings Counties. The natural and man-made channels of the Kaweah River system dominate the Unit and are key elements in present flood control operations in this Unit. One of these channels, St. Johns River, joins Cottonwood Creek and contributes to flooding along Cross Creek in Tulare and Kings Counties and in Tulare Lake. Many of the Kaweah Delta ditches terminate in Elk Bayou and water from those ditches, together with Tule River water, floods land in western Tulare County and can aggravate water management problems in the Tulare Lake area. Other Kaweah Delta ditches, although feeding spreading grounds and reservoirs in western Tulare County, also deliver tailwater into Kings County areas and affect water management problems there. Antelope, Mehrten, Yokohl and Lewis Creeks all have specialized rain-flood problems, but also must be considered in planning flood control measures for the Kaweah River system. Apart from localized flooding, water in these streams literally has "no place to go" at times of large flows in Dry (Limekiln) Creek or large releases from Terminus Reservoir.

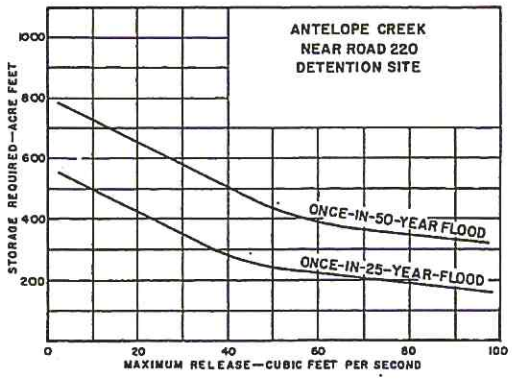
Dry Creek itself is critically important to flood control measures below Terminus Dam; it is reported to have had a peak flow of 14,500 cfs in 1966 about one-half mile upstream of its junction with Kaweah River, an amount to be compared with the objective flow of 5,500 cfs at McKays Point control structure, which divides the flow between St. Johns and Kaweah River channels. Dry Creek also carries large quantities of debris which, in lodging against the control structure at McKays Point, threaten its security and ability to function properly.

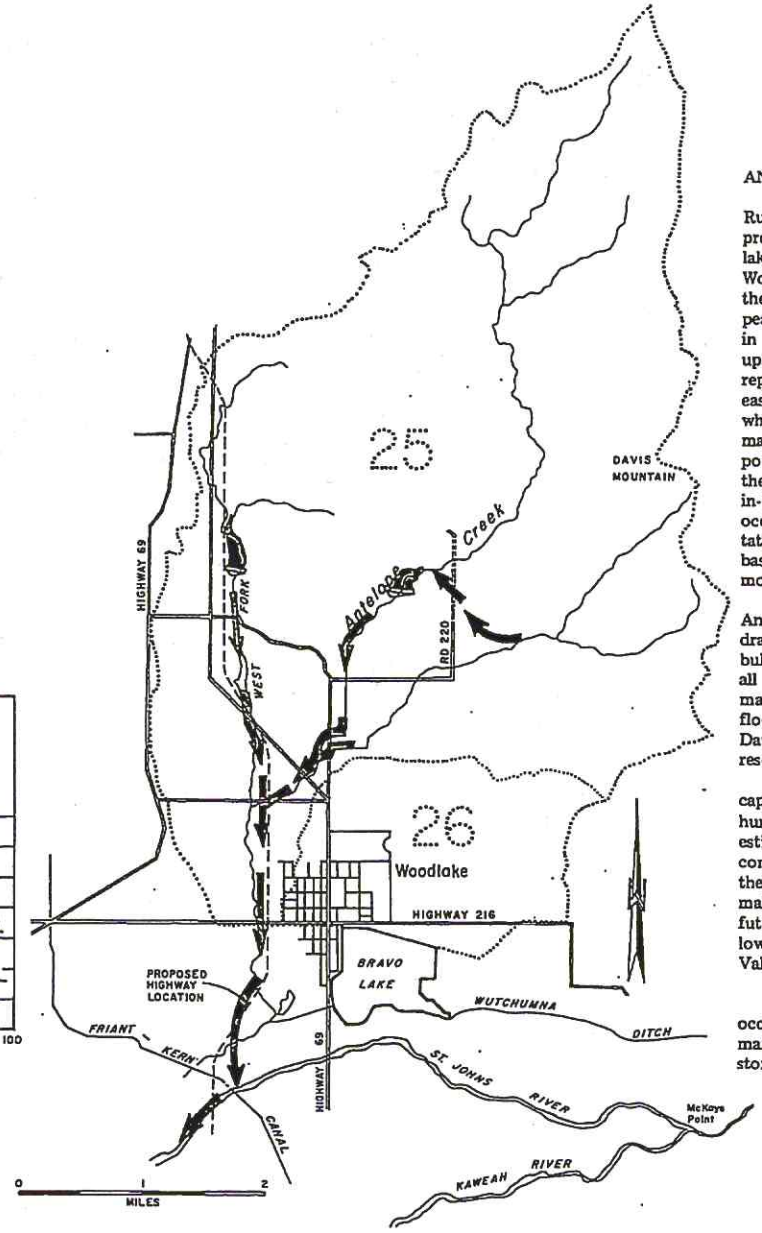
Flows in excess of 5,500 cfs pose serious operational problems at the McKays Point structure. As a result, serious flooding in Visalia is a definite hazard under present conditions. Currently, the Corps of Engineers is studying means of alleviating this problem. Until river flows reaching the structure can be controlled to less than 5,500 cfs (and such control should be the long-range goal as discussed below) correction of the existing hazardous condition is urgently required. Accordingly, every encouragement should be given to early completion of the Corps study and to subsequent corrective measures at the McKays Point structure.

Construction of a large reservoir on Dry Creek, possibly with a tunnel connecting it with Terminus Reservoir, and increasing the size of Terminus Reservoir through gating of the overflow spillway, are currently being studied. These studies should be encouraged and supported since projects which result may eliminate the existing Dry Creek problem, improve control of snowmelt runoff to the benefit of land throughout the Kaweah Unit, reduce flooding in Kings County — especially Tulare Lake — and reduce necessary rain-flood releases from Terminus Reservoir, which would enable the use of Consolidated Peoples Ditch and Outside Creeks to convey controlled rain runoff of Mehrten and Yokohl Creeks.

To summarize, there are three key steps to improved flood control in the Unit: a combined Tulare-Kings County effort to augment flood storage space on Dry Creek and Kaweah River, localized improvements in the Antelope, Mehrten, Yokohl and Lewis Creek watersheds, and continued and improved use of Kaweah Delta ditches and creeks for conveyance and distribution of rain runoff from these low foothill watersheds, both to minimize flood damage and to conserve water through direct crop use and spreading.


FRESNO CO.
TULARE CO.
FRESNO COUNTY
KINGS COUNTY
TULARE COUNTY
0 1 2 3 4 5
MILES
COTTONWOOD CREEK
Elbow Creek
Cottonwood Creek
Antelope Creek
Dry Creek
Wutchumna Ditch
IVANHOE
HIGHWAY 65
WOODLAKE
26
25
27
Lake Kaweah
28
McKays Point
ST JOHNS RIVER
KAWEAH RIVER
GOSHEN
Mill Ck
VISALIA
Consolidated Peoples Ditch
HIGHWAY 198
Packwood Creek
South Fork Mill Creek
FARMERSVILLE
EXETER
Deep Creek
Ontario Ditch
Friant Kern Canal
Yokohl Creek
29
2
30
TULARE
CAMERON CREEK
MAIN ST
CANAL
HIGHWAY 99
LEWIS CREEK
HIGHWAY 137
LINDSAY
Round Valley
32
31
EL BAYOU
TULE RIVER
Lewis Creek





ANTELOPE CREEK

Runoff from the 20.7 square mile Antelope Creek watershed produces extensive ponding north and northwest of Woodlake; however, Antelope Creek produces flooding within Woodlake city boundaries only in the northwest corner of the City. Antelope Creek is reported to have discharged a peak flow of 1,050 cfs across Highway 216 west of Woodlake in February 1969, although extensive ponding occurred upstream of the highway and a small part of the streamflow reportedly entered the main part of the City of Woodlake east of Highway 69. Since 1969, work has been accomplished which will prevent Antelope Creek water from entering the main part of Woodlake above Bravo Lake. The extensive ponding upstream of Highway 69 indicates that peak flows at the highway during 1969 might have approached the once-in-50-year peak of 1,920 cfs had overflow and ponding not occurred. It also appears that urbanization in the area dictates that detailed planning for flood protection should be based on floods having a frequency of once in 50 years or more.

It is highly desirable to provide detention storage in the Antelope Creek drainage, especially on the main creek, which drains the higher portion of the watershed and thus yields the bulk of peak runoff. Only one such detention site appears at all practical. This site west of Road 220 has a probable maximum capacity of 500 acre feet. Additional control of flood runoff can be attained by diverting the flow from the Davis Mountain area northerly into this proposed detention reservoir.

The graph shows the relationship between reservoir capacity at the main-creek site and controlled releases. Four hundred fifty acre feet of storage at this site could reduce the estimated once-in-50-year peak flow of 1,170 cfs from the combined drainage areas to 50 cfs. Below the detention site the existing channels can be improved to deliver the regulated main-creek flow to conveyance facilities along the proposed future alignment for Highway 69. Unregulated flow from below the Davis Mountain diversion structure in Antelope Valley also can be introduced into this improved channel.

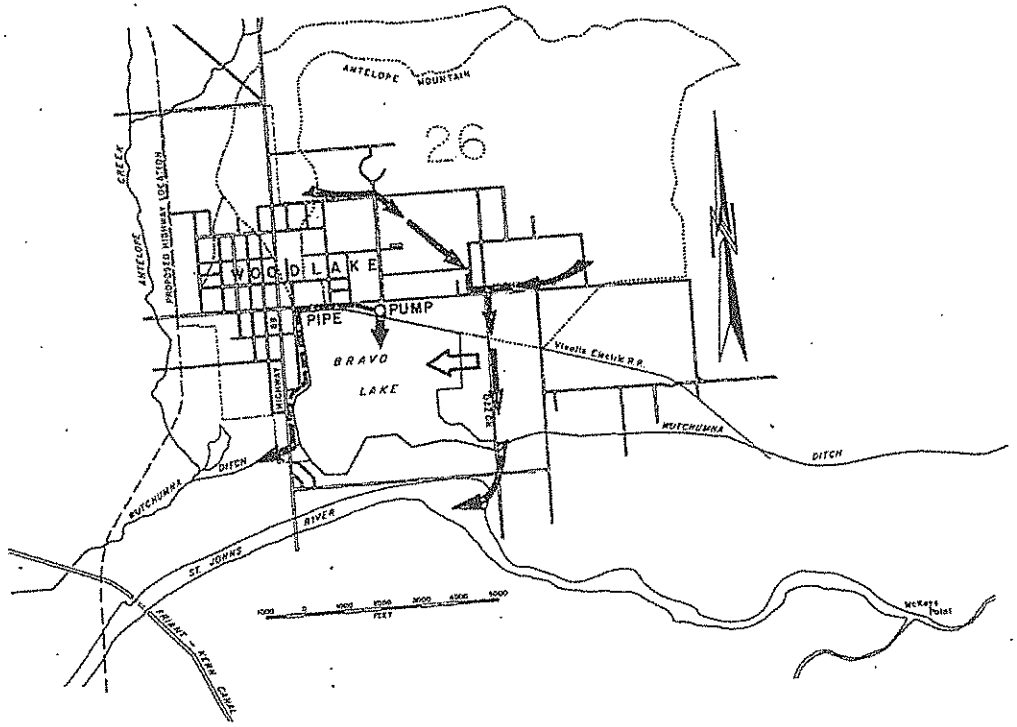
Peak flows of several hundred cubic feet per second may occur in the West Fork of Antelope Creek, which joins the main channel northwest of Woodlake. Sites for detention storage on the West Fork are quite limited, there appearing to

Antelope Creek and Woodlake

be only one of about 400 acre foot capacity as shown on the map. Even this small capacity reservoir should be considered in detailed studies since it may be useful in reducing peak flows of the West Fork to a rate which, together with West Fork flow below the detention site, can be channelized along the proposed highway right-of-way to the location of the main Antelope Creek channel. From this location the combined flow can be directed southerly adjacent to the highway right-of-way to the St. Johns River.

ANTELOPE MOUNTAIN—WOODLAKE DRAINAGE (AREA 26)

Past flooding in Woodlake above Bravo Lake has been caused by a combination of Antelope Creek overflow north of the city and runoff from the hills to the east. As noted above, Antelope Creek flows are not now likely to contribute to flooding in Woodlake north of Bravo Lake. The flows from the east are guided by Highway 216 and the Visalia Electric embankment into Woodlake. As shown on the map, interceptor channels could collect flow from the north and east of Woodlake and convey it into Bravo Lake, if feasible, or to St. Johns River. The remaining runoff in the immediate vicinity of Woodlake could be handled by enlargement of the existing pump station and utilization of the 36" pipe around Bravo Lake to Wutchumna Ditch.



Dry Creek

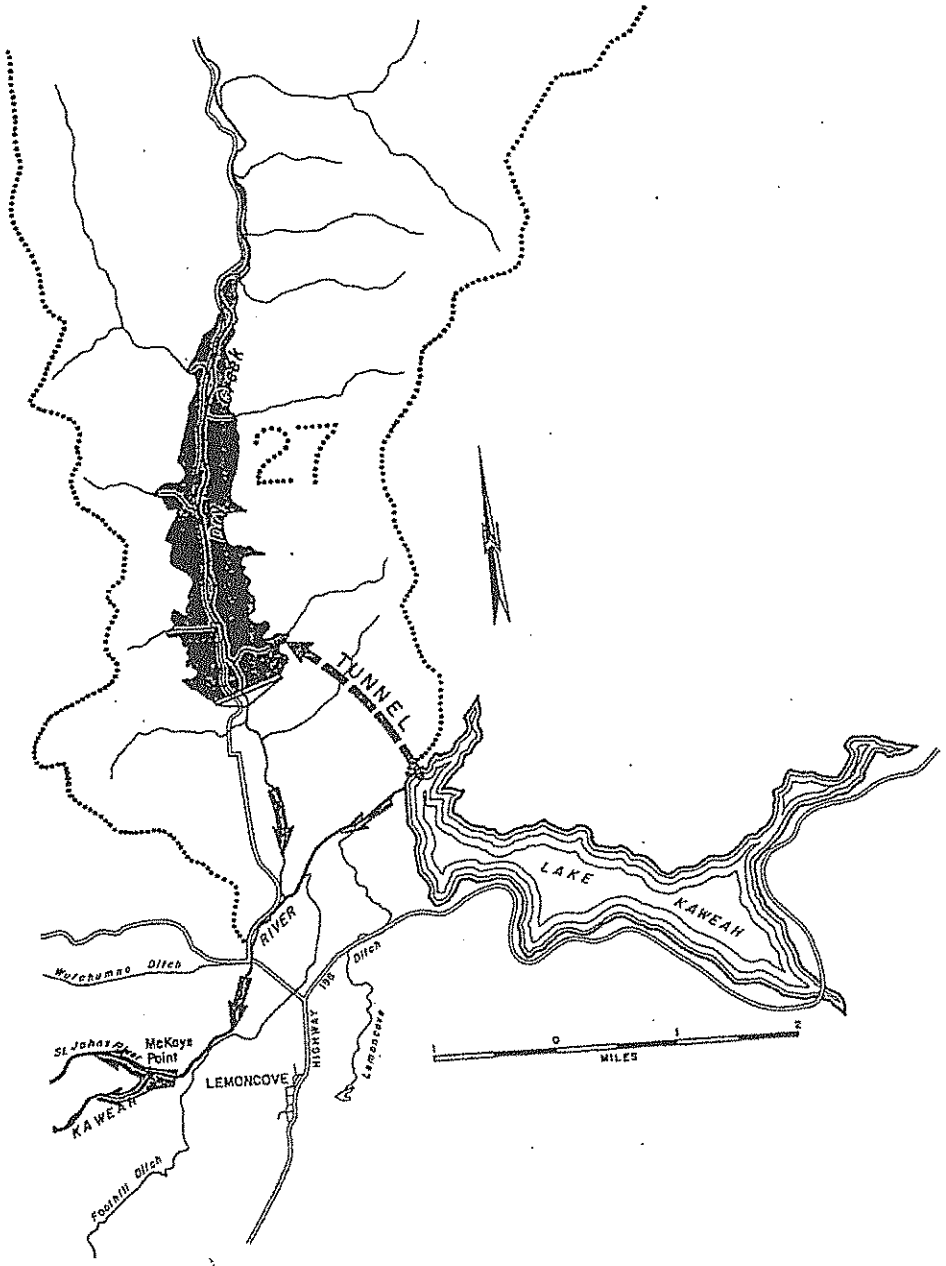
DRY CREEK (AREA 27)

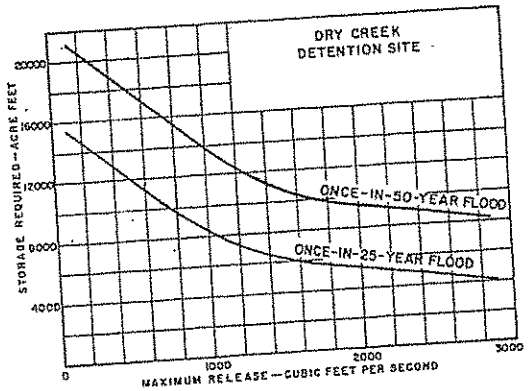
Detention storage on this watershed is essential to all the concepts of flood control in the Kaweah Unit. During the rain-flood of December 1966 releases from Lake Kaweah were minimized so as to aid in reducing peak flows at McKays Point, and although the peak flows of Dry Creek were attenuated considerably through channel storage, flows at the McKays Point weir are reported to have ranged between 8,000 and 9,000 cfs. While there is no assurance that Lake Kaweah rain-flood releases can be controlled as effectively at all times as in 1966, it is obvious that rain-flood flows of more than 5,500 cfs will occur at McKays Point fairly frequently and probably more frequently than once in every 25 years on the average. Furthermore, since the essential concept of rain-flood control in most of the Kaweah Unit requires use of existing Kaweah Delta distribution channels, whose capacity is taxed when flows reach 5,500 cfs at McKays Point, it is clear that the objective flow at this location during the rainy season should be well under that presently established.

Long range studies now underway by the Corps of Engineers include evaluating the merits of increasing the capacity of Lake Kaweah. Increased capacity in the Lake can not only provide urgently needed additional rain-flood protection, but can better control snowmelt-flood runoff to Tulare Lake and can regulate it for improved distribution on the valley floor. Also under study is the possible construction of a large reservoir on Dry Creek connected by tunnel to Lake Kaweah. The wide fluctuations in natural flows of Dry Creek militate against the economic feasibility of a Dry Creek reservoir constructed only to conserve the creek flows and to provide control of its flood runoff. However, combining these purposes with the ability to store Kaweah River water in a Dry Creek reservoir will augment the total benefits through better conservation of Kaweah River snowmelt runoff and reduction of snowmelt damage in Tulare Lake. Reduction of overall rain-flood releases from such a multi-purpose project would be a key element in a coordinated system for reducing winter flood damage over a substantial part of the Kaweah Unit. Such a coordinated system must reduce the combined peak rain-flood runoff from Kaweah River, Antelope, Dry, Mehrten, Yokohl and Lewis Creeks to amounts which could be distributed throughout the St. Johns, Kaweah, and Elk Bayou channels at rates which can be managed successfully in both the Kaweah and Tulare-Kings Units.

Although flood control storage on Dry Creek is critically needed, and may ultimately be secured best in a large reservoir which can effectively regulate part of Kaweah River snowmelt runoff, it will probably be a number of years before such a project can materialize. In the interim, the hazardous conditions below McKays Point will continue to exist and reduction of flood damages from flows of Mehrten, Yokohl and Lewis Creeks will be more difficult unless detention storage is provided on Dry Creek. Under these practical circumstances, consideration might be given to construction of a single-purpose flood control dam on Dry Creek designed to anticipate eventual incorporation in a much larger dam, such as is now being considered by the Corps of Engineers. The size of such a single-purpose reservoir would depend on the desired amount of control of Dry Creek inflows to the Kaweah River. Relationships between reservoir capacity and controlled releases are shown on the graph for the Dry Creek detention site at the location proposed for the larger reservoir.

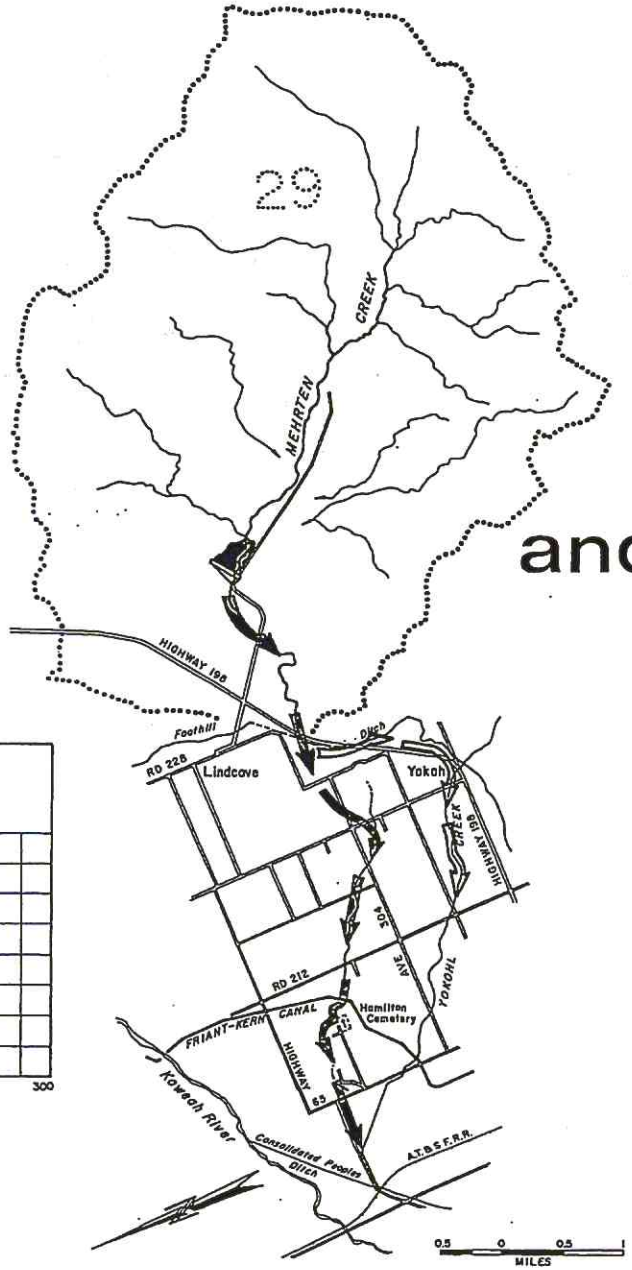
If such a single-purpose Dry Creek reservoir is considered in detailed studies of Kaweah Unit, its size must reflect the probability that Terminus Dam releases alone may exceed the 5,500 cfs objective flow at McKays Point perhaps once in 40 years. Also, the reservoir would have to have gated outlets, since it would be necessary to operate it in conjunction with Terminus Dam.

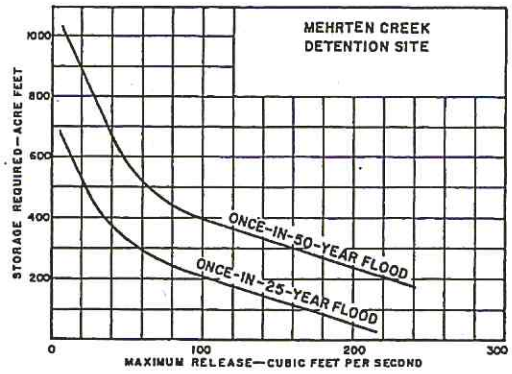

27
TUNNEL
LAKE KAWEAH
RIVER
Watchumna Ditch
McKays Point
LEMONCOVE
HIGHWAY 198
Ditch
KAWEAH
Foothill Ditch
0 1 2
MILES


DRY CREEK
DETENTION SITE
STORAGE REQUIRED—ACRE FEET
20000
16000
12000
8000
4000
0
ONCE-IN-50-YEAR FLOOD
ONCE-IN-25-YEAR FLOOD
1000
2000
3000
MAXIMUM RELEASE—CUBIC FEET PER SECOND

Flood flows of Mehrten and Yokohl Creeks cause extensive inundation of developed orchards east of Friant-Kern Canal, flood property to the outskirts of Exeter by ponding against man-made obstructions, and on entering Consolidated Peoples Ditch, may overflow to other areas to the southwest. The channel of Mehrten Creek west of Highway 198 has been virtually obliterated by land-leveling. The channel of Yokohl Creek at the Highway 198 crossing is restricted, but from that point to Friant-Kern Canal has a capacity of about 2,000 cfs. However, flows of this magnitude cannot be managed in the Consolidated Peoples Ditch without damage.

Mehrten Creek and Yokohl Creek





MEHRTEN CREEK (AREA 29)

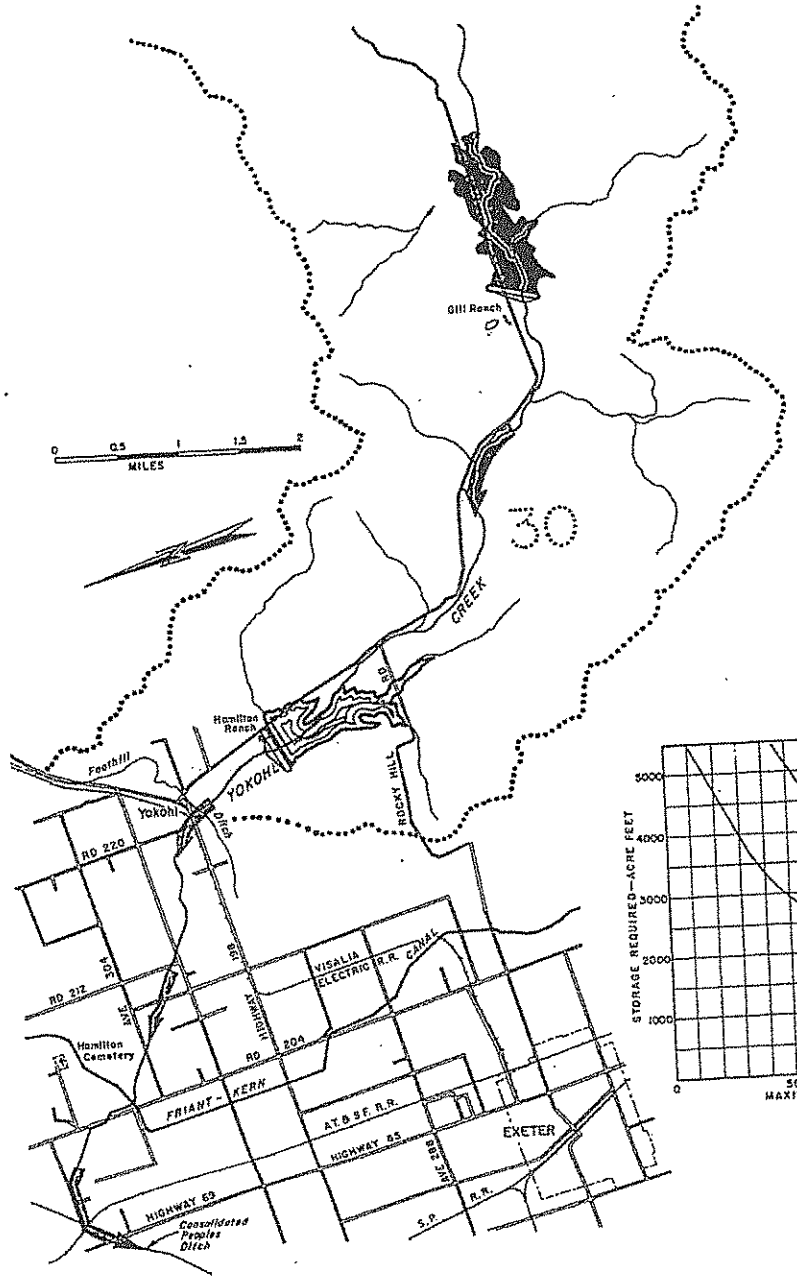
As with other detention and channel modification concepts presented in this report, detailed study of Mehrten Creek should explore various combinations of reservoir size and channel capacities and routings to determine the plan most satisfactory from the viewpoints of cost and impact on existing improvements. A graph for a Mehrten Creek detention site located east of Highway 198 shows the relationship between detention storage capacities and controlled releases of flows of Mehrten Creek. As shown, about 860 acre feet of detention storage at this site could control peak flows of Mehrten Creek, expected once in every 50 years on the average, to about 25 cfs at Highway 198. A reservoir with low dikes, having a capacity of 1,000 acre feet, is topographically possible at the site and could reduce such peaks to as little as 10 cfs. It may be possible to convey controlled flows of these magnitudes along the east side of Highway 198 to Yokohl Creek or in conveyance channels to the Mehrten Creek culvert at Friant-Kern Canal then to Yokohl Creek near Consolidated Peoples Ditch. Conveyance even of severely reduced Mehrten Creek flows to points where they will cause no damage will require detailed study because of developments west of Highway 198.

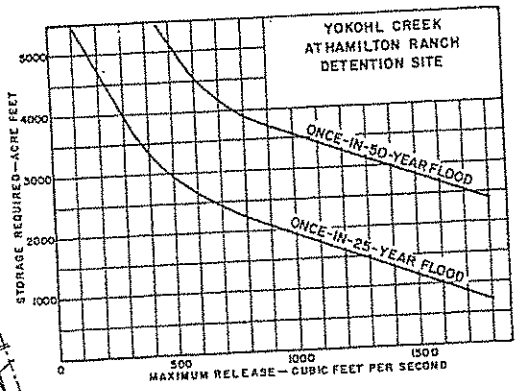
YOKOHL CREEK (AREA 30)

Disposal of regulated Yokohl Creek water poses less difficult problems since such flows can be managed by modification of Consolidated Peoples Ditch, assuming the practicality of the concepts related to McKays Point flows developed in the Dry Creek section above. There are several storage sites physically available on Yokohl Creek, including one near Hamilton Ranch and one near Gill Ranch. The Hamilton Ranch site is lower on the watershed, hence could control more runoff, but the Gill Ranch site appears, topographically, to be less costly. Relationship between required storage capacity and controlled releases at the Hamilton Ranch detention site is shown in the graph. Essentially the same storage volume at the Gill Ranch site is required because runoff below Gill Ranch could not be regulated and additional storage would therefore be required at that site to compensate for the necessarily smaller releases from the reservoir. Depending on the reduction of inflow to the Consolidated Peoples Ditch from the Kaweah River by control of Dry Creek and Lake Kaweah, it appears that a detention reservoir of about 3,000 to 5,000 acre-foot capacity should be capable of controlling Yokohl Creek rain-flood flows to amounts which can be handled in this ditch.

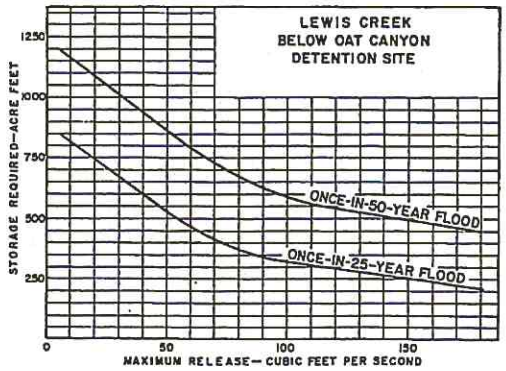
MULTI-PURPOSE PROJECTS ON MEHRTEN AND YOKOHL CREEKS

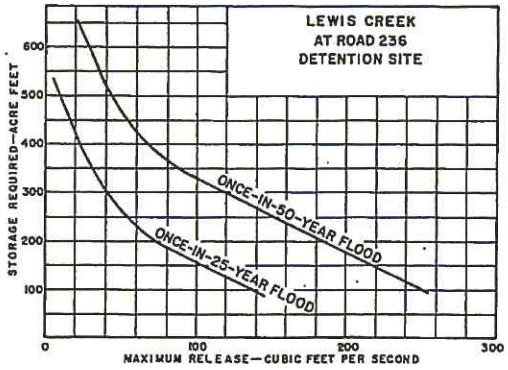
Suggestions have been made that large conservation reservoirs be considered on one or both of these creeks and the sites mentioned previously are topographically capable of such development. Water to be conserved in such larger reservoirs would be pumped into them from the proposed East Side Canal since the dependable supplies of the two creeks are small. The Secretary of the Interior is now considering a report on the East Side Project, Initial Phase, in which consideration is given to the development of several off-channel reservoirs along the proposed East Side Canal, including one in Tulare County on Deer Creek. It is possible that large reservoirs on Mehrten or Yokohl Creeks might be incorporated in final plans of an East Side Project, Ultimate Phase. The small amount of space required for control of rain-floods on the two creeks might be secured more economically as part of a large conservation reservoir than as a separate, single-purpose project. It is likely, however, that the urgency of controlling floods on the two creeks will require such single-purpose construction much earlier than a large reservoir on either creek. It is suggested that in any further planning of a single-purpose detention reservoir, efforts be made to provide for its eventual incorporation into a larger structure or to so locate it as not to preempt the site for a larger dam.





Lewis Creek





LEWIS CREEK (AREAS 31 AND 32)

Peak flows of about 1,850 and 2,650 cfs may be expected in Lewis Creek near its crossing of Friant-Kern Canal on the average of once in 25- and 50-years, respectively. The channel capacity is not much more than 250 cfs downstream of this point which is about three miles east of Lindsay. The channel is particularly constricted in the vicinity of Lindsay and Tonyville and is abutted by many improvements, including residences. From Tonyville westward, Lewis Creek has been almost completely realigned during land development. The realigned channel capacity for the most part is believed to be about 250 cfs to its crossing of Highway 137. South of Highway 137 the Lewis Creek channel disappears, resulting in widespread flooding. Flood potentials are best illustrated by the results of the December 1966 and February 1969 storms when 1,900 cfs and 1,480 cfs, respectively, are estimated to have flowed in Lewis Creek about five miles east of Lindsay. These peak flows do not include the substantial runoff contribution from the Round Valley area. From analyses of the flood runoff characteristics of the Lewis Creek watershed, it is estimated that peak flows downstream of Round Valley in the 1966 and 1969 storms were in the order of 2,000 to 2,500 cubic feet per second.

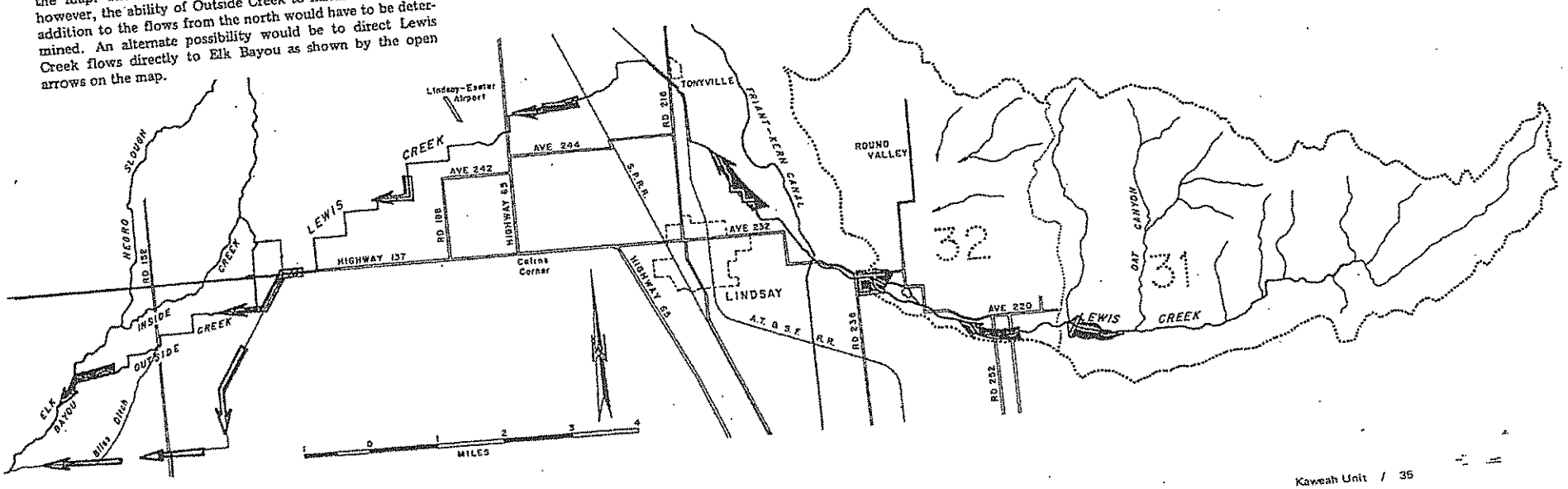
Because of the highly developed land in the vicinity of Lindsay, it would be extremely difficult to obtain the greatly increased channel capacity needed to convey the high rates of runoff produced by the Lewis Creek drainage area. The state of development along Lewis Creek, particularly in the Lindsay-Tonyville area, would indicate at least once-in-50-year protection should be the goal. Detention storage on Lewis Creek is essential if a reasonable degree of flood control is to be obtained.

The upper 16.6 square miles of the Lewis Creek drainage area can be controlled by a dam located below Oat Canyon Creek. Peak flows at this site are estimated to be about 1,130 and 1,620 cfs on the average of once in 25 and 50 years, respectively. The relationship between storage capacity and downstream releases is shown on the graph for this detention site. However, even with no flow passing the Oat Canyon site, the 15.5 square miles of drainage area between this site and Lewis Creek—Road 236 crossing can produce estimated peak flows in Lewis Creek of 1,050 and 1,470 cfs with average frequencies of occurrence of 25 and 50 years, respectively. Additional detention storage can be obtained immediately to the east of Road 236 by construction of about one mile of embankment. The graph showing the relationship between storage capacity and downstream releases for this lower site

was prepared assuming no flow passing the Oat Canyon site. As a practical matter, releases would have to be made from the upper site and would pass through the lower detention site to add to the flow of Lewis Creek to the west. The combined effect of releases from both detention sites on the downstream channel must be considered in detailed planning studies of the overall Lewis Creek flood problem.

Because of the critical location of the downstream detention site, it appears essential that outlet facilities be provided at this site capable of passing up to 200 cfs with a minimum of head. Also, during detailed planning the sustained carrying capacity of the entire Lewis Creek channel should be determined.

At present Lewis Creek is not actually connected to the Outside Creek—Elk Bayou system. To implement flood control throughout the Lewis Creek system such a connection will have to be made. Two possibilities of connecting Lewis Creek with Outside Creek and Elk Bayou are shown on the map. The most direct connection is to Outside Creek; however, the ability of Outside Creek to handle this flow in addition to the flows from the north would have to be determined. An alternate possibility would be to direct Lewis Creek flows directly to Elk Bayou as shown by the open arrows on the map.



TULE UNIT

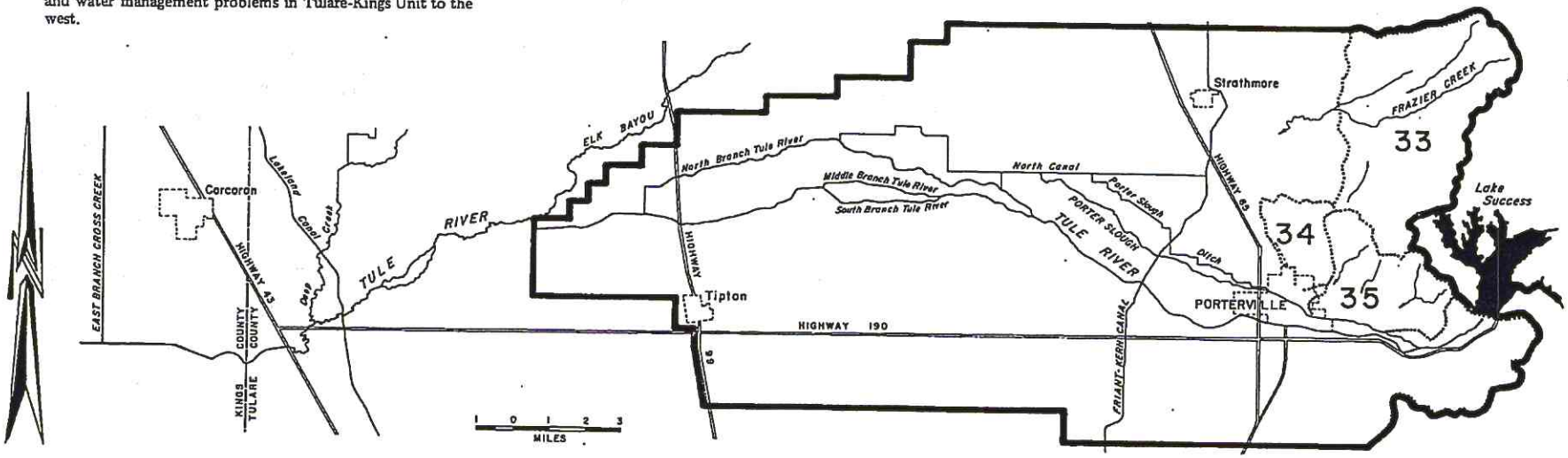
GENERAL

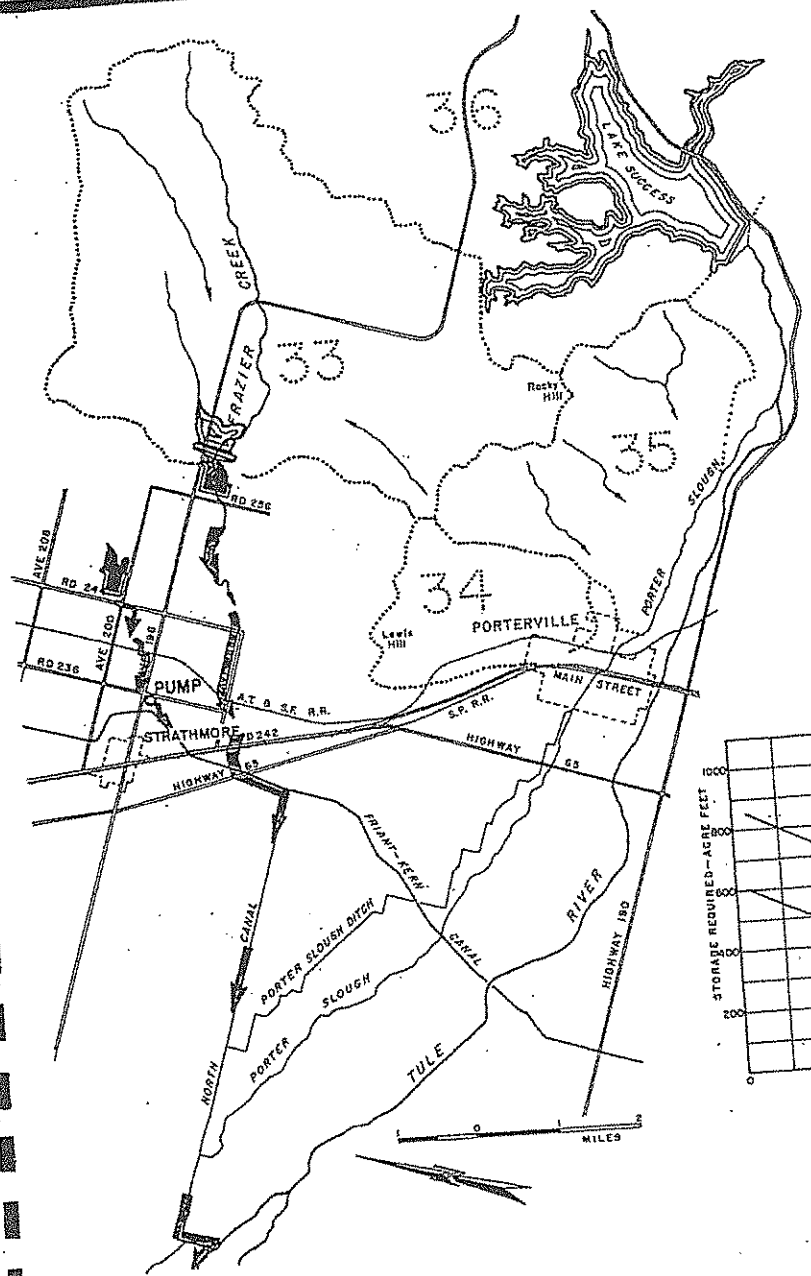
As in the Kaweah Unit, flooding in the Tule Unit and solutions therefor are of interest to landowners in both Tulare and Kings Counties. Success Reservoir provides regulation of rain-floods on Tule River, but as a result of the December 1966 flood and in the interest of better controlling snowmelt runoff, consideration is being given to increasing the capacity of the reservoir. Reduction of peak flows can assist in eliminating flooding near Highway 99 and below the junction of the River with Elk Bayou and also partially alleviate flooding and water management problems in Tulare-Kings Unit to the west.

TULE RIVER

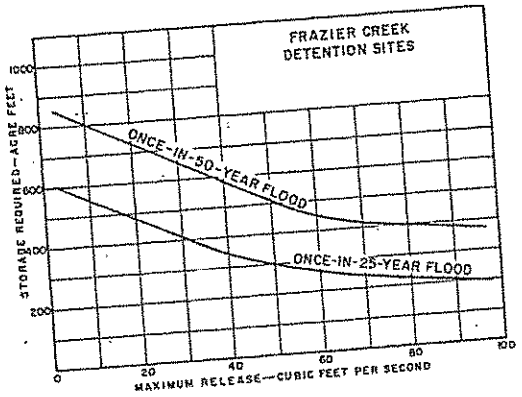
Lake Success provides rain-flood protection to Porterville and most other areas along Tule River especially since considerable channel improvement work has been accomplished. Nevertheless, the objective maximum rain-flood release from Lake Success of 3,200 cfs was unavoidably exceeded in December 1966 when a maximum discharge of 9,050 cfs occurred. The 3,200 cfs objective release was reached in the February 1969 flood. As shown on the Flooded Area Map in the Introduction, some 18,000 acres of land near Tule River above its junction with Elk Bayou were flooded in December 1966. In spite of substantial channel work having been done after that flood, the 1969 storm produced some channel overflow along both branches east of Highway 99. River flows westerly of Highway 99 in 1969, in combination with flows in Elk Bayou, also produced flooding from the junction of the two streams to the vicinity of the Lakeland Canal, a distance of about six miles.

Increased storage capacity in, and reduced rain-flood releases from, Lake Success appear to be the physical solution to the present rain-flood problems on the Tule River. Economic justification for such a solution probably would rest principally on better control and conservation of snowmelt runoff, benefits of which would extend into Tulare Lake.





Frazier Creek



FRAZIER CREEK (AREA 33)

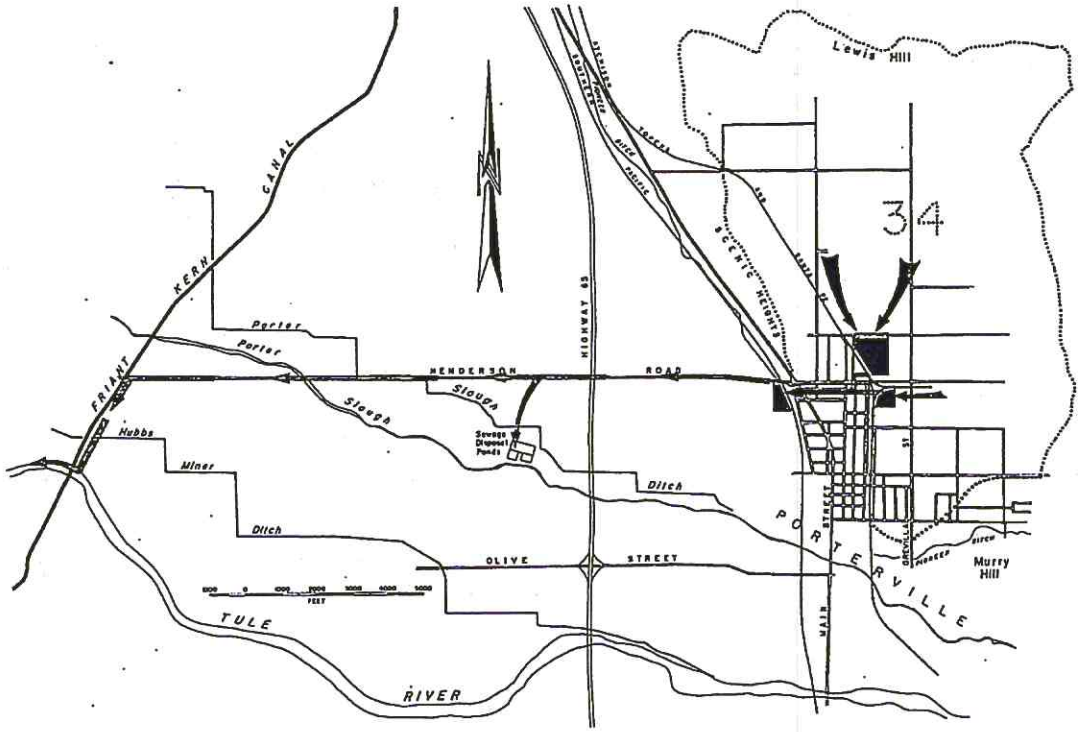
Frazier Creek channel has been obliterated west of Road 256 to Friant-Kern Canal. Where Frazier Creek crosses Road 256, peak flows of 1,010 and 1,440 cfs may occur on the average of once in 25- and 50-years, respectively. There is little question that measures to control such flows to non-damaging rates must include detention, since there are literally no channels to which uncontrolled peak flows of the expected rate can be conveyed without incurring high costs.

At present, only one culvert, located just north of Highway 65 crossing of Friant-Kern Canal, permits drainage to pass under the canal in the vicinity of Strathmore. Although flood waters do tend to pond at the intersection of the Southern Pacific Railroad embankment and the Friant-Kern Canal, the principal cause of flooding both east and west of the railroad crossing is the obliteration of natural drainage channels by land development.

The low hills between which Frazier Creek flows about one-half mile east of Road 256 might form abutments for a low dike across the creek, or detention storage can be obtained at Road 256. Either site could be used to form a reservoir of adequate capacity to control creek flows to rates which could be disposed of in Friant-Kern Canal or, as a possibly more desirable alternative, in North Canal of Lower Tule Irrigation District. The extent of development between the detention site and Friant-Kern Canal probably will require that channel capacities in this reach be less than 50 cfs — perhaps even as low as 10-20 cfs. As shown on the graph, detention storage at either of these two sites necessary to achieve controlled flows of 10-20 cfs is 550 and 800 acre feet, respectively, for once-in-25-year and once-in-50-year floods. These controlled flows could be directed through the culvert under Friant-Kern Canal (north of the Highway 65 crossing) to a ditch along the western side of that canal to the head of North Canal, which should always have excess capacity available during the rain-flood season.

A flood problem also exists east of Friant-Kern Canal at Avenue 196. A siphon under the canal at this location has been closed to reduce flooding in Strathmore and water collecting here is pumped into the canal. Some relief can be afforded by a detention dam east of Road 244. Detention storage at this site could regulate the runoff from a 3.3 square-mile area. If the flow from the east of this site is channelized, peak flows of 340 and 490 cfs can be anticipated once in 25 and once in 50 years on the average. An embankment with a maximum height of about 13 feet could develop about 150 acre feet of storage and control the once-in-50-year flood runoff to releases of about 5 cfs or less, which could be conveniently pumped into the Friant-Kern Canal and greatly alleviate the ponding at Avenue 196.

Porterville Area



LEWIS HILL (AREA 34)

The crest of Scenic Heights trends north from the outskirts of Porterville and, with the east-west crest of Lewis Hill to the north and a north-south ridge to the east, forms Lewis Hill drainage (Area 34) which drains into the northern part of the City. From all three crests, topography gradually flattens toward the City and actually forms a sump between the Southern Pacific and Santa Fe Railroads in the vicinity of Henderson Road. From this sump, topographic slopes are very flat toward Porter Slough and Tule River. The result of this situation is inevitably heavy ponding in the northern part of Porterville and in its northern and eastern outskirts. The developed part of Porterville, with its streets, houses and commercial improvements, occupies the relatively flat natural drainage slopes to the south and southwest of the sump area. This makes any physical solution to the flooding of north Porterville difficult and expensive. If runoff from the hills draining to the sump area were concentrated, peak flows of 315 and 450 cfs would occur on the average of once in every 25 and 50 years, respectively. The urban character of the flooded area would appear to warrant protection against at least once-in-50-year concentrations, but pipelines and drainage channels to carry peak flows of these magnitudes from the sump area would be quite large and therefore expensive.

Pioneer Ditch and Porter Slough pass through Porterville. However, the capacity of each is small in comparison with the peak flow into the sump area. It is considered that the ditch and slough may be taxed to convey flows originating in the part of the City south, east and west of the sump area and cannot be relied on to carry water originating in the watershed north of the City.

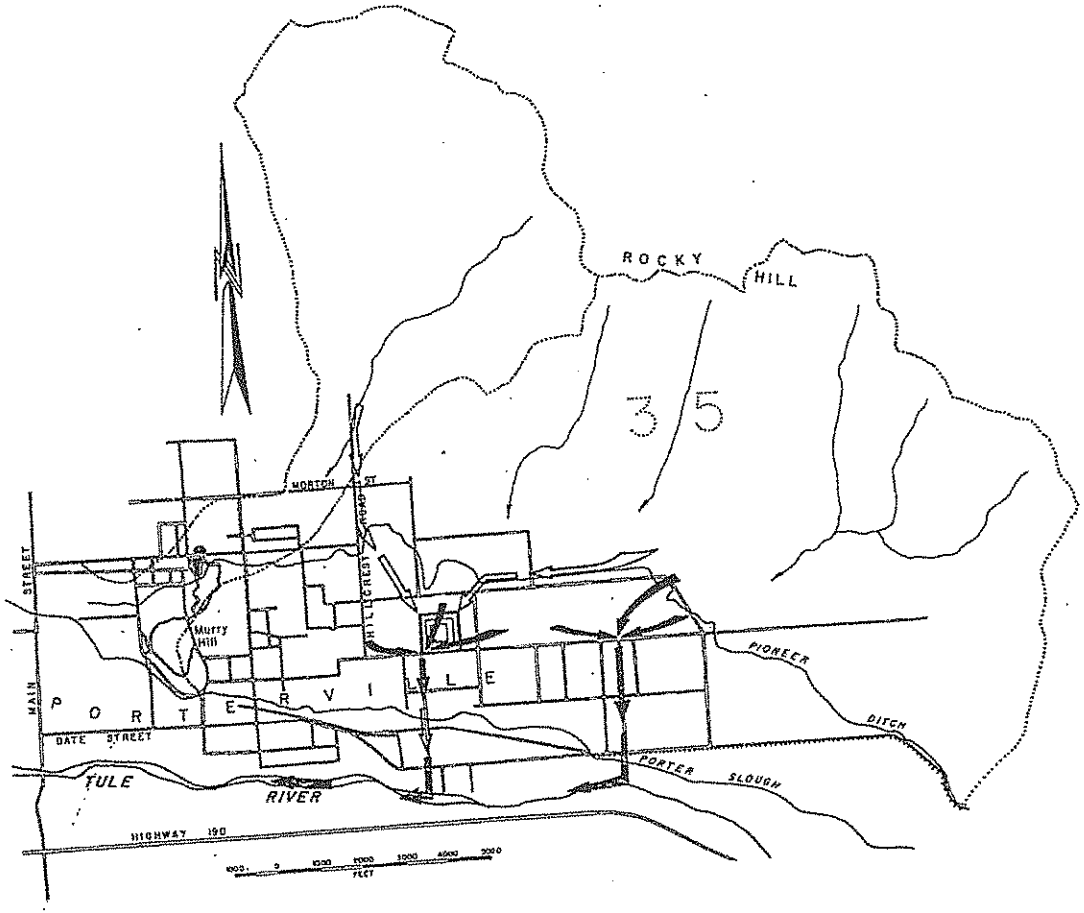
Over five years ago an ultimate drainage system for Porterville was suggested as a part of the General Plan of the City. This drainage system contemplated two detention basins in the general sump area near Henderson Avenue, with disposal in Porter Slough and in Tule River via improved existing ditch systems and, principally, new large open channels. Conceptually, detention storage is essential to control flooding in northern Porterville; conceptually also, draining of detention reservoirs to Tule River following the westerly- and northwesterly-trending land slopes appears to be without reasonable alternative. From hydrology studies made in connection with this report, it appears that some combination of detention reservoirs and main disposal channels might adequately control once-in-50-year floods.

ROCKY HILL (AREA 35)

A separate flooding-drainage problem exists in the eastern outskirts of Porterville. This problem also was studied in some detail during development of the 1965 Master Plan. Flooding in this area results from runoff originating on Rocky Hill to the east of Porterville. Under the 1965 plan interceptor ditches, shown by open arrows, would feed a proposed detention reservoir located east of Hillcrest Road with disposal in Tule River.

It is also possible to intercept the Rocky Hill drainage by a collecting system without utilizing detention storage and dispose of this runoff in the Tule River, as shown on the map in solid arrows. However, Murry Hill drainage to Porter Slough would continue to flow southwesterly as it does today. Some remedial work in the vicinity of Murry Park would be required to eliminate flooding in this area.

As indicated in the 1965 Master Plan, Porterville areas other than the north and east portions also have problems of inadequate drainage. These areas include those south and southwest of the City. The 1965 report suggested three detention reservoirs in these areas which are south of the Tule River, a concept considered appropriate and necessary with disposal of water from the detention reservoirs to Tule River.



DEER UNIT

The Deer Unit encompasses the drainage area of Deer Creek, including Fountain Springs Gulch and the foothill drainage between Terra Bella and Ducor. Extensive flooding occurs along Deer Creek and on the branches of Fountain Springs Gulch in the vicinity of Terra Bella. The only appreciable area of flooding reported in 1969 between Terra Bella and Ducor was about 500 acres west of Highway 65.

Numerous diversion weirs exist all along the channel of Deer Creek west of Friant-Kern Canal and divert water into ditches leading away from the creek. To some extent these weirs may direct flood waters into the ditches north of Deer Creek. To ensure the availability of the Deer Creek channel to carry flood waters, the weirs must be constructed and operated to permit the passage of flood waters with a minimum of obstruction. It is noted that at the confluence of Fountain Springs Gulch with Deer Creek there are numerous man-made obstructions to free flow of water.

No comprehensive plan for control of Deer Creek flood flows, including the Fountain Springs Gulch contribution, can be developed without recognizing the inadequacies of channel capacities from Highway 65 to Highway 99 and west of the latter highway in the Tulare-Kings Unit; however, channel improvement alone will simply transfer flooding problems downstream. Accordingly, a basic concept for flood control is that detention storage be provided on Deer Creek and, preferably, on one or both forks of Fountain Springs Gulch.

DEER CREEK (AREAS 37 AND 38)

In-channel capacity of Deer Creek from the foothill line northwest of Terra Bella is reported to vary from about 4,000 cfs to about 5,000 cfs at the Friant-Kern Canal crossing. Between Friant-Kern Canal and the west edge of Deer Unit at Highway 99, channel capacity decreases to about 350 cfs, although the highway bridge is reported to have a capacity of 2,000 cfs. Flows exceeded these capacities substantially in the February 1969 flood with the result that extensive over-bank flow occurred from Highway 65 near Terra Bella all the way to Highway 99. The estimated once-in-25-year and once-in-50-year flood flows of Deer Creek at Avenue 120, about six miles east of Terra Bella, are 7,730 and 11,000 cfs, respectively.

A reservoir having a capacity of 800,000 acre feet has been proposed on Deer Creek as a feature of the East Side Division, Initial Phase, Central Valley Project. This reservoir would derive its water supply almost entirely by pumping from the proposed East Side Canal since natural flows of Deer Creek vary widely from year to year and cannot be relied upon as a firm water supply. If such a large reservoir were to be constructed in the near future, capacity to regulate Deer Creek rain-flood runoff could be secured economically. However, it may be that 10 or even 20 or more years may elapse before the proposed Hungry Hollow reservoir is completed; accordingly, consideration should be given in detailed studies of Deer Unit to construction of a small, single-purpose detention reservoir near the Hungry Hollow site. If the Hungry Hollow site proves too expensive or otherwise impractical, consideration might be given to providing detention storage on Deer Creek farther upstream where there are several potential dam and reservoir sites. Required detention capacities on Deer Creek at Hungry Hollow for various controlled flows are shown on the graph. To control a once-in-25-year flood to a release of 200 cfs would require about 17,000 acre feet of storage.

FOUNTAIN SPRINGS GULCH (AREAS 39 AND 40)

Fountain Springs Gulch watershed lies east and south of Terra Bella and contributes significant rain-flood runoff to Deer Creek, thus aggravating flooding problems along that creek west of Highway 65. The Gulch itself has two principal channels which join and then enter Deer Creek east of Highway 65. The principal channel is the main Gulch, shown as Area 40, and a second channel drains the Fountain Springs North Drainage, Area 39. Peak runoffs expected from the Fountain Springs Gulch and Fountain Springs North Drainage for once-in-25-year and once-in-50-year floods are 1,400 and 2,000 cfs and 840 and 1,200 cfs, respectively.

A possible detention site on Fountain Springs Gulch exists about five miles southeast of Terra Bella. The graph for the Fountain Springs Gulch detention site shows that 640 acre feet of storage is required to control releases to 50 cfs during a once-in-25-year flood. There is also a possible detention site on the North Drainage located immediately upstream of its confluence with the main Gulch near Deer Creek; under present conditions, storage of about 500 acre feet could be developed at this site to control runoff from North Drainage into Deer Creek.

DEER CREEK WEST OF HIGHWAY 65

Analysis of flood flow data makes it clear that further detailed study of control of Deer Creek rain-flood runoff west of Highway 65 may require combinations of Deer Creek and Fountain Springs Gulch measures. Even with storage of all Deer Creek flows at Hungry Hollow damsite, downstream flood runoff would still result in flows west of Highway 99 which exceed the present limited channel capacity. Even higher uncontrolled peak flows would occur at Highway 65 Bridge over Deer Creek if the storage sites upstream of Hungry Hollow were used. Thus, detention storage on either or both Fountain Springs Gulch or its North Drainage is desirable.

From the foregoing, it is concluded that storage on the Deer Creek channel in the vicinity of the Hungry Hollow site and at the Fountain Springs Gulch site, with some channel rectification work along Deer Creek, could give a reasonable degree of protection west of Highway 65 for the current level of development. Detailed planning of storage on Deer Creek should recognize that significant amounts of snowmelt runoff occur from the watershed in some years and that much of such runoff will enter Tulare Lake unless it is controlled. Substantial snowmelt runoff enters the lake from all Tulare Basin streams in such years and any Deer Creek inflows should be reduced if possible. If single-purpose detention storage is provided on Deer Creek, consideration should be given to gated outlets which could be left completely open during the rain-flood season and used to regulate snowmelt inflow to a reasonably useful irrigation pattern without adding to flooding of Tulare Lake.

TERRA BELLA—DUCOR DRAINAGE (AREA 41)

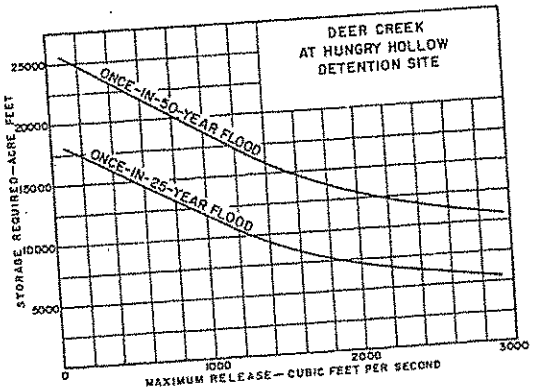
This 16.9 square mile drainage area lies between the Fountain Springs Gulch and White River watersheds. In February 1969 several hundred acres of land between Highway 65 and Friant-Kern Canal were inundated by runoff from Terra Bella—Ducor drainage. Concentrations of 610 and 870 cfs at Friant-Kern Canal can be expected from this watershed on the average of once in 25 and once in 50 years, respectively, if the flows are channelized to this location. However, the channel is ill-defined or obliterated over most of the distance west of Highway 65 and if conditions east of the highway remain the same as they are today, it is probable that the peak flows at Friant-Kern Canal will be less than those indicated since the runoff is dissipated in flooding above the Canal.

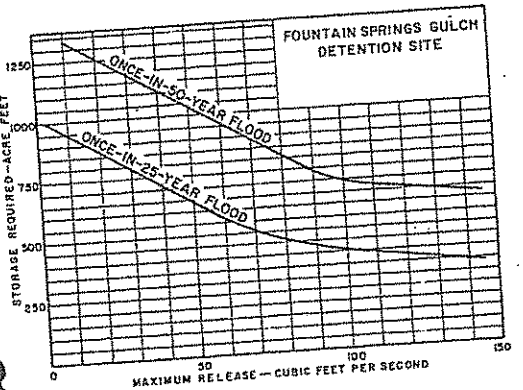
Detailed studies of the Terra Bella—Ducor drainage should consider zoning and/or land development controls adjacent to defined channels, detention storage, and channel dedication and improvement. Volumetric data indicate that detention storage of about 200 acre foot capacity combined with downstream disposal-channel capacity of about 25 cfs might be considered at the site shown in Area 41 on the map. However, the contributing area to this detention site is relatively small. There are several other sites for detention storage in and upstream of the area inundated in 1969 which should be examined in detailed studies.

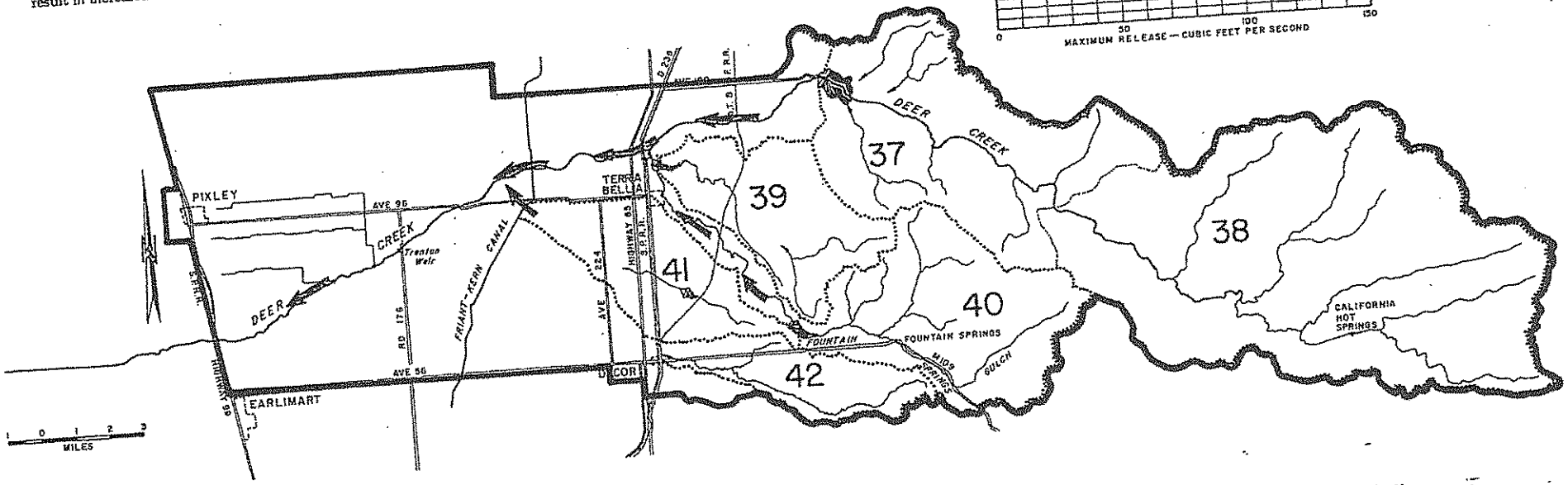
DUCOR EAST DRAINAGE (AREA 42)

The 13.9 square mile Ducor East Drainage Area is drained by a poorly defined channel. In addition, the drainage characteristics of the watershed are such as to produce a relatively slow runoff rate. The peak flows of 540 and 770 cfs for once in 25 and once in 50 years, respectively, assume the runoff is channelized.

In a way, this drainage area is presently close to the state-of-nature condition of lower foothill watersheds in Tulare County and can be considered typical of such areas prior to land development and other activities of man. So long as the water course east of Highway 65 is not obliterated by land development it is not likely that storms over the watershed will cause major damage. However, unless the flood potential in the area is recognized and planned for, it is probable that uncontrolled developments inevitably will result in increased flood damage in coming decades.

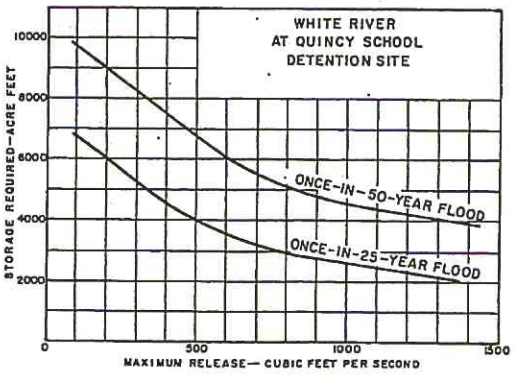






WHITE UNIT

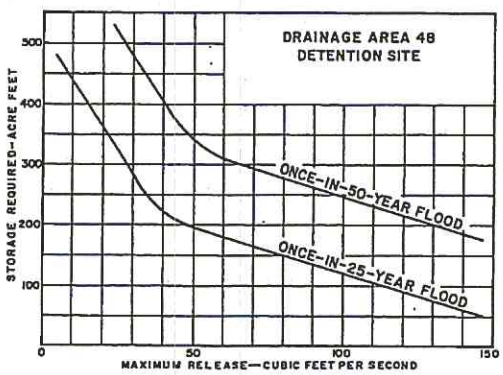
For convenience, this southernmost Unit includes both White River and Rag Gulch, although the sources of floodwaters, the areas flooded by them and concepts for control are separable. White River runoff produces flooding from the vicinity of Friant-Kern Canal to Highway 43, seven miles west of Earlimart. As demonstrated during the February 1969 storm, Rag Gulch begins to overflow its defined channel south of the Tulare-Kern County boundary. However, the principal area flooded by this stream lies on both sides of the County boundary between the Southern Pacific Railroad near Richgrove and the Friant-Kern Canal. In this area, flows of Rag Gulch spread out over an area as much as one-half mile wide. At Friant-Kern Canal, a small pump has delivered Rag Gulch water into the Canal in the past, but some ponding has occurred along the eastern canal bank over a distance of about three miles. The Bureau of Reclamation recently has altered this arrangement by constructing a gravity inlet to the canal.



WHITE RIVER (AREAS 43 AND 44)
RICHGROVE EAST DRAINAGE (AREA 48)

In 1969, a peak flow of 4,560 cfs measured at the Highway 65 crossing of the White River caused little overflow for four miles to the west. From this location to the Friant-Kern Canal, a combination of flows in White River and from Richgrove East Drainage inundated about 1,200 acres of land, much of which is intensively farmed. The combined flows of the two sources, after passing the Canal, inundated several thousand acres east of Highway 99, including the southern part of Earlimart. Between the Friant-Kern Canal and Highway 99 the White River is considered to have a capacity of about 1,000 cfs.

The Corps of Engineers, in a 1967 preliminary report, estimated average annual damages due to White River flooding to be $130,000. The Corps study, however, did not reflect the effects of the floods of December 1966 or February 1969. It is possible that if the 1967 report were updated, average annual damages under today's conditions of development would be considerably higher.

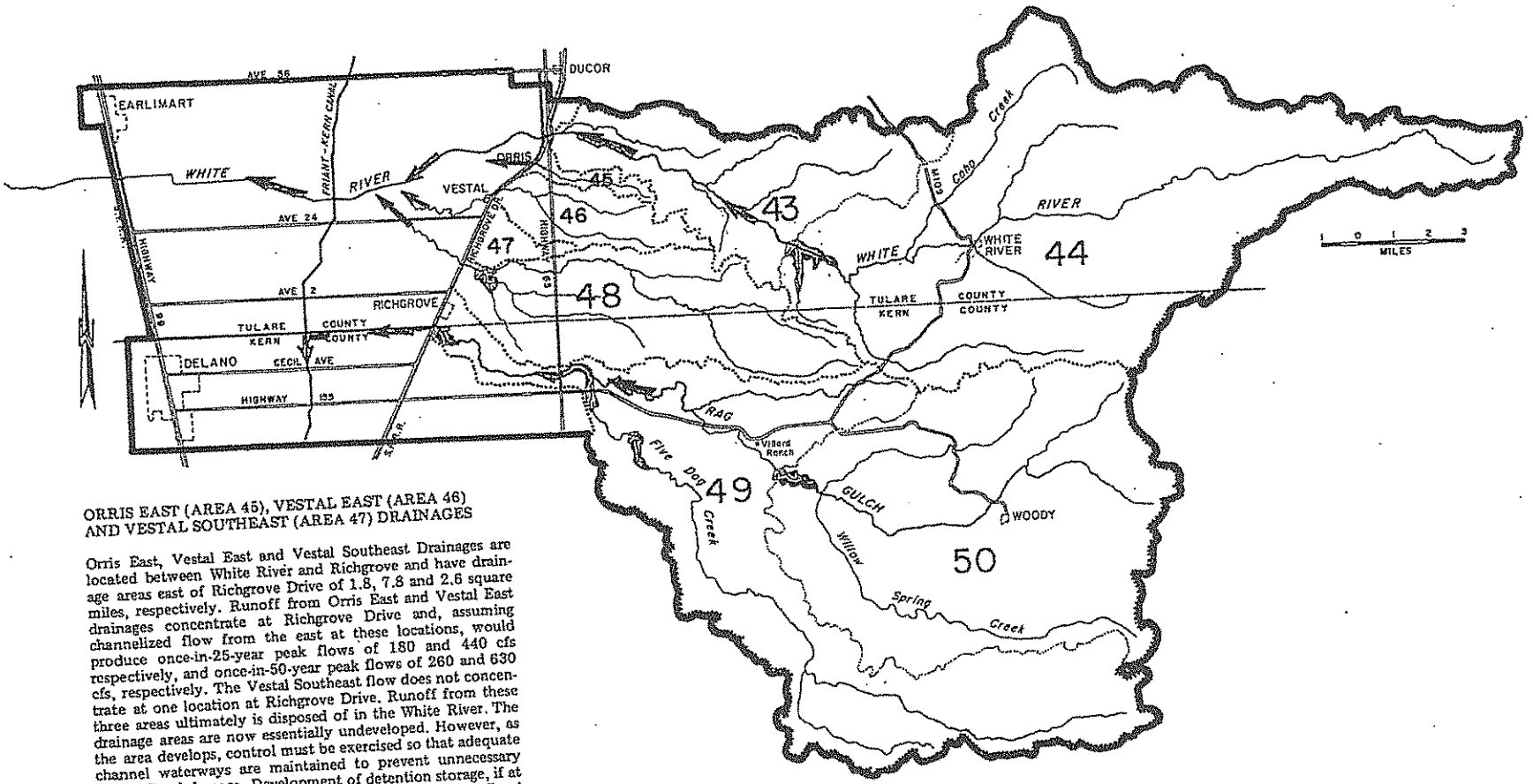


In the study the Corps considered several alternative concepts of flood control for White River, including channelization only, diversions to Deer Creek, storage in a large percolation pond on the valley floor, and detention storage in the foothills about 10 miles southeast of Ducor at what is termed the Quincy School site. The last concept appeared most practical and, although the Corps concluded its development was uneconomic at that time, further study at a later time was recommended. Review of the Corps report and further study of the hydrology, topography and present development in the area confirms the merit of a White River concept based on detention storage and that the best site for such storage probably is at the Quincy School site.

Peak flows for White River near Ducor (Quincy School site) and White River near Vestal for once-in-25-year and once-in-50-year events are 3,760 and 4,150 cfs and 5,370 and 5,950 cfs, respectively. The Richgrove East Drainage may generate peak flows at the Richgrove Drive crossing of 905 and 1,300 cfs with average recurrence periods, respectively, of 25 and 50 years. With some channelization work west of Richgrove Drive these quantities could be delivered into White River above the Friant-Kern Canal crossing. These estimates indicate that detailed planning to control flooding adjacent to White River downstream of a point about two miles east of its crossing of Friant-Kern Canal should consider both runoff sources.

Although White River flows of 1,000 cfs may be nondamaging between Friant-Kern Canal and Highway 99, such flows produce flooding west of that highway. Thus, unless detention storage can be provided in the Richgrove East Drainage close to Richgrove Drive, larger amounts of storage might be required at the Quincy School site to enable White River flows to be interrupted completely during heavy runoff from the other downstream drainage areas. This is not entirely impractical, but it does illustrate the need for coordinating the detailed planning of projects for control of White River and Richgrove East Drainage. The graph for the Quincy School detention site shows that about 5,000 acre feet of storage is required to control releases to 750 cfs during a once-in-50-year flood.

Examination of Richgrove East Drainage topography does not reveal any satisfactory detention sites that are not intensively farmed. A low dike across the principal watercourse about one-half mile upstream of its crossing of Richgrove Drive could provide 250 acre feet of storage which could control a once-in-25-year flood to a release of 35 cfs as shown by the graph for Drainage Area 48 detention site.



ORRIS EAST (AREA 45), VESTAL EAST (AREA 46) AND VESTAL SOUTHEAST (AREA 47) DRAINAGES

Orris East, Vestal East and Vestal Southeast Drainages are located between White River and Richgrove and have drainage areas east of Richgrove Drive of 1.8, 7.8 and 2.6 square miles, respectively. Runoff from Orris East and Vestal East drainages concentrate at Richgrove Drive and, assuming channelized flow from the east at these locations, would produce once-in-25-year peak flows of 180 and 440 cfs respectively, and once-in-50-year peak flows of 260 and 630 cfs, respectively. The Vestal Southeast flow does not concentrate at one location at Richgrove Drive. Runoff from these three areas ultimately is disposed of in the White River. The drainage areas are now essentially undeveloped. However, as the area develops, control must be exercised so that adequate channel waterways are maintained to prevent unnecessary future flood damage. Development of detention storage, if at all possible, would also assist in minimizing future flood damage in these drainage areas.

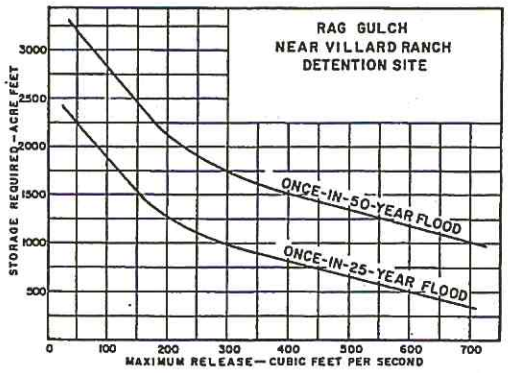
RAG GULCH (AREAS 49 AND 50)

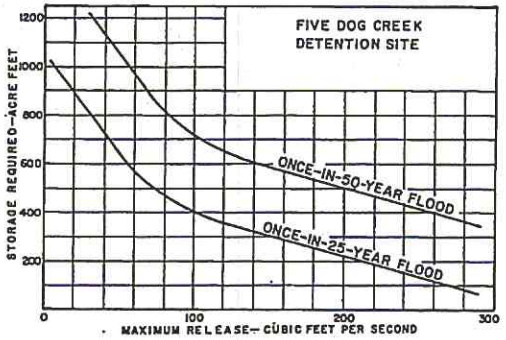
Peak flows, assuming moderate channel improvement for about one and one-half miles east of the Rag Gulch crossing of Richgrove Drive and the Southern Pacific Railroad, may reach 3,280 and 4,680 cfs on the average of once in 25 and once in 50 years, respectively. The Rag Gulch channel immediately to the east of Richgrove Drive has been obliterated. This condition, together with water ponding against the Southern Pacific Railroad embankment, produced ponding in the area during the 1969 floods. Clearly, detention storage is required on Rag Gulch to reduce or eliminate the flooding easterly of Friant-Kern Canal and to reduce to manageable rates the flows reaching the new inlet structure at the Friant-Kern Canal.

There are few detention storage sites on Rag Gulch and its principal tributary, Five Dog Creek. Two sites on the main Gulch and one on Five Dog Creek offer some potential and should be examined further in detailed studies; other sites on both streams also should be sought. The upper site on Rag Gulch, located near Villard Ranch, would provide the principal detention by regulating 71 out of the 138 square miles

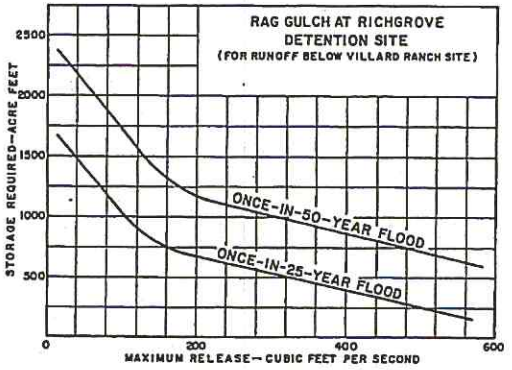
in the drainage basin. The graph shows the reservoir capacities required at the upper site near Villard Ranch to regulate flows of Rag Gulch to various amounts during floods occurring once in 25 and once in 50 years on the average. Approximately 1,900 acre feet of storage could control the once-in-25-year flood to releases of 100 cfs.

However, with a single detention reservoir on Rag Gulch near Villard Ranch, flows at Richgrove Drive cannot be controlled to non-damaging amounts even with flows from such a reservoir reduced to zero. Also, development between Richgrove and Friant-Kern Canal is such that flows following County Line Road to the Canal must be controlled to low rates to avoid expensive conveyance works. For these reasons, separate detention storage should be provided for Five Dog Creek flood flows or, alternatively, for all flows originating below the Villard Ranch site including those on Five Dog Creek.





Detention storage may be obtainable on Five Dog Creek at the site shown on the map; 400 acre feet of capacity could control once-in-25-year flood flows to 100 cfs.



A reservoir just east of Richgrove Drive could control flood flows originating on the Rag Gulch watershed below the Villard Ranch site including those of Five Dog Creek. The graph shows that 1,000 acre feet of capacity at the Richgrove site could control to 100 cfs the once-in-25-year flood flows originating on this part of the Rag Gulch watershed. Detailed studies of the three potential detention reservoirs should examine various combinations of controlled releases, uncontrolled flows and channel capacities west of Richgrove Drive.

Only the eastern boundary of the Tulare-Kings Unit which is common to the western boundaries of the other five valley-floor Units is indicated on the map shown on page 14. The junction of Cottonwood Creek and St. Johns River at Cross Creek and of Elk Bayou and Tule River provide two definite eastern boundary points. All areas of Tulare Lake subject to flooding by snowmelt or rain-flood runoff are assumed to be included in the Unit.

TULARE - KINGS UNIT

Because flooding in one part of the Unit may not be related causally to flooding in another and solutions to flooding in one part of the Unit may not affect flooding in another, some division into sub-Units might be appropriate in further studies. For example, flood waters entering the Unit through Cross Creek from the Tulare-Fresno or Kaweah Units have little or no effect on lands and improvements west of Earlimart; flood flows from Deer Creek and White River do not affect areas along Cross Creek. However, a single unit is presented here because the flood waters which produce damage in this area originate in one or more of the other six units.

Snowmelt runoff originating in the higher elevation watersheds of the Tulare Basin produces water management and flooding problems in the Tulare-Kings Unit. These problems can be reduced by implementing the long range concept of controlling snowmelt runoff from the larger watersheds to useable, nondamaging amounts by securing increased storage on the Kings, Kaweah, Tule and Kern Rivers. In addition, consideration should be given to the concept of diverting excessive Kern River snowmelt runoff into the California Aqueduct, thus eliminating this source of flood water from the Unit. Implementation of such snowmelt control measures is essential; however, additional action is also required to minimize the rain-flood problem.

For the Tulare-Kings Unit there are three concepts for reduction of rain-flood damage such as occurred in December 1955, December 1966 and February 1969: (1) reduced rain-flood releases from enlarged reservoirs on Kings, Kaweah and Tule Rivers and provision of new detention reservoirs wherever practicable on foothill watersheds from Wahtoke Creek in the north to White River in the south, (2) structural and operational changes in existing distribution systems in the other five valley-floor Units to minimize flood flows entering the Unit, and (3) operational changes, if required, in Lakeland, Homeland and other canals within Tulare-Kings Unit and along natural channels such as Cross Creek and Tule River, possibly accompanied by some structural modifications.

Structural changes in the canal systems would be those necessary to permit introduction of flows during the winter season and to direct them in appropriate distributaries to disposal areas (valley-floor percolation ponds and farm land) where they will not cause damage. Operational changes may be required to enable rain-flood flows entering the Unit to be managed effectively. Such flows may come on short notice (although not as short as in the areas closer to the foothills), and effective operations will require dependable communications among water management agencies in the Unit and in areas to the east, including adoption of efficient notification procedures. If all the concepts for Tulare-Fresno, Kaweah, Tule, Deer and White Units presented in this chapter were implemented at once, control of rain-flood runoff from those Units would be assured and flooding in Tulare-Kings Unit from such runoff would occur much less frequently. Obviously, many years will pass before all the concepts can be implemented. In the interim, improved operational procedures based on a well-planned communication system would provide the opportunity to handle flood flows and reduce rain-flood damage in Tulare-Kings Unit as well as elsewhere in Tulare County.

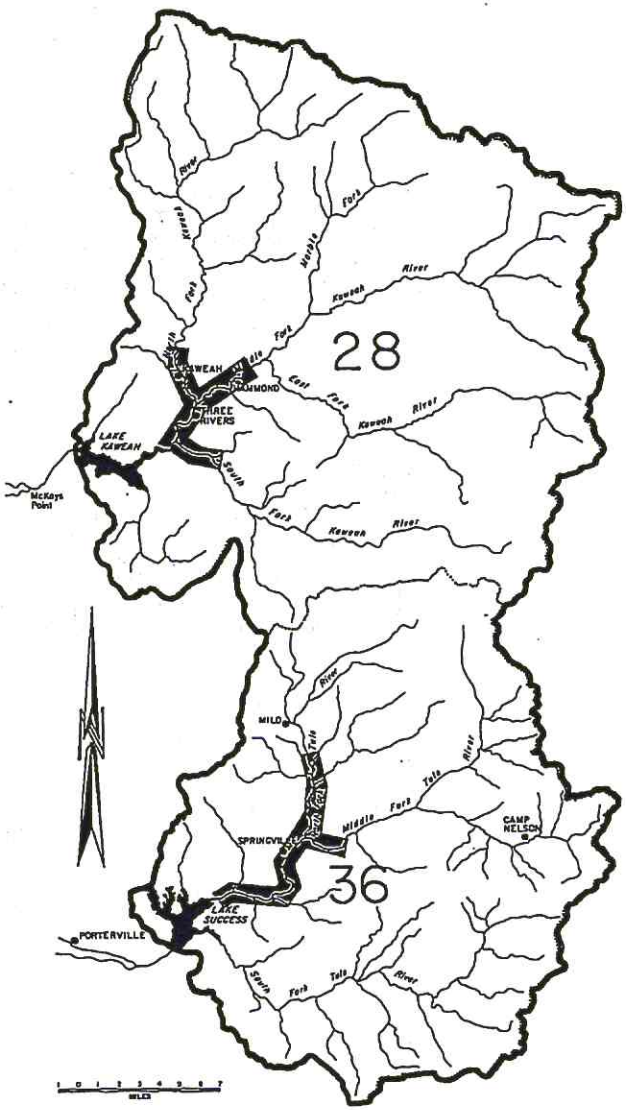
To the extent that flows from other Units which now terminate in the Tulare-Kings area can be controlled by upstream storage or diversion out of the area and by careful distribution in existing, improved or new channels to percolation ponds and to farm lands, flood damages in the Tulare-Kings Unit can be reduced. Therefore, all landowners in the Unit have a community of interest with others in Fresno, Tulare and Kern Counties in flood control measures implemented outside the Unit.

Both existing development and probable future growth in recreation activities in the Upper Kaweah and Tule River Basins justify consideration of flood control concepts for those areas. Flood problems in the two basins are similar and accordingly the basins are combined in a single Unit.

MOUNTAIN UNIT

The mountainous terrain limits locations of buildings and roads to areas adjacent to the streams in both basins. Esthetic attraction of flowing streams makes waterside homesites even more desirable. These physical and esthetic characteristics are at the heart of the flood problems in both the upper Tule and Kaweah River areas above Lakes Success and Kaweah, since improvements near streams can be inundated at frequent intervals. Both the Three Rivers and Springville areas suffered heavy damages in the floods of 1950, 1955, 1963, 1966 and 1969 and it is known that floods of the same and possibly greater magnitude have occurred at intervals since 1844. Studies of the Corps of Engineers indicate that a flood of the magnitude of that of December 1966 will probably occur, on the average, once in about 100 years. However, even larger floods can occur and future floods may provide data indicating that flood peaks such as those of 1966 will occur more frequently than is estimated on the basis of present records.

Snowmelt runoff does not cause significant flooding in the Kaweah and Tule River Basins above the two foothill reservoirs, although melting snow, especially at lower elevations, may contribute to rain-flood damage. Intense rains cause rapid rises in stages of the rivers and their tributaries. Velocities of flow are very high (in the order of 10 to 15 miles per hour) due to the steep gradients of the streams. Thus, only a part of the damage occurring during floods is that due to inundation; a major share of flood damage results from the force of the moving water itself. Between floods, trees fall adjacent to the streams and brush grows in the channels; these are carried in the flood waters and lodge against buildings and bridges, thus tending to make river stages even higher as debris dams are formed. Detailed studies on the extent of the flood plains in the vicinity of Three Rivers and Springville are available in reports of the Corps of Engineers for the areas shown in brown on the map.



KAWEAH BASIN (AREA 28)

The October 1967 Flood Plain Information Report of the Corps depicts the flood plain of Kaweah River and its North, Middle and South Forks. The area included in that report is adjacent to the Kaweah River upstream from the headwater of Lake Kaweah and along the lower reaches of the North, Middle and South Forks. The area also includes the town of Three Rivers and the vicinities of Kaweah and Hammond. Fairly detailed topographic and photographic maps are presented in the report along with extensive data on historical floods prior to those of January-February, 1969, including the highest flow of record, that of December 1966.

As noted in the Corps report, exact limits of the flood plain for flows of a given magnitude may vary due to channel changes which occur from time to time. Nevertheless, the information in the report can be highly useful to Tulare County officials and to individuals planning improvements in the area.

Also, Blair-Westfall Associates, Consulting Engineers, made a report to the Three River Soil Conservation District in 1962 which reflects consideration of flood problems in the vicinity of Three Rivers. The authors of this report reviewed 26 possible storage sites upstream of the mouth of the South Fork and analyzed them from a flood control viewpoint to a sufficient extent to suggest the most economical ones on each of the forks.

Analysis of data in the two reports and field inspections indicate that flood damage occurs in the vicinity of Three Rivers when flows exceed about 40,000-50,000 cfs and that such flows will occur once in about 20 to 25 years on the average. The Corps report estimates a flow of 80,000 cfs (about that of December 1966) may occur once in about 100 years on the average. The Corps also estimates that flows of 102,000 cfs will occur at Three Rivers less frequently and notes that such flows would produce river stages about three feet higher than occurred during the 1966 flood. Flood hazards in the vicinity can be gaged from these estimates.

Like rain-floods elsewhere in California, flood peaks in the vicinity of Three Rivers are sharp and of short duration and the volume of water in such floods is relatively small compared to the volumes occurring during the snowmelt season. For example, during December 5 and 6, 1966, when flows exceeded 40,000 cfs at Three Rivers, the volume of water in excess of that flow was approximately 21,000 acre feet. Thus, if combined storage capacity of about 30,000 acre feet were provided on the North and Middle Forks, it would be possible to control flows of this magnitude below the mouth of the North Fork to non-damaging amounts.

Review of North and Middle Fork topography makes it abundantly clear that reservoir sites are poor and that developing detention storage of the amounts indicated would require relatively high dams and large outlays of money. The 1962 report to the Soil Conservation District concluded that none of the 26 sites considered was economically justified at that time and there is no reason to conclude that they are economically justified now. Uncontrolled improvements in the flood plain might result, at some future indefinite date, in a situation where investments in protective reservoirs could be justified, but such improvements should not be permitted.

Detailed analysis based on field surveys might indicate that some parts of the flood plain in the Three Rivers area could justifiably be protected through channel improvements and levee work. However, from available information, economic justification of such work is not probable.

Therefore, reduction of flood damage in the Kaweah Basin must rest on control of development in the flood plain. This is currently being done through Tulare County ordinances. At present the population in the Three Rivers area is about 1,000 and it can be expected to increase to 4,000 or 5,000 over the next 50 years. All present trends indicate that most of the increased population will be retirees, vacationers and workers in occupations providing services to residents in the area. Esthetic considerations will lead many of the new residents to want streamside homes just as such homes are desired today. Also, of course, to the extent topography and soils determine housing sites, the flood plains offer advantages to the builder. However, as is abundantly clear from the records of flooding in recent years, occupation of flood plains with homes and businesses brings inevitable damage or destruction of such improvements. Important also is the fact that the severity of flood damage fades from memory as the years pass and the inevitability of another flood coming — some day — must be kept in public view.

TULE BASIN (AREA 36)

With the exception of location and peak flood magnitude, the general commentary and the concepts of flood control for the Tule Basin parallel those of the Kaweah Basin. The principal part of the Tule Basin extends about 10 miles up the main river and the Middle Fork from highwater level in Lake Success and along the lower four miles of the North Fork. Springville, a community of about 1,500 people, is the only population center in the basin.

In July 1968, the Corps of Engineers prepared a Flood Plain Information Report on the part of the Tule River Basin which is shown on the map. The recorded peak flow of the river near Springville, according to information given in the report, occurred about midnight December 5-6, 1966, and amounted to 49,600 cfs. Peak flows of this magnitude are estimated by the Corps to occur less often than once in 100 years on the average. Even larger floods, having peak stages about one foot higher than was reached in 1966, are expected to occur less frequently still.

The Corps report presents topographic and photographic maps depicting the areas inundated in once-in-100-year floods and in less frequent floods having a peak flow at Springville of 53,000 cfs. The report notes that these flood plain limits may vary over time due to changing channel conditions. The information on the report is highly useful for planning purposes.

As in the Kaweah Basin, satisfactory reservoir sites on Middle and North Fork Tule River above Springville do not appear to exist. Detention storage to control once-in-100-year floods (which seems a desirable degree of protection in view of the urban development) is probably not justified economically. From the Corps report, Tule River Drive appears to follow a ridge between the river and low ground to the west; this ridge is close to the elevation the water would reach in a once-in-100-year flood. Study might be given to the cost and hydraulic effects of installing a levee on this ridge, which might necessitate raising the level of Tule River Drive over part of its length. Such a levee, if connected to high ground in the vicinity of the sewage treatment plant and near the place the Drive ascends the bluff toward Highway 190, might provide protection to a substantial part of the area flooded in December 1966. However, such a levee could raise river stages on the east side of Tule River Drive, a condition that might be unacceptable.

As in the case of the Three Rivers area, control of flood plain development is probably the only practical method of reducing periodic flood damages. Present Tulare County ordinances can provide such controls.

Flood Plain Management and Waterway Capacity Protection

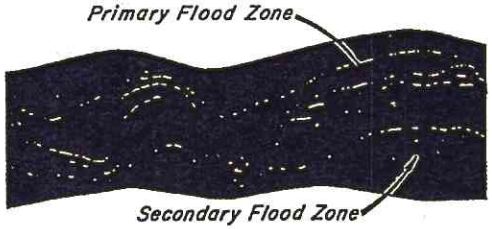
FLOOD PLAIN MANAGEMENT

The concepts suggested for the two basins of the Mountain Unit warrant general discussion since they may have applicability elsewhere in flood-prone areas of Tulare County. The concept of controlling development in such areas, or flood plain management as it is frequently called, is being used increasingly, both nation-wide and in California, as a definite part of flood control programs. Many counties and cities have applied the concept in part for many years through normal zoning procedures in areas known to be subject to flooding. Flood plain management applies the same principle to all parts of a stream or stream system whose adjacent banks may be overflowed to varying degrees and with varying frequency.

Development along the overflow areas adjacent to streams may be controlled permanently or until such time as projects prevent overflow during floods or reduce the extent of overflow. Flood plain management does not preclude use of land, but only limits use to the extent of the flood hazard.

Ordinarily, flood plains are managed under ordinances which define flood zones and the types of developments which may take place in them. The zonal boundaries are established after careful hydraulic studies are made to define the limits of flooding during the occurrence of a flood of a definite magnitude. Frequently, two or more zones may be established with permissible types of developments varying in each zone.

A section of river having primary and secondary flood zones is illustrated. The first step in defining the outer boundaries of the secondary zone is to select the magnitude of flood to be used; usually this is done after study of historical floods and the frequency of occurrence of floods of different magnitude. Variations in width of overflow along the river with flows of the selected magnitude are then determined by hydraulic study, taking into account the topography adjacent to the river and the hydraulic properties of the channel and the overflow area.



Frequently a primary flood zone also is defined, with boundaries being the minimum width of floodway needed to carry flood flows of the selected magnitude. Such a primary zone might be established in anticipation of eventual construction of levees which would confine flood flows and prevent overflow into the secondary zone. Or a primary flood zone might be that area which would be inundated by releases made from a future detention reservoir designed to control a flood of the selected magnitude.

The type of development permitted in each zone is based on the nature and permanence of the flood hazard. Agricultural activities normally are permitted in all zones, although at times the density of certain types of orchard plantings may be controlled. Structures in primary flood zones usually are limited to those which will not endanger life or impair the free flow of water during floods of the selected magnitude — a control which may eliminate most buildings. Structures for shelter of animals, machinery and equipment normally are permitted in secondary flood zones, but houses or other structures for human habitation are not permitted unless they are flood-proofed or protected by levees or have their living areas elevated above the water level expected to be reached during the selected flood. Where primary and secondary flood zones are established pending construction of levees, secondary zone restrictions on development may be modified or eliminated once levees of appropriate size and location are completed.

Control of development of flood plains by local agencies has been encouraged or required by State and Federal governments, especially during the past 20 or 30 years. For example, in the Congressional authorization of a bank improvement project in Tehama, Glenn and Butte Counties, construction by the Corps of Engineers was made contingent upon enactment of flood plain zoning ordinances. Under the Cobey-Alquist Act of 1965 (California Water Code Section 8400, et seq.) procedures are outlined for defining flood zones and, under certain circumstances, State funds for acquisition of lands, easements and rights-of-way for Federal flood control projects may be denied. Federal flood insurance at subsidized premium rates is available to defined categories of property owners where local agencies of government have adopted flood plain management ordinances; such insurance is now available to eligible property owners in unincorporated areas of Tulare County.

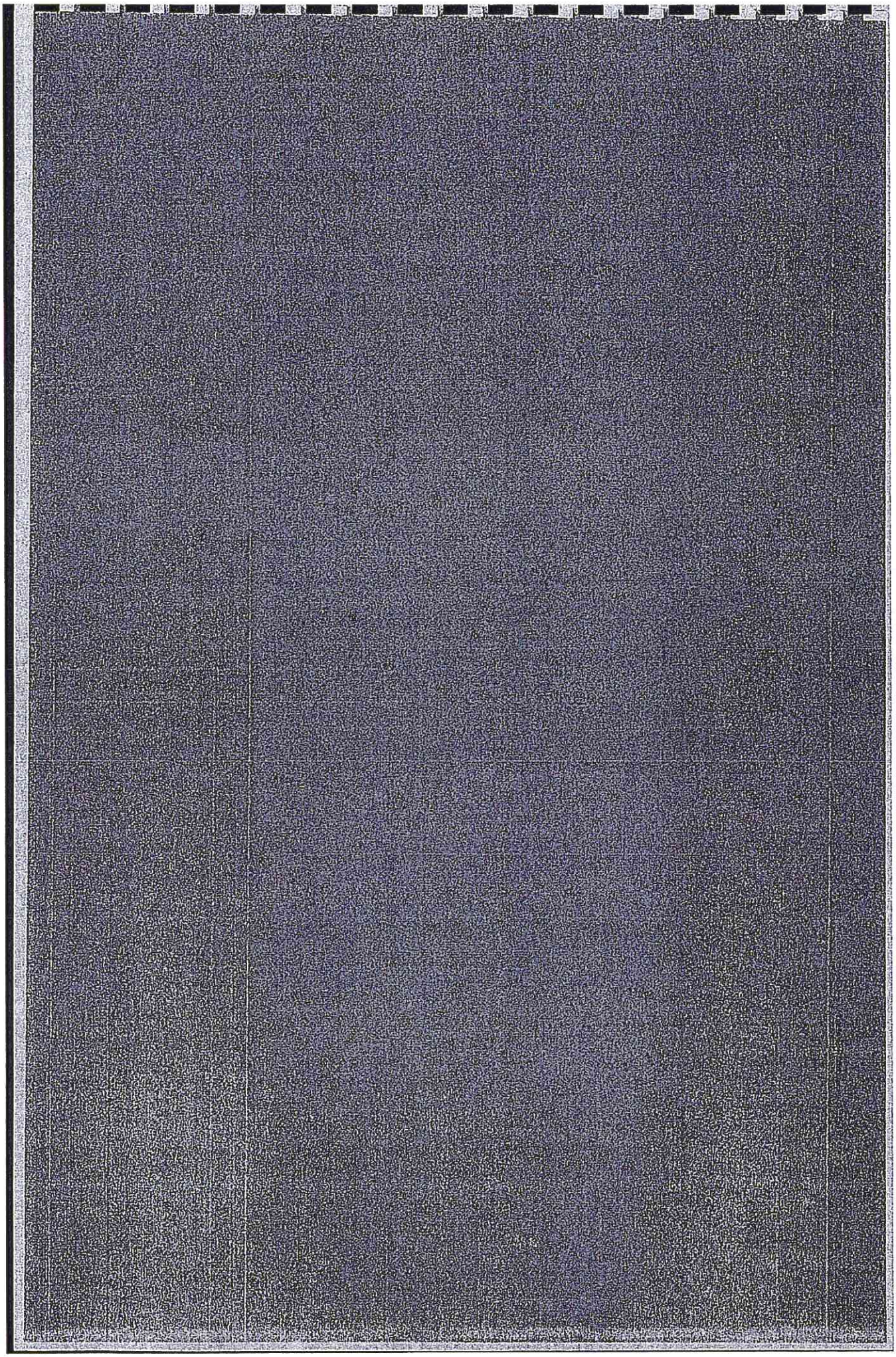
Under Water Code Section 8723 the State Reclamation Board has the authority to control certain activities in and adjacent to stream channels in the Central Valley Basin where the Board or the Legislature has adopted a plan of flood control. Currently the Board is carrying out a program of designating floodways on streams of the Basin. A floodway has been designated in the Upper Sacramento Valley and designation of other floodways, including Kings River, are pending. Floodways adopted by the Board under this program correspond closely with primary flood zones as discussed above. Once a floodway has been adopted as a plan of flood control, plans for proposed structural or other modifications within the limits of the floodway must be submitted to the Board for its approval, as provided in Water Code Section 8710.

PROTECTION OF WATERWAY CAPACITIES

Related to the concept of flood plain management is the concept of protecting or maintaining adequate waterways for smaller collecting drainage areas and for distributary channels. Obliteration of collecting or distributary waterways can result in flooding just as damaging as overflow from a major stream.

Many of Tulare County's flood problems are the result of the obliteration of collecting or distributary channels during land development. An essential concept to be included in an overall Tulare County flood program is the protection or maintenance of adequate waterways as land development takes place. In more intensively developed areas of the County, only a few such waterways remain to be protected but reduction in their capacities should not be permitted. In other areas, where land development has not progressed as far, the concept, if implemented, can insure the maintenance of adequate waterway capacity and thus prevent or reduce future flood damage.

FINANCING IN FLOOD CONTROL



FINANCING FLOOD CONTROL

IV

The studies leading to development of this Master Plan deal broadly with flooding throughout Tulare County Flood Control District and the immediately adjacent areas. It has necessarily been a broad study for the engineering purposes of developing detailed flood hydrology and flood control concepts. A substantial amount of additional study will be required to determine the economic justification and financial feasibility of specific projects and to identify the zones or areas benefitting from such projects. Following completion of such further studies, arrangements will have to be made for financing the two subsequent phases of each project, construction and operation and maintenance. Various alternative methods of financing implementation of the flood control concepts presented in Chapter 3, including programs of state and federal agencies dealing with flood control either separately or as a part of other programs, are described below.

THE DISTRICT ACT

Chapter 1149, Statutes of 1969, confers on Tulare County Flood Control District certain powers relating to control of flood waters originating within the District or originating outside the District and flowing through the District. The Act contains provisions relating to financing of flood control work as well as numerous other matters. Since the Act provides means of financing improvements which are largely independent of other agencies, it is appropriate to outline the principal elements of these financing powers of the District. Also, these financing provisions may be utilized to meet certain parts of total project costs (for example, operation and maintenance) where other agencies have planned or constructed the projects under the programs described in other sections of this chapter.

The Act establishes the Board of Supervisors of Tulare County ex officio as the governing Board of the District. Also, the Board appoints a commission of seven members to which may be delegated any or all of the Board's powers under the Act.

The Act permits an ad valorem tax not to exceed two cents on each $1.00 of assessed value to pay general administrative expenses and to carry out functions of common benefit. Such maximum assessment was levied in the current fiscal year and, based on a secured roll of about $470,000,000, yielded over $90,000 for these expenses of common benefit. Except for these funds, the District must rely on special assessments levied for activities of benefit to zones whose boundaries are fixed in accordance with procedures set out in the Act.

The District, through its Board of Supervisors (or the Commission) determines which projects or improvements are for the common benefit of the District, for the benefit of two or more zones (called participating zones), or for the benefit of a single zone. Once a zone or zones have been established, their boundaries may be amended by annexing property to them or by withdrawing property from them or a single zone may be divided into two or more zones. New or amended zones also may be superimposed on zones already in existence. However, no project may be undertaken without approval of a majority of the voters within a proposed zone or zones at an election, and once such approval has been indicated the boundaries of the zone or zones may not be changed without a further election.

Assessments may be levied against real and personal property within a zone or against real property only within such a zone. A bonding proposal may also be presented to the electorate within a zone as provided in general law.

OTHER AGENCIES OF LOCAL GOVERNMENT

Within Tulare County Flood Control District are many other agencies of local government. All are agencies organized under various special or general acts of the Legislature to carry out certain functions which may be either broad or limited depending on the type of district. Many are authorized, at least at the discretion of the governing board, to carry out flood control related activities. Many also incur higher costs of operation and maintenance due to structure damage and failures during floods and can act cooperatively with other agencies, including Tulare County Flood Control District, on joint developments which would reduce these higher costs. Others, such as those operating canal systems, have liability potentials derived from floodwaters flowing through their systems and have an interest in reducing such liabilities.

On another level, Fresno, Kings, Kern and Tulare Counties have common interests in varying degrees in solutions to flood problems in the general area. All have a broad common interest in developing better control of snowmelt runoff of the four large Tulare Basin streams to reduce damaging inflows to Tulare Lake and to conserve a maximum of such runoff. It is not within the scope of this report to present an analysis of the mechanics for two-, three- and four-county cooperation in these areas; suffice it to say such cooperation, including joint funding of planning, operation and maintenance, and possibly construction of specific projects should be explored.

STATE OF CALIFORNIA

There are a number of State programs of financial assistance to local agencies for water resources development, including flood control. Most of such programs, however, are for purposes other than flood control.

Under a 1945 Act of the Legislature (Water Code Section 12570, et seq.), the State provides funds, through the Department of Water Resources, to meet costs of lands, easements and rights-of-way for flood control projects constructed by the Corps of Engineers pursuant to federal law. Similarly, pursuant to Water Code Section 12850, et seq., the Department of Water Resources allocates funds to meet the same costs on projects constructed under the Federal Watershed Protection and Flood Prevention Act (familiarly known as Public Law 566).

Before the Department of Water Resources can expend funds for rights-of-way under these basic acts, the Legislature must authorize State participation in each specific project and thereafter must appropriate funds. Authorization of the Legislature is not required separately for State participation in so-called Small Flood Control Projects of the Corps, because Water Code Section 12750, et seq., authorizes such participation, in effect, when funds therefor are appropriated. Authorizations under these Acts were made regularly through the 1969 session of the Legislature, but no new projects have been authorized since that session. Bills looking toward modifications in present State-local agency cost-sharing arrangements were considered during recent sessions of the Legislature and several are under consideration in the current Legislature. These bills vary in detail but all, under certain circumstances, require local agencies to pay part of the costs of lands, easements and rights-of-way.

Closely parallel to the reimbursement procedures under the 1945 Act are the programs of the State Reclamation Board for acquisition of lands, easements and rights-of-way for levee and channel improvement projects constructed by the Corps of Engineers. The principal difference in the two programs is that under the reimbursement program of the Department of Water Resources, local agency personnel do the work associated with the acquisition, and rights-of-way are paid for with local funds. Then the agency is reimbursed for the costs upon approval by the Department. Under the Reclamation Board program, State personnel do the land acquisition work and landowners are paid directly with State funds, with rights-of-way being acquired in the name of the State. Only the Department is authorized to participate in the Corps small flood control program and the reimbursement procedure must be followed in such projects. Participation of the Reclamation Board in Corps projects is authorized in each case by the Legislature.

Under the Davis-Grunsky Act (Water Code Section 12800, et seq.), the Department of Water Resources can, with approval of the California Water Commission in all cases and with approval of the Legislature where grants of more than $400,000 are involved, grant funds to assist local agencies in constructing water projects, including those for the control of floods. Essentially, the amount of grants provided reflect project accomplishment in areas of recreation and fish and wildlife enhancement. Recreation benefits at reservoirs are dependent in part on availability of on-shore facilities such as picnic grounds, camp grounds, water supply and sanitation, and the capital costs of such facilities use a substantial part of the funds granted. It is unlikely that any of the foothill reservoirs can develop reliable minimum recreation pools or fish and wildlife benefits, and accordingly, financial assistance through the Davis-Grunsky Act is not promising.

Under a 1947 Legislative Act (Fish and Game Code Section 1300, et seq.), the Wildlife Conservation Board may construct or may provide funds for construction of on-shore facilities and small craft launching ramps along the rivers and at reservoirs managed by local agencies. Limited funds are available for this program and for the same reasons discussed in the previous paragraph, it is doubtful if they would be of assistance in construction of foothill reservoirs in Tulare County operated for flood control purposes.

Under Section 9063.1 of the Public Resources Code, the Division of Soil Conservation in the Department of Conservation makes grants to assist districts in carrying out projects, including small watershed flood control projects. Recipient districts must be Soil Conservation Districts organized in accordance with State law. Each grant must be approved by the State Soil Conservation Commission and an appropriation must be provided by the Legislature.

The California Water Commission is responsible for coordinating statewide programs relating to appropriations for surveys, investigations, and construction of projects by the Corps of Engineers and the Bureau of Reclamation. The Commission hears the recommendations of all local interests in regard to these appropriations, coordinates them, and represents the State of California in presentations to the appropriations committees of the Congress each year. These functions are exercised with respect to the funding of feasibility studies leading to requests for federal authorization as well as to the funding of actual construction of authorized projects. The functions are important because they aid in presenting to the Congress a unified California position rather than fragmented presentations by a large number of local interests.

FEDERAL AGENCIES

Corps of Engineers, Department of the Army

Under its civil works program, the Corps carries on two major programs involving construction of new flood control projects. One program, which has been in effect nationwide since 1936, is the program which led to completion of many flood control projects in California, including Pine Flat, Terminus, Success and Isabella Dams on the major Tulare Basin streams and many levee and channel projects. The other such major program was first authorized by the Congress in 1948 and involves what are called "Small Flood Control Projects"; that is, projects whose total federal cost does not exceed $1 million. In addition to these activities on new flood control projects (or modifications of existing projects which may involve further federal funding), the Corps performs important emergency work following floods. Also, under specific congressional authorizations, the Corps may disburse federal funds to local agencies building multiple-purpose reservoirs; the amounts of such funds reflect flood control benefits resulting from operation of the projects under regulations

prescribed by the Secretary of the Army. Both the regular and Small Project programs of the Corps may be helpful in implementation of parts of this Master Plan.

Under the first (1936) program, a history of floods and requests of local interests will lead to a resolution by the Public Works Committee of either the House of Representatives or the United States Senate directing the Corps to make a survey of the area. Once funds for the survey are appropriated, the District Engineer directs preparation of a report which is in sufficient detail to determine economic justification of a project; specifically, average annual flood damages are estimated, the engineering soundness of a definite project plan is determined, estimates of capital and annual costs are made and the ratio of benefits to costs is defined. Also, opportunities for multiple-purpose development are explored, including recreation, fish and wildlife preservation and enhancement, irrigation, municipal water supply, and hydroelectric power, and the impact of the proposed project on the environment is appraised. After completion of such a report in draft form, the District Engineer holds public hearings, receives comments of local interests and local offices of affected state and federal agencies, completes his report, and forwards it through the Division Engineer to the Chief of Engineers, the Board of Engineers for Rivers and Harbors, and the Secretary of the Army for their reviews. Assuming approvals at these review levels, with or without modifications, the Secretary sends the report as his "Proposed Report" to the Governor of the affected State and designated federal agencies for their comments. Finally, after making any revisions he deems advisable in light of the formal comments received, the Secretary secures the views of the Director of the Office of Budget and Management, a part of the President's staff, and then transmits the report to the Congress for consideration. If the project is authorized for construction, funds for preparing designs and plans and specifications are subsequently sought in annual Public Works appropriations, as are funds for construction of the project. All these procedures are time consuming. While the time required between identification of need for a project and its completion varies from situation to situation, the whole process usually requires several years — ten or more years is not uncommon.

Under the second Corps of Engineers program, first authorized in 1948, small flood control project developments follow many of the above steps but omit others. Annual lump sum appropriations are made by the Congress, nationwide, for these projects and they are conducted by District Engineers under authorization of the Chief of Engineers. The same requirements of engineering feasibility and economic justification must be met and similar processes of coordination with local and state interests are followed. Procedurally, a small flood control project begins with a reconnaissance study to determine roughly that the project can be completed at a federal cost of less than $1 million and that its annual benefits will exceed its annual costs. This reconnaissance is followed with a detailed project report similar to the survey report described above. The latter report serves as a vehicle through which the Chief of Engineers can authorize preparation of final plans and specifications for the project and its construction. Availability of funds for planning and construction largely determines the time required to bring a small flood control project to completion but such projects, once their planning is initiated, require much less time than the normal Corps projects.

Over the years, project reports prepared under both of these Corps programs have given increased consideration to recreation and fish and wildlife preservation and enhancement. More recently, widespread concern with environmental and ecological effects of water resources developments have intensified study of these matters during report presentation and reviews. These evolving changes are identified here because they probably will extend the time required for completion of reports and projects of the Corps under either of the programs.

Except for certain projects so authorized by the Congress, both of the above programs place three responsibilities on non-federal interests apart from their initiatory and participatory functions in the planning stages. As a general rule, on channel improvement projects, non-federal interests must, prior to construction, furnish assurances that they will (1) furnish all lands, easements, and rights-of-way required for construction and operation of the project, (2) hold and save the United States free from damages due to the work and (3) maintain and operate the completed projects, but these requirements do not apply to reservoir projects. In some cases, additional requirements are placed on non-federal interests or one or more of these three requirements may be modified.

As referred to in the discussion of state programs, state funds have been used in most cases since 1945 to meet the costs of rights-of-way and road and utility relocations on both Corps programs. In recent years, local interests have furnished the other necessary assurances and have operated completed projects in accordance with regulations prescribed by the Secretary of the Army.

Presently, the District Engineer of the Sacramento District, which includes the San Joaquin Valley, is conducting studies in and adjacent to Tulare County under both its general and small projects authorizations. For example, studies of possible enlargement of Isabella Reservoir to expand recreational opportunities have been essentially completed and studies of enlargement of space for storage of water of Kings, Kaweah, and Tule Rivers and of connecting the Kern River to the California Aqueduct near Buena Vista Lake are under way.

Department of Agriculture

The Soil Conservation Service of the United States Department of Agriculture provides technical or financial assistance under three programs which may have some application to implementing this Flood Control Master Plan for Tulare County. The first of these comes under the Watershed Protection and Flood Prevention Act (Public Law 566) which has been referred to previously in describing state participation in that program. Under federal law, flood protection districts may participate; however, California law does not permit use of State funds for other than established soil conservation districts. Federal assistance includes conducting investigations and surveys, preparation of plans, cost estimates and cost allocations, and financial and other assistance. Where estimated federal costs exceed $250,000 or involve reservoirs storing more than 2,500 acre feet of water, the Committees on Agriculture of the House of Representatives and the Senate must approve. Where a reservoir having a capacity of more than 4,000 acre feet is involved, approvals of the House and Senate Public Works Committees are required. Both loans and grants may be made, but the total federal funds for a project are limited to $5 million. Except for projects involving recreation and fish and wildlife, federal funds meet construction and engineering costs related to flood control, while non-federal interests bear costs of lands, easements and rights-of-way and of operation and maintenance. Projects involving watershed and farm management and water conservation as well as flood control are common. Although individual steps vary, procedures from initiation of project planning through construction are similar to those for Corps of Engineers' projects in that other federal and state agencies are consulted and review proposals at various stages, including formal reviews by the Governor and Secretaries of major federal agencies, before definite proposals are transmitted to the Office of Budget and Management and the Congress. Federal appropriations are "lump sum" amounts made available to the Secretary of Agriculture with which to meet nationwide Public Law 566 requirements during each fiscal year.

Two other programs of the Department of Agriculture, both of which are loan programs, are administered by the Farmers' Home Administration of that Department. These programs appear to have limited application to a flood control program for Tulare County, but are mentioned because they might be of assistance in isolated cases. In one program, loans which may be repaid in up to 40 years may be made for

construction of drainage facilities in farming areas where sustained production is impaired because the land is too wet. The loan interest rate under this program is 5 percent on the unpaid balance of the principal amount loaned.

In another program of the Farmers' Home Administration, 5 percent loans may be made to soil and water conservation districts for special purpose equipment with which to do certain kinds of work including drainage. Loans may be repaid over the useful life of the equipment but not to exceed 40 years. There are other conditions involved in the loan which of themselves limit application of the program to the Tulare County Flood Control District and local districts within its boundaries.

Department of Housing and Urban Development

Under Public Law 83-560, the Community Resources Development Administration can make interest-free advances to public agencies to develop plans for public works to be placed under construction rapidly in the future. Advances may be used for feasibility studies, designs and preparation of plans and specifications for later construction of specific projects. The receiving agency must agree to contract to complete the plans promptly and to repay the advance. The advance is repayable when construction begins or a proportionate part is repayable when a portion of the public work is put under contract. Construction must conform to an overall state, local or regional plan.

Under this act, there are no provisions for assisting financially with construction, but the program could aid in completing feasibility studies, plans and specifications for some of the projects of this Master Plan. It would appear that those areas of the County where urban damages are suffered in floods, such as Woodlake, Tonyville, and Porterville, might be able to develop plans under the program preliminary to seeking alternative means of financing construction in a timely manner.

The same Administration, under the Housing and Urban Development Act of 1965 (Public Law 89-117), is authorized to make limited grants to state and local public bodies to assist in purchase of land and interest in land for future public uses. The amount of such grants is limited to the amount of reasonable interest paid on the locally borrowed funds used to finance acquisition of land only. The grant also is limited to the amount of interest accruing between the date funds are borrowed and the date construction begins on the acquired land, but not to exceed a 5-year period. Such a program appears of little assistance in implementing a master plan of flood control, but it is conceivable that in a specific circumstance, such as immediate availability of a particular land parcel for a project whose need is urgent, the approach offered in this program might be used.

Under Public Law 84-345, the Community Resources Development Administration can purchase securities of certain public agencies and private non-profit corporations, with priority given to towns of less than 10,000 population, which plan to construct basic public works including water and sewer systems. The securities involved must be first advertised for public sale and the Administration will purchase them only if private investors do not offer to purchase them at interest rates equal to or less than the rate governing the Housing and Urban Development Department. This program obviously is of little value in connection with this Master Plan; if the program is of any value at all, it would appear to be only in those areas where storm sewers are justified and are considered eligible under the program.

Under Title XIII of Public Law 90-448, the Federal Insurance Administration, Department of Housing and Urban Development, administers the National Flood Insurance Act of 1968. This program provides a means for residents of flood-prone areas to be reimbursed through private insurance companies for losses incurred from stream and coastal flooding. Those who reside in portions of the flood plain below a base flood level can obtain insurance at subsidized rates for losses incurred from flooding that is greater than the base flood. Future development below the base flood elevation must be regulated by State or local governments.

Through action of the County Board of Supervisors, Tulare County has been included in this program. Residents of recognized flood-prone areas in the County can purchase insurance at subsidized rates for single family residences, 2-4 family dwellings and small businesses. Final premium rates will be based on actuarial studies conducted for the Administration. Such actuarial studies are under way by the U.S. Corps of Engineers for the White River and Deer Creek areas upstream from Highway 99, the Springville and Three Rivers areas and the Woodlake and Porterville areas.

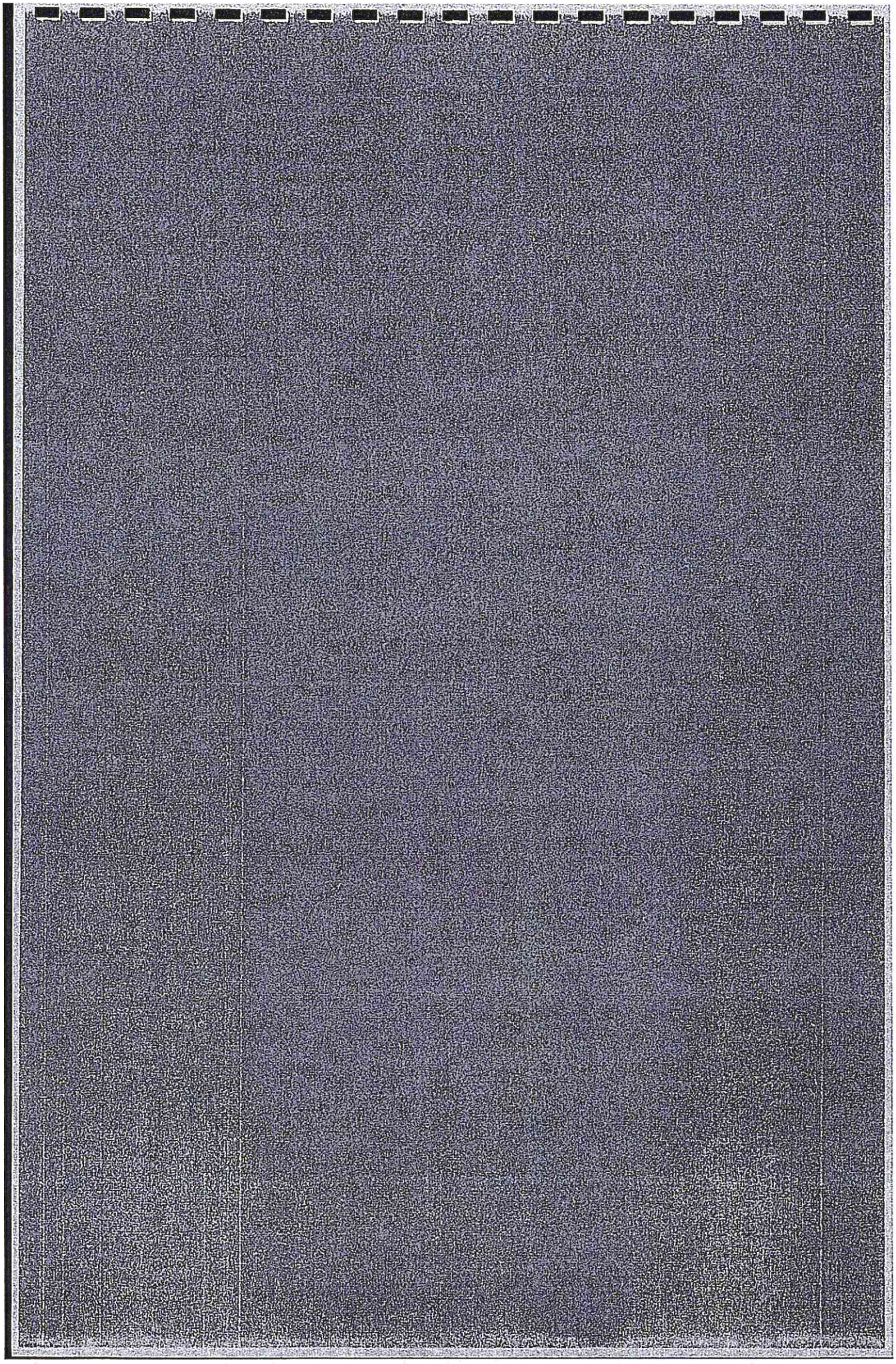
Economic Development Administration,
Department of Commerce

The Economic Development Administration makes grants and loans for public works and development of facilities which improve opportunities to establish or expand industrial and commercial plants. Essentially, the program is aimed in creating, through public works activities, long-term employment opportunities in an area primarily to benefit "hard core" unemployed and low-income families. The area involved must be one found economically depressed and must have an approved overall plan for economic development. Grants generally are limited to 50 percent of total project costs, although total grants up to 80 percent may be made in certain economically depressed areas. Loans are made only when funds for the project are not otherwise available, and if made, must be repaid in not more than 40 years. Some flood control projects in the Tulare County area may be eligible for grants or loans and further consideration should be given to this program of the Economic Development Administration; it appears, however, that the program will be of limited assistance in connection with this Flood Control Master Plan.

Bureau of Reclamation,
Department of the Interior

Under the Small Reclamation Projects Act of 1956 (Public Law 84-984), the Bureau of Reclamation can lend funds for primarily-irrigation projects costing not more than $10 million. While many of the reservoir concepts developed in Chapter 3 could augment irrigation uses of rain-flood runoff through control of releases, it is doubtful if any of these reservoirs would develop sizable irrigation benefits. More important, because of water right and other limitations described in Chapter 3, it is clear that development of firm irrigation yields at any of these reservoirs is not practical. Accordingly, it is considered that the Bureau's Small Reclamation Project Program cannot be used effectively in implementing this Flood Control Master Plan.

V DEVELOPING SPECIFIC PROGRAMS



DEVELOPING SPECIFIC PROGRAMS

Historical flooding in Tulare County and its adjacent areas, flood hydrology, flood control concepts, and financing considerations which have been discussed in the previous chapters lead, as a whole, to the conclusion that solution of the flood problems in the seven flood control Units will involve continuing programs over a period of many years and perhaps of decades. Such programs may require that the Tulare County Flood Control District engage in activities which are largely independent of agencies outside Tulare County and participate in activities involving adjacent counties and State and Federal agencies. Action by County government also may be required to control development of flood plains for short or long periods of time, since the authority to establish such controls rests with the Board of Supervisors as the legislative body governing Tulare County rather than in the organic Act under which the Flood Control District functions.

Floods in the Tulare County area have only rarely resulted in loss of life, except perhaps indirectly through emotional stresses placed on individuals. It is probable that loss of life will not occur frequently in the future, but the potential will always be present. Flood damages principally reflect monetary losses, primarily in the expense of repair and replacement of the many different kinds of improvements affected by flood waters: inundated dwellings and commercial shops; overflowed or eroded farm land, or cropped areas laden with sand, gravel or other debris; destroyed farm roads, pumps and equipment; damaged County roads, bridges and culverts; eroded and broken levees; railroad failures; State highway damage; interrupted communication facilities; and broken canal systems belonging to individuals, private companies, local public agencies and the Federal Government. Monetary losses are also sustained by individuals and public agencies when travel and communications are disrupted by flooding. Social losses occur as well when homes are damaged and people are evacuated even temporarily.

All these factors are important to the individuals and agencies concerned and illustrate the impracticability of listing flood problems in any single order of severity. Urban and residential damage resulted from the 1966 and 1969 floods in many communities. Agricultural lands along most streams suffered varying degrees and kinds of damages. Irrigation systems were inundated and suffered extensive damage to structures and canal banks. Visalia and Tulare, the largest cities in the County, face potential hazards of inadequate controls of the combined flows of Dry Creek and Kaweah River.

Establishment of priorities for approaching solutions to flood problems on a stream by stream or area by area basis also is impractical. However, by pursuing flood problems in cooperation with other public agencies in Tulare County and on the inter-county, State and Federal levels, a properly organized effort can attack the County-wide flood problems on a broad basis enabling affected individuals, landowners and public officials within each area of the County to determine the priorities with which problems in their area may be resolved. Suggested steps and procedures at the intra-District level, the inter-county level and the State-Federal level are described below.

LOCAL PROGRAMS AND PROCEDURES

Flooding in Tulare County is partially caused by runoff originating in southern Fresno County and Kern County (Rag Gulch), as well as in the County itself. Control of such inter-county streams can benefit lands in all three counties and in Kings County as well. Thus, the six valley-floor flood control

Units discussed in Chapter 3 form an over-all hydrologic area having interrelated problems. No single governmental agency is authorized to resolve these problems effectively and in a manner equitable to all residents and property owners in the over-all area. If there were such a single agency, accomplishment of effective and equitable measures at the local level would be much easier.

Tulare County Flood Control District can act only for the benefit of residents and property owners within the District. The District may, for example, construct a detention basin on Hills Valley Creek to benefit lands and improvements within the District; however, if the District did construct such a basin, Fresno County landowners would benefit also and the District Act does not provide for participation by those landowners in the cost of the works. For purposes of suggesting procedures at the local level, this report ignores the fact that the Act applies only within the boundaries of Tulare County. In effect, the report assumes that the flood control Units described in Chapter 3 *are* within a single agency having the powers of the District.

As discussed below, it may be possible to reconcile the different hydrological and political areas through cooperative action and thus achieve the same result. If such a cooperative approach cannot be achieved, then the procedures outlined below will necessarily have to be reviewed and, possibly, limited in application to the District itself. Obviously such modified procedures may not achieve control of flooding in a fully beneficial way to all those affected by flows from all streams within the hydrological area.

Detailed planning and construction of many of the flood control projects in Tulare County and the adjacent areas will probably be the responsibility of agencies other than the District. However, there is little likelihood that these other agencies will solve all the flood control problems of the area except possibly over a period of many decades. The District itself, especially if cooperative arrangements can be established with other governmental agencies within its boundaries and in adjacent counties, may be able to carry out planning, construction and operating functions in parts of the area, thus supplementing efforts of others and aiding earlier completion of an over-all program. Accordingly, it is appropriate to consider possible procedures which might be employed in flood control activities in the District and its adjacent areas assuming provisions of the District Act are applicable throughout.

Two other factors — one practical and the other legal — also favor or require participation by local citizens in action flood control programs. Under present State and Federal policies, local agencies must agree to operate and maintain many completed flood control works to prescribed standards; such action involves continuing annual expenditures which equitably should be provided by those benefitting. Practically, also, the willingness of local agencies to expend their own funds on such programs encourages participation by higher governmental agencies.

Among the functions which the District might carry out are:

1. Liaison with cities and irrigation, soil conservation and other similar districts within Tulare County, with adjacent counties, and with local and State offices of appropriate Federal and State agencies.
2. Coordinating flood control activities on the individual streams and related stream systems.
3. Making recommendations as to boundaries of zones of benefit for planning purposes.
4. Reporting on the engineering and economic justification of specific projects.
5. Preparing final designs, plans and specifications of specific projects and directing their construction.
6. Operating and maintaining completed works.
7. Cooperating with local, State and Federal agencies in the collection of hydrologic data.
8. Conducting hydrologic and hydraulic studies for use of various departments of County government.

All these functions are required in an over-all flood control program. This does not mean they should or can be carried out only by County staff personnel. Time, availability of qualified personnel and funding limits will restrict the number and extent to which these functions can be performed by County staff. For specific projects, some of the functions will be carried out by others (for example, Corps of Engineers, local irrigation, water conservation, soil conservation districts, etc.). On specific studies and projects also, engagement of consultants may be appropriate for planning and zone of benefit studies and for design and construction of physical works.

Establishing Zones of Benefit

With this Master Plan at hand, implementing any of the concepts of Chapter 3 should follow three steps: (1) making detailed studies of the engineering feasibility and economic justification of specific projects and defining areas benefitting from their operation, (2) preparing final designs, plans and specifications, acquiring rights-of-way and constructing such projects, and (3) operating and maintaining them. In general, costs of the first and third steps are relatively small compared with the costs of the second step. Also, the first and second steps, though differing widely in cost, are "one-time" programs while the third—operation and maintenance of a specific project—represents a continuing annual cost. The distinction between the detailed engineering, economic and benefitted-area studies of Step 1 and the final design and construction work of Step 2 is important, for Step 1 determines the practical viability of a project.

Definition of a zone or zones benefitting from one or more projects requires thorough, detailed study of flooded areas, reservoirs and channel location and sizing. Normally the detailed study performed in Step 1 develops the zone or zones benefitting from a specific project or projects.

Any discussion of action programs by the District, either by itself or in cooperation with other local agencies, should consider the mechanics of financing such programs through Zones of Benefit as provided in the District Act. It is noted, however, that the District Act is not entirely clear as to whether all three of the normal procedural steps set forth above can be financed with funds raised under the District Act except over a period of many years. Without question, funding of Steps 2 and 3 can be accomplished through establishment of Zones of Benefit in accordance with the Act. It may be, however, that the Act does not provide specifically for Zones of Benefit for funding of the planning work of Step 1, which is necessary to establishing the justification for final design, acquisition of rights-of-way, construction, and eventual operation and maintenance. The Act may permit the Step 1 work to be accomplished with funds raised through District-wide assessment, but the relatively small amounts of such funds, apart from any other consideration, may restrict the rate at which these planning efforts can be carried out.

If it is desired to carry on a more extensive locally financed planning effort than can be accomplished through District-wide assessment, then a practical approach to raising more funds might be to develop Zones of Benefit for the purpose of making the determinations of engineering and economic viability called for in Step 1. If such a procedure is not permissible under the Act, amendments to the Act should be sought in the interests of establishing maximum flexibility in solution of the flood problems of Tulare County and adjacent areas. The discussion that follows is based on the assumption that establishment of Zones of Benefit for planning purposes is permissible under the Act or that the Act has been amended to permit zones to be established for that purpose. An example of application of the three-step procedure to flood control implementation is discussed below and illustrated schematically in Figures A, B, C and D.

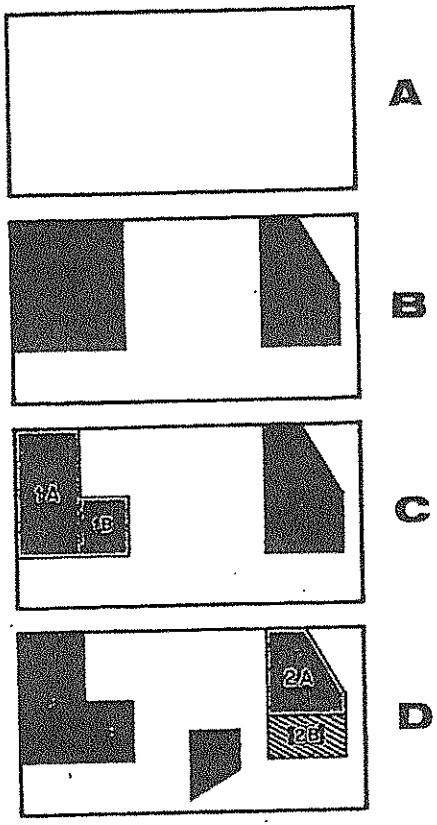


Figure A schematically represents the District-wide Zone of Benefit which was established, in effect, by the Act creating the District and implemented by the Board of Supervisors. This Master Plan, which quantifies the area-wide hydrology of flood problems and suggests concepts for flood control, was financed by funds raised District-wide as an essential first step in flood control planning for the entire District.

In Figure B, it is assumed that two "Planning Zones of Benefit", No. 1 and No. 2, have been established for the necessary detailed planning. These zones are in areas of past and potential flooding where prospects of developing a definite project either by action programs of the District or of other agencies appear promising. In establishing boundaries of the zones, recent flooding patterns and consequent tangible and intangible damages were considered. The number of such zones in existence at any one time will depend on the intensity of planning efforts by the District and other agencies.

Next, it is assumed that the engineering and economic feasibility of a definite project in Planning Zone No. 1 has been established as a result of detailed planning. The project would be advantageous to land and improvements in part of the zone and would protect a portion of Planning Zone of Benefit No. 1, identified as 1A in Figure C, against more frequent or damaging flooding than the portion marked 1B. It was also established that part of Planning Zone of Benefit No. 1 would receive negligible benefits from the construction and operation of the project; this part should be separated from the other two areas. Thus, as a result of the detailed planning effort, the areas designated as 1A and 1B are proposed as Action Zones of Benefit.

In Figure C it is assumed that the areas designated 1A and 1B have been approved as Action Zones of Benefit for implementation of the selected project. Figure C also shows schematically the continuation of detailed planning work in Planning Zone of Benefit No. 2.

It is emphasized that limited work would be done with funds raised in the Planning Zones of Benefit. The engineering and economic feasibilities of projects would be examined and the specific areas which would benefit by operation of the projects would be determined. This planning, in almost all cases, will cost a small fraction of actual construction cost of the project and will establish engineering and economic facts on which action programs can be presented for decision to the Supervisors and the residents of a proposed Action Zone of Benefit. The actions taken and the means of financing them may vary widely. Small inexpensive projects might be financed by annual assessments within the Action Zones of Benefit, with portions of the work being executed each year and without exceeding reasonable assessments. Larger projects might require bonding. Definite plans and the demonstration of economic merit might support grants or loans from other agencies under programs discussed in Chapter 4. Action programs might consist simply of turning to other agencies with requests for review and concurrence in the merits of the project and consequent direction of final design, construction and participation in costs of lands, easements and rights-of-way. Appropriately, under the District Act residents within a proposed Action Zone of Benefit will determine the program to be undertaken through their approval of establishment of such a zone.

Figure D shows further development of flood control within the District. A new Planning Zone of Benefit, No. 3, has been established for development of detailed plans and the boundaries of another possible Action Zone of Benefit. The project for Action Zones of Benefit Nos. 1A and 1B has been constructed and those zones have been converted to Operation and Maintenance Zones of Benefit Nos. 1A and 1B, with assessments which cover continuing costs of operation and maintenance of the work reflecting the different degrees of flood protection provided by the project. Also, a portion of Planning Zone of Benefit No. 2, marked 2A, was found to be a viable Action Zone of Benefit, while the remainder, marked 2B, although subject to serious flooding, was found to be so costly to protect as to make it an impractical part of an Action Zone of Benefit. The Board of Supervisors might consider designating the latter area as an area where development would be controlled under ordinance, as indicated in Figure D; establishment of such controls could make affected property owners in area No. 2B eligible for flood insurance under Public Law 90-448.

Other examples could be developed to illustrate the application of these procedures. An apparently viable project proposed as a result of detailed studies in Planning Zone of Benefit No. 3, for instance, might prove to be impossible to finance and might subsequently be abandoned altogether.

The procedure for establishing separate Zones of Benefit described above has the advantage of permitting the electorate affected to become informed at each stage as to costs and benefits. However, the procedure may be cumbersome and overly time-consuming, inasmuch as at least two elections are required and each election must be preceded by hearings. When one considers the number of potential Zones of Benefit in the District, and in related areas outside the District, it is apparent that the sheer mechanics of these procedures may make them difficult and expensive to apply.

Since areas upstream of Success and Terminus Dams are not, at least at present, economically susceptible of protection, there is justification for treating the Mountain Unit portion of the District differently from the remainder of the District and adjacent areas. Also, the potential unwieldiness of the procedures outlined previously tends to justify consideration of forming a single valley-floor Planning Zone of Benefit, including all of the District except the Mountain Unit; in such a zone, detailed planning could be accomplished within an over-all program to solve progressively the valley-floor flood problems.

Thus, it is suggested that consideration be given to three approaches to defining Planning Zones of Benefit. In one, a valley-floor Planning Zone of Benefit would be established and would include all the District except the Mountain Unit. In a second approach, separate Planning Zones of Benefit would be established. In a third approach, a valley-floor Planning Zone of Benefit might be established as in the first approach, and separate Planning Zones of Benefit might be superimposed thereon. If separate Planning Zones of Benefit were established, or were superimposed on a larger Planning Zone of Benefit, the separate zones might encompass the areas suggested below, although more detailed analysis will be required to support their specific metes and bounds descriptions.

Tulare-Fresno Unit

Consideration of the widespread flooding during the 1966 and 1969 storms and the concepts presented in this Master Plan clearly indicate that this entire Unit is influenced by the canal system of Alta Irrigation District and that system is important to solution of flood problems throughout the Unit. Wide areas within the Unit are flooded from combined sources. Most residents of the areas not actually flooded are inconvenienced to some extent by disruption of communications. Drainage of urban areas is interrupted during periods of flooding, and damage to county roads, bridges and culverts requires expenditure of county funds which otherwise could be devoted to other purposes.

If a Planning Zone of Benefit covering the whole Tulare-Fresno Unit were established and the concepts presented in Chapter 3 were used, detailed planning of a coordinated development to control flooding in that Unit could be initiated. As a part of such detailed planning, and consistent with the procedures recommended above, the difference, if any, in benefits of operating the planned works to the various parts of the Unit should be determined because even if the works are constructed by other agencies the local area may have to finance their operation and maintenance. Also, such information will be required if the residents of the Unit are called upon to decide the desirability of constructing the work in stages through annual assessments, or in a continuing program based on bond financing.

As suggested, portions of the Tulare-Fresno Unit lying outside the boundaries of the District, from a standpoint of equity and self-interest, should participate financially and otherwise in development of detailed plans for flood control on many of the streams in the Unit. In Fresno County, areas east of Kings River and Wahtoke Creek and in the vicinity of Friant-Kern Canal can benefit from a coordinated plan of flood control.

Kaweah Unit

The entire Kaweah Unit could also be designated as a single Planning Zone of Benefit. Almost all of the residents within the Unit have an interest in the successful conclusion of current studies by the Corps of Engineers on augmentation of storage on Kaweah River and control of Dry Creek and of possible modifications of the control structure at McKays Point. These interests are either direct, because landowners are flooded by combined flows of Kaweah River and Dry Creek, or indirect in that they are threatened by such flooding or are inconvenienced in many ways when floods occur. Other landowners, including those in the vicinities of Woodlake, Lindsay and Exeter and those flooded by waters of Antelope, Mehrten, Yokohl and Lewis Creeks, have an interest in common with those actually or potentially flooded from Kaweah River and Dry Creek flows because the ultimate solutions to flooding in their areas depend on the availability of sufficient capacity in Kaweah River distributaries to convey controlled flows of all these creeks.

Terminus Dam is a Federally-owned structure; its modification is appropriately a function of the Corps of Engineers. The Corps is presently studying the feasibility of controlling Kaweah Basin snowmelt by providing additional storage in Lake Kaweah and a reservoir on Dry Creek. Any detailed planning for the control of rain-floods originating on the other smaller watersheds within Kaweah Unit should be coordinated with studies of Kaweah River flood control being conducted by the Corps. Equally important, detailed planning for protection against rain-floods in the smaller watersheds of Kaweah Unit should be conducted in close consultation with management and operating officials of agencies owning Kaweah Delta canal systems.

Tule Unit

After the December 1966 flood, in which extensive areas adjacent to Tule River were inundated by the high flows passing Success Dam, considerable channel work west of Porterville was done; as a result, runoff from the smaller flood of February 1969 was carried with only minor channel overflow. Most of the area in the Unit has a substantial interest in possible augmentation of storage space at Success Reservoir. Other portions of the Unit, including specifically those affected by the flows of Frazier Creek and those in the vicinity of Porterville, warrant detailed planning study. The entire Unit can benefit through improved communications and otherwise if floods are reduced. Thus, the entire Tule Unit might form a Planning Zone of Benefit.

Deer Unit

Study of areas flooded by the flows of Deer Creek during the flood of 1969 indicates that this Unit could well be included in a single Planning Zone of Benefit. Direct benefits from flood control measures would, of course, accrue to owners of land and improvements in areas such as were flooded in 1969. Indirect benefits from improved communication during flood times would accrue to all the area within the Deer Unit from control of flows of Deer Creek, Fountain Springs Gulch and Terra Bella—Ducor and Ducor East drainages.

White Unit

As in the case of the Deer Unit, flooding patterns resulting from the storms of February 1969 suggest that the entire Unit form a single Planning Zone of Benefit through which detailed planning could be conducted for control of floods on White River, Rag Gulch and intervening drainages. More study might reveal that indirect benefits such as non-interruption of communications during high flows of White River and Rag Gulch are not sufficiently interrelated as to warrant establishment of such a single Planning Zone of Benefit. If not, then consideration might be given to establishing two Planning Zones of Benefit in White Unit, one of which would

examine detailed plans for control of White River and adjacent drainages, and the other, detailed plans for control of Rag Gulch. The localized nature of flows from Rag Gulch, the concepts for such control discussed in Chapter 3, and the fact that lands in both Tulare and Kern Counties are involved might also support a conclusion that such separate Planning Zones of Benefit would be appropriate.

Tulare-Kings Unit

Districts in Kings County currently are participating with Tulare County districts in flood control activities. However, the entire Tulare-Kings Unit is involved in control of flooding from streams originating in the other five valley-floor Units and in the Mountain Unit. It is clear also that some of the streams flooding the other Units do not produce significant damage in the whole of Tulare-Kings Unit. At least as evidenced by flood patterns during the 1969 flood, one stream, Rag Gulch, does not convey water to Tulare-Kings Unit at all. Obviously the largest part of Tulare-Kings Unit is outside Tulare County Flood Control District.

It appears equitable and in the self-interest of landowners in Tulare-Kings Unit that they participate actively in financing detailed planning studies in the other valley-floor Units and in guiding such planning. Landowners in various parts of the Unit also could profitably coordinate their efforts in studying plans of flood control through channel modifications within the Unit.

Consideration might be given (if appropriate multi-county coordination is secured) to establishing a Unit-wide Planning Zone of Benefit. It is possible also, that Tulare-Kings Unit might be divided into two or more Planning Zones of Benefit to recognize the different sources of damaging waters. If two such Planning Zones of Benefit were established in the Unit, one might include the portion of Tulare-Kings Unit north of Tule River and the other a portion of the Unit south of Tule River. Also, a Unit-wide Planning Zone of Benefit might be established with two separate zones — one north and one south of Tule River — superimposed thereon.

INTER-COUNTY ACTION

Flooding of land in the District is related in part to flooding in portions of Fresno, Kings and Kern Counties. No single political subdivision of the State encompasses the entire area involved. Equitable solutions to the interrelated problems of the area perhaps could best be accomplished if such a single entity existed; in its absence all possible forms of effective, cooperative action should be explored among the four county governments concerned, with full participation of all local water and soil conservation districts and agencies.

Exploration in depth of ways and means to secure this effective and coordinated action must be based on understanding the flooding problems in the area. It is believed that this Master Plan can make possible such understanding. Beyond this, and without essential agreement by property owners in the areas affected that common problems do exist, it is possible only to suggest a few mechanics for achieving results.

Inasmuch as Tulare County Flood Control District is an important and centrally located portion of the total area, it might initiate proposals for joint action on the various flood problems involving land and flood sources in two or more of the four counties. Preliminary to such proposals, copies of this Master Plan should be provided to officials in Fresno, Kings and Kern Counties and to the many local districts in the four county area. Assuming agreement that common problems do exist in one part of the general area or another and should be attacked by coordinated effort of the many political agencies involved, legal advice could be sought to determine their powers to enter into formal cooperative agreements or to otherwise undertake appropriate action.

PROGRAMS INVOLVING STATE AND FEDERAL AGENCIES

State and Federal agencies may accomplish a substantial part of the over-all flood control program in the District and adjacent areas. Locally, the District should monitor the programs of State and Federal agencies and should encourage existing and suggest new programs. Moreover, the District actually can help State and Federal agencies accomplish their programs by direct action in gathering data and in performing detailed planning studies. Any arrangements made to implement inter-county actions discussed above should involve all three of these activities — monitoring, encouraging or suggesting programs, and direct action.

Monitoring is simply maintaining current knowledge of the programs of Federal and State agencies and of their status. Frequent contacts with local and State offices of these agencies can provide the knowledge upon which suggestions can be based and which can assure coordination with the District's program. At the same time, District officials should be aware of legislative proposals affecting the area. Participation in associations with broader interests may also be of help.

Encouraging Corps studies of enlarging snowmelt storage capability on Kings, Kaweah, Tule and Kern Rivers obviously is of great importance to developmental planning on many of the foothill streams of Tulare County and adjacent areas. Similarly, local action should encourage further planning, authorization and construction of the proposed East Side Project, since that project can provide facilities significant to an over-all flood control program. New Small Flood Control Projects can be suggested to the Corps and planning trends on other projects may be influenced in ways to assist the flood control program.

Where individual projects clearly will cost less than $1,000,000, and consultation with the District Engineer of the Corps of Engineers indicates the action to be appropriate, such individual projects might be planned in conformance with Corps standards as to engineering, cost estimates and benefits. It appears reasonable, as a minimum, that preparation of feasibility reports by the District in such cases could accelerate construction of some projects which the Corps otherwise would necessarily have to schedule at later times.

SELECTED BIBLIOGRAPHY

FLOODS

California High Water, 1966-1967, Bulletin No. 69-67, June 1968
California High Water, 1968-1969, Bulletin No. 66-69, June 1970
—Department of Water Resources, The Resources Agency, State of California

Floods of January and February 1969 in Central and Southern California, Open-file report, 1969
—Geological Survey, U.S. Department of the Interior

Report on Floods, Central Valley of California, 1966-67 Flood Season, December 1967
Report on Floods, Central Valley of California, 1968-69 Flood Season, August 1970
—Sacramento District, Corps of Engineers, Department of the Army

FLOOD HYDROLOGY

Flood Control Master Plan: Hydrology Appendix, Tulare County Flood Control District, April 1971
—Murray, Burns and Kienlen, Consulting Civil Engineers and The Spink Corporation, Sacramento, California

FLOOD PLAIN MANAGEMENT

Flood Plain Management Study, Tulare County, California, March 1970
—Tulare County Planning Department

Flood Plain Information, Kaweah River, Three Rivers, California, October 1967
Flood Plain Information, Tule River, Springville, California, July 1968
—Sacramento District, Corps of Engineers, Department of the Army

GENERAL PLANNING

An Area General Plan, Tulare County, California, Report No. 1: Basic Determinates for Plan Preparation, April 1962
Report No. 2: Proposals and Tools for Achievement, April 1963
—Robert Grunwald and Associates, City and Regional Planning Consultants, Hanford, Calif.

General Plan, City of Porterville, California: Public Services and Facilities, October 1965
—Koebig and Koebig, Inc., Hahn, Wise and Associates, Inc., Los Angeles and San Carlos, Calif.

A Comprehensive Master Plan for the Development of the Soil and Water Resources of the Upper Kaweah River Watershed: A Report for the Three Rivers Soil Conservation District, c. 1962
—Blair-Westfall Associates, Consulting Engineers, San Jose-Fresno, California

PROJECT PLANNING AND OPERATION

Preliminary Report and Plans and Specifications, Curtis Mountain Drain, Navelencia Soil Conservation District, Tulare County, April 1970
—Soil Conservation Service, U.S. Department of Agriculture

Stone Corral Watershed Work Plan, May 1970;
Hydrologic Appendix, May 1968
—Stone Corral Soil Conservation District, Stone Corral Irrigation District and Tulare County Board of Supervisors with Division of Soil Conservation, State of California and Soil Conservation Service, U.S. Department of Agriculture

Review Report for Flood Control on Poso Creek Stream Group, California, November 1967
—Sacramento District, Corps of Engineers, Department of the Army

East Side Division, Initial Phase, Central Valley Project: A Report on the Feasibility of Water Supply Development, December 1965, rev. June 1966
—Region 2, Bureau of Reclamation, U.S. Department of the Interior

East Side Division, Initial Phase: Proposed Report of the Secretary of the Interior, September 1968
Comments of the State of California, August 1970

Conceptual Study for the Long Range Development of the Water Resources of the Kaweah River and Adjacent Streams, for the Southern San Joaquin Valley Flood Control and Water Conservation Association, June 1970
—Amalio Gomez, Consulting Civil Engineer

Success Project, Tule River, Reservoir Regulation Manual, June 1961, rev. August 1966
Terminus Project, Kaweah River, Reservoir Regulation Manual, June 1962, rev. February 1963
—Sacramento District, Corps of Engineers, Department of the Army

OTHER

Handbook of Federal and State Programs of Financial Assistance for Water Development, 1969
—California Legislature, Assembly Committee on Water, Carley V. Porter, Chairman

Report and General Soil Map, Tulare County, California, Unpublished report, October 1967
—Soil Conservation Service, U.S. Department of Agriculture

The Possibilities of the Permanent Reclamation of Tulare Lake Basin, California, January 10, 1907
—Engineering-News Record

2. Flood Damage Prevention Ordinance.

CHAPTER 27. FLOOD DAMAGE PREVENTION

ARTICLE 1. GENERAL PROVISIONS

7-27-1000 STATEMENT OF PURPOSE:

It is the purpose of this Chapter to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

(a) To protect human life and health;

(b) To minimize the need for rescue and relief efforts associated with flooding;

(c) To minimize potential property losses in special flood hazard areas;

(d) To minimize damage to public facilities and utilities located in areas of special flood hazard;

(e) To insure that potential buyers are notified that property is in an area of special flood hazard; and

(f) To insure that those who occupy the areas of special flood hazard assume responsibility for their actions.

7-27-1001 STATUTORY AUTHORIZATIONS:

The Legislature of the State of California has in Government Code Sections 65302, 65560, and 65800 conferred upon local government units authority to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the Board of Supervisors of the County of Tulare does hereby adopt the floodplain management regulations set forth in this Chapter.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1002 FINDINGS OF FACTS:

The flood hazard areas of the County of Tulare are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare. These flood losses are caused by uses that are inadequately elevated, floodproofed, or protected from flood damage. The cumulative effect of obstructions in areas of special flood hazards which increase flood heights and velocities also contribute to the flood loss.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1005 METHODS OF REDUCING FLOOD LOSSES:

In order to accomplish its purposes, this Chapter includes methods and provisions for:

(a) Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities.

(b) Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction.

(c) Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters.

(d) Controlling, filling, grading, dredging, and other development which may increase flood damage.

(e) Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

7-27-1010 DEFINITIONS:

Unless specifically defined below, words or phrases used in this Chapter shall be interpreted so as to give them the meaning they have in common usage and to give this Chapter its most reasonable application.

"ACCESSORY USE" means a use which is incidental and subordinate to the principal use of the parcel of land on which it is located.

"ALLUVIAL FAN" is an area subject to flooding when the floodplain is comprised of low flow channels where sediment accompanies the shallow flooding and the unstable soils scour and erode during a flooding event.

"APPEAL" means a request for a review of the Floodplain Administrator's interpretation of any provision of this Chapter.

"AREA OF SHALLOW FLOODING" is a designated Zone A, AO, A1-A30, AE, A99, or AH on the Flood Insurance Rate Map. In these zones, the base flood depths range from one to three feet; a clearly defined channel does not exist; the noticeable path of flooding is unpredictable and indeterminate; and noticeable velocity flow may be evident.

"AREA OF SPECIAL FLOOD HAZARD" has the same meaning as "SPECIAL FLOOD HAZARD AREA."

"BASE FLOOD" is the flood having a one percent chance of being equaled or exceeded any given year.

"BASEMENT" means any area of the building having its floor subgrade (below ground level on all sides).

"BREAKAWAY WALLS" are any types of walls, whether solid or lattice, and whether constructed of concrete, masonry, wood, metal, plastic or any other suitable building material which is not part of the structural support of the building and which is so designed as to break away under abnormal flood conditions without damage to the structural integrity of the building on which they are used or any building to which they might be carried by flood waters.

"BUILDING" has the same meaning as "Structure."

"BUILDING PERMIT" means a permit issued pursuant to Chapter 15 of Part VII of the Ordinance Code, including a mobile home installation permit.

"DEVELOPMENT" is any man-made change to improved or unimproved real estate (including filling, grading, paving, excavation, mining, dredging, storage of equipment or materials, or drilling operations) located within the area of special flood hazard.

"ENCROACHMENT" means the advance of infringement of uses, plant growth, fill, excavation, building, permanent structures or development into a floodplain which may impede or alter the flow capacity of a floodplain.

"EXISTING MANUFACTURED HOME PARK OR SUBDIVISION" means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by the County.

"EXPANSION TO AN EXISTING MANUFACTURED HOME PARK OR SUBDIVISION" means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

"FLOOD" OR "FLOODING" is a general and temporary condition of a partial or complete inundation of normally dry land areas from:

(a) The overflow of inland waters and/or

(b) The unusual and rapid accumulation of runoff of surface waters from any source.

"FLOOD BOUNDARY FLOODWAY MAP" is the official map on which the Federal Emergency Management Agency has delineated both the areas of flood hazards and the floodways.

"FLOOD HAZARD BOUNDARY MAP" means the official map on which the Federal Emergency Management Agency or Federal Insurance Administration has delineated the areas of flood hazards.

"FLOOD INSURANCE RATE MAP" or "FIRM" is the official map on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

"FLOOD INSURANCE STUDY" is the official report provided by the Federal Emergency Management Agency that includes flood profiles, the Flood Insurance Rate Map (FIRM), the Flood Boundary Floodway Map, and the water surface elevation of the base flood.

"FLOODPLAIN" OR "FLOOD-PRONE AREA" means any land area susceptible to being inundated by water from any source. Also see "Flood" or "Flooding."

"FLOODPLAIN ADMINISTRATOR" is the individual or individuals appointed to administer and/or enforce the floodplain management regulations. See Section 7-27-1095.

"FLOODPLAIN MANAGEMENT" means the operation of an overall program of the corrective and preventive measures for reducing flood damage and preserving and enhancing, where possible, natural resources in the floodplain, including but not limited to emergency preparedness plans, flood control works, floodplain management regulations, and open space plans.

"FLOODPLAIN MANAGEMENT REGULATIONS" means this chapter and other zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as grading and erosion control) and other applications of police power which control development in flood-prone areas. This term describes federal, state or local regulations in any combination thereof which provide standards for preventing and reducing flood loss and damage.

"FLOODPROOFING" means any combination of structural and non-structural additions, changes or adjustments to non-residential structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures, and their contents (Refer to FEMA Technical Bulletins TB 1-93, TB 3-93 and TB 7-93 for guidelines on dry and wet floodproofing).

"FLOOD-RELATED EROSION" is a condition that exists in conjunction with a flooding event that alters the composition of the bank of a watercourse and increases the possibility of loss due to the erosion of the land area adjacent to the watercourse.

"FLOODWAY" means the channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot. The floodway is delineated on the Flood Boundary Floodway Map, on maps adopted by the

State Reclamation Board when acting within its jurisdiction, and/or on the County Zoning Map (signified by the F-1 Primary Flood Plain Zone).

"FLOODWAY FRINGE" is that area of the floodplain on either side of the "regulatory floodway" where encroachment may be permitted.

"FRAUD AND VICTIMIZATION," as related to Section 7-27-1265 of this Chapter pertaining to variances, means that the variance granted must not cause fraud on or victimization of the public. In examining this requirement, the Governing Body will consider the fact that every newly constructed building adds to government responsibilities and remains a part of the community for fifty to one hundred years; that buildings that are permitted to be constructed below the base flood elevation are subject during all those years to increased risk of damage from floods, while future owners of the property and the community as a whole are subject to all the costs, inconvenience, damage and suffering that those increased flood damages bring; and that, in addition, future owners may purchase the property, unaware that it is subject to potential flood damage, and can be insured only at very high flood insurance rates.

"GOVERNING BODY" means the Board of Supervisors of the County of Tulare which is empowered to adopt and implement regulations to provide for the public health, safety and general welfare of its citizenry.

"HABITABLE FLOOR" means any floor usable for living purposes, which includes working, sleeping, eating or recreation, or a combination thereof. For flood insurance purposes, "Habitable floor" and "Lowest floor" will share the same definition.

"HARDSHIP" as related to Section 7-27-1265 of this Chapter pertaining to variances means the exceptional hardship that would result from a failure to grant the requested variance. The hardship justifying a variance must be exceptional, unusual, and peculiar to the property involved. Mere economic or financial hardship alone is not exceptional. Inconvenience, aesthetic considerations, physical handicaps, personal preferences, or the disapproval of one's neighbors likewise cannot as a rule qualify as an exceptional hardship. All of these problems can be resolved through other means without granting a variance, even if the alternative is more expensive, or requires the property owner to build elsewhere or put the parcel to a different use than originally intended.

"HIGHEST ADJACENT GRADE" means the highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

"HISTORIC STRUCTURE" means any structure that is:

(a) Listed individually in the National Register of Historic Places (a listing maintained by the Department of the Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(b) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;

(c) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(d) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either by an approved state program as determined by the Secretary of the Interior or directly by the Secretary of the Interior in states without approved programs.

"LEVEE" means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

"LEVEE SYSTEM" means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

"LOWEST FLOOR" means the lowest floor of the lowest enclosed area, including basement (see definition of "Basement"), as follows:

(a) An unfinished or flood resistant enclosure below the lowest floor that is useable for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor provided it conforms to applicable non-elevation design requirements including but not limited to:

(1) the wet floodproofing standard in Section 7-27-1180,

(2) the anchoring standards in Section 7-27-1170,

(3) the construction materials and methods standards in Section 7-27-1175,

(4) The standards for utilities in Section 7-27-1200.

(b) For residential structures, all the subgrade enclosed areas are prohibited as they are considered to be basements (see "Basement" definition). This prohibition includes below-grade garages and storage areas.

"MANUFACTURED HOME" means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for the use with or without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

"MANUFACTURED HOME PARK OR SUBDIVISION" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

"MARKET VALUE" shall be determined by estimating the cost to replace the structure in new condition and adjusting that cost figure by the amount of depreciation which has accrued since the structure was constructed. The cost of replacement of the structure shall be based on a square foot cost factor determined by reference to a building cost estimating guide recognized by the building construction industry. The amount of depreciation shall be determined by taking into account the age and physical deterioration of the structure and functional obsolescence as approved by the floodplain administrator, but shall not include economic or other forms of external obsolescence. Use of replacement costs or accrued depreciation factors different from those contained in recognized building cost estimating guides may be considered only if such factors are included in a report prepared by an independent professional appraiser and supported by a written explanation of the differences.

"MEAN SEA LEVEL" means, for purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's Flood Insurance Rate Map are referenced.

"MOBILE HOME" is a structure, including a manufactured home certified under the National Mobile Home Construction and Safety Standards Act of 1974, that is transportable in one or more sections, built on a permanent chassis, and designed to be used with or without a permanent foundation when connected to the required utilities. It does not include recreational vehicles or travel trailers placed on a site for less than 180 consecutive days, or factory-built housing on permanent slab foundation.

"NEW CONSTRUCTION" means structures for which the "start of construction" commenced on or after the effective date of this Chapter, and includes any subsequent improvements to such structures.

"NEW MANUFACTURED HOME PARK OR SUBDIVISION" means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of this Chapter.

"OBSTRUCTION" includes, but is not limited to, any dam, wall, wharf, embankment, levee, dike, pile, abutment, protection, excavation, channelization, bridge, conduit, building, wire, fence, rock, gravel, refuse, fill, structure, vegetation or other material in, along, across or projecting into any watercourse which may alter, impede, retard or change the direction and/or velocity of the flow of water, snare or collect debris carried by the flow of water, or is likely to be carried downstream.

"ONE-HUNDRED-YEAR FLOOD" or "100 YEAR FLOOD" has the same meaning as "BASE FLOOD."

"PUBLIC SAFETY AND NUISANCE" as related to Section 7-27-1265 of this Chapter pertaining to variances means that the granting of a variance must not result in anything which is injurious to safety or health of an entire community, neighborhood, or any considerable number of persons, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, river, bay, stream, canal, or basin.

"RECREATIONAL VEHICLE" means a vehicle which is:

(a) Built on a single chassis,

(b) Four hundred (400) square feet or less when measured at the largest horizontal projection,

(c) Designed to be self-propelled or permanently towable by a light-duty truck, and

(d) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

"REGULATORY FLOODWAY" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

"REMEDY A VIOLATION" means to bring the structure or other development into compliance with State or local floodplain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of this Chapter or otherwise deterring future similar violations, or reducing State or Federal financial exposure with regard to the structure or other development.

"RIVERINE" means relating to, formed by, or resembling a river (including tributaries), stream, brook, creek, or other similar watercourses.

"SHEET FLOW AREA" has the same meaning as "Area of shallow flooding."

"SPECIAL FLOOD HAZARD AREA" is the land in the floodplain subject to a one percent or greater chance of flooding in any given year. The area is designated as Zone A, AO, A1-A30, AE, A99, or AH on the FIRM.

"START OF CONSTRUCTION" includes substantial improvement and other proposed new development and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days from the date of the permit. The "actual start" means either the first placement of permanent construction of a structure on a site such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the installation of a mobile home to its permanent site. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the "actual start of construction" means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

"STRUCTURE" is a walled and roofed building or mobile home that is principally above ground; this includes a gas or liquid storage tank or a manufactured home.

"SUBSTANTIAL DAMAGE" means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

"SUBSTANTIAL IMPROVEMENT" means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either:

(a) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions; or

(b) Any alteration of a "historic structure"; provided, that the alteration will not preclude the structure's continued designation as a "historic structure."

"VARIANCE" means a grant of relief from the requirements of this Chapter which permits construction in a manner that would otherwise be prohibited by this Chapter.

"VIOLATION" means the failure of a structure or other development to be fully compliant with this Chapter. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in this Chapter is presumed to be in violation until such time as the documentation is provided.

"WATER SURFACE ELEVATION" means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929 (or other datum where specified), of floods of various magnitudes and frequencies in the floodplains of the coastal or riverine areas.

"WATERCOURSE" means a lake, river, creek, stream, wash, arroyo, channel or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

(Amended by Ord. No. 3212, effective 10-29-98; amended by Ord. No. 3425, effective 6-9-11; amended by Ord. No. 3436, effective 3-29-12)

7-27-1015 APPLICATION:

This Chapter shall apply to all areas of special flood hazards within the jurisdiction of the County of Tulare.

7-27-1020 BASIS FOR ESTABLISHING THE AREAS OF SPECIAL FLOOD HAZARD:

The areas of special flood hazard identified by the Federal Insurance Administration, through the Federal Emergency Management Agency in a scientific and engineering report entitled "The Flood Insurance Study for Tulare County, California," dated September 29, 1986, with an accompanying Flood Insurance Rate Maps and Flood Boundary and Floodway Maps, dated September 29, 1986, and all subsequent amendments and/or revisions, are hereby adopted by reference and declared to be a part of this Ordinance. The Flood Insurance Study is on file at the County Public Works Department.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1025 COMPLIANCE:

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this Chapter and other applicable regulations.

7-27-1030 ABROGATION AND GREATER RESTRICTIONS:

This Chapter is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this Chapter and another chapter, ordinance, easement, covenant, or deed restriction, conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

7-27-1035 INTERPRETATION:
In the interpretation and application of this Chapter, all provisions shall be:

(1) Considered as minimum requirements.

(2) Liberally construed in favor of the County of Tulare.

(3) Deemed neither to limit or repeal any other powers granted under state statutes.

7-27-1040 WARNING AND DISCLAIMER OF LIABILITY:
The degree of flood protection required by this Chapter is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man made or natural causes. This Chapter does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This Chapter shall not create liability on the part of the County of Tulare, any officer or employee thereof, or the Federal Emergency Management Agency, for any flood damages that result reliant on this Chapter or any administrative decision lawfully made thereunder.

7-27-1041 SEVERABILITY:
This Chapter and the various parts thereof are hereby declared to be severable. Should any section of this Chapter be declared by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the Chapter as a whole or any portion thereof, other than the section so declared to be unconstitutional or invalid.

(Amended by Ord. No. 3212, effective 10-29-98)

ARTICLE 3. ADMINISTRATION

7-27-1090 ESTABLISHMENT OF BUILDING PERMIT:
A Building Permit shall be obtained in accordance with Chapter 15 of this Part before construction or development is commenced within any area of special flood hazard established in section 7-27-1020 of this Chapter. In addition to the requirements of Chapter 15, an application for a Building Permit shall be made on forms furnished by the Planning and Development Director and may include, but not be limited to: plans in duplicate scale showing the nature, location, dimensions, and elevation of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing. Specifically, the following information is required:

(a) Site plan, including but not limited to:

(1) For all proposed structures, spot ground elevations at building corners and 20-foot or smaller intervals along the foundation footprint, or one foot contour elevations throughout the building site; and

(2) Proposed locations of water supply, sanitary sewer, and utilities; and

(3) If available, the base flood elevation from the Flood Insurance Study and/or Flood Insurance Rate Map: and

(4) If applicable, the location of the regulatory floodway; and

(b) Foundation design detail, including but not limited to:

(1) Proposed elevation in relation to mean sea level, of the lowest floor (including basement) of all structures; and

(2) For a crawl-space foundation, location and total net area of foundation openings as required in Section 7-27-1180 of this Chapter and FEMA Technical Bulletins TB1-93 and TB7-93; and

(3) For foundations placed on fill, the location and height of fill, and compaction requirements (compacted to 95 percent using the Standard Proctor Test method); and

(c) Proposed elevation in relation to mean sea level to which any nonresidential structure will be floodproofed, as required in Section 7-27-1180 of this Chapter and FEMA Technical Bulletin TB 3-93; and

(d) All appropriate certifications listed in Section 7-27-1180 of this Chapter; and

(e) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

7-27-1095 DESIGNATION OF RESPONSIBILITY:
The Planning and Development Director and Public Works Director are hereby appointed as Floodplain Administrators to jointly administer and implement this Chapter by granting or denying building permit applications in accordance with its provisions.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1100 JOINT DUTIES AND RESPONSIBILITIES:
The joint duties and responsibilities of the Planning and Development Director and Public Works Director shall include, but not be limited to:

(a) Development Review:

(1) Review of all building permits to determine that the permit requirements of this Chapter have been satisfied.

(2) Review of all other required state and federal permits have been obtained.

(3) Review of all permits to determine that the site is reasonably safe from flooding.

(4) Review of all building permits to determine if the proposed development adversely affects the flood carrying capacity of the area of special flood hazard. For purposes of this Chapter, "adversely affected" means that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point.

(5) Review of all proposals for the development of five (5) or more lots or dwelling units to assure that the flood discharge exiting the development after construction is equal to or less than the flood discharge at the location prior to development.

(b) Review Use and Develop Other Base Flood Data:

(1) When the base flood elevation data has not been provided in accordance with section 7-27-1020 (special flood hazard areas designated as Zone A on the FIRM), the Planning and Development Director and Public Works Director shall obtain, review, and reasonably utilize the best base flood data available from any source (federal, state, or other) such as: high water mark(s), floods of record, or private engineering reports, in order to administer Article 5 of this Chapter and provide the developer with an estimated base flood elevation.

(2) If no base flood elevation data is available from a federal or state or other source, then a base flood elevation shall be obtained using one of two methods from the FEMA publication "Managing Floodplain Development in Approximate Zone A Areas—A Guide for obtaining and developing Base (100 year) Flood Elevations" dated July 1995 in order to administer Article 5:

(A) Simplified method.

(i) 100 year or base flood discharge shall be obtained using the appropriate regression equation found in a U.S. Geological Survey publication, or the discharge-drainage area method; and

(ii) Base flood elevation shall be obtained using the Quick-2 computer program developed by FEMA; or

(B) Detailed method. The 100 year or base flood discharge and the base flood elevation shall be obtained using detailed methods identified in FEMA Publication 265, published in July 1995 and titled: "Managing Floodplain Development in Approximate Zone A Areas—A Guide for obtaining and developing Base (100 year) Flood Elevation."

(C) Documentation of Floodplain Development. Obtain and maintain for public inspection and make available as needed the following:

(i) Certification required by Section 7-27-1180 and Section 7-27-1210 (lowest floor elevations).

(D) Map Determinations. Make interpretations, where needed, as to the exact location of the boundaries of the special flood hazard. Where there appears to be a conflict between a mapped boundary and actual field conditions, grade and base flood elevations shall be used to determine the boundaries of the special flood hazard area. The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in Section 7-27-1315.

(E) Remedial Action. Take action to remedy violation of this Chapter as specified in Section 7-27-1025.

(c) Notification of other agencies:

(1) Alteration or relocation of a watercourse:

(A) Notify adjacent communities and the California Department of Water Resources prior to alteration or relocation;

(B) Submit evidence of such notification to the Federal Emergency Management Agency; and

(C) Assure that the flood carrying capacity within the altered or relocated portion of said watercourse is maintained.

(2) Base Flood Elevation changes due to physical alterations:

(A) Within 6 months of information becoming available or project completion, whichever comes first, the floodplain administrator shall submit or assure that the permit applicant submits technical or scientific data to FEMA for a Letter of Map Revision (LOMR).

(B) All LOMRs for flood control projects are approved prior to the issuance of building permits. Building Permits must not be issued based on Conditional Letters of Map Revision (CLOMRs). Approved CLOMRs allow construction of the proposed flood control project and land preparation as specified in the "start of construction" definition.

Such submissions are necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements are based on current data.

(3) Changes in corporate boundaries: Notify FEMA in writing whenever the corporate boundaries have been modified by annexation or other means and include a copy of a map of the community clearly delineating the new corporate limits.

(Amended by Ord. No. 3212, effective 10-29-98; amended by Ord. No. 3425, effective 6-9-11; amended by Ord. No. 3436, effective 3-29-12)

7-27-1105 DUTIES AND RESPONSIBILITIES OF THE PLANNING AND DEVELOPMENT DIRECTOR:
The duties and responsibilities of the Planning and Development Director shall include, but not be limited to:

(a) Referral and inspection:

(1) Refer all building permits for property located within special flood hazard areas to the Public Works Director for review prior to approval.

(2) Inspect all construction, including installation of mobilehomes, to insure compliance with the requirements of this Chapter.

(b) Information to be Obtained and Maintained: Obtain and maintain for public inspection and make available as needed for flood insurance policies:

(1) The certified elevation required in section 7-27-1180(a); (residential)

(2) The certification required in section 7-27-1180(b); (shallow flooding)

(3) The certification required in section 7-27-1180(c); (Zone A)

(4) The floodproofing certification required in section 7-27-1180(d); (non residential)

(5) The certified elevation required in section 7-01-2035; (subdivision) and

(6) The anchoring and compliance certification required in section 7-27-1210(b) and (d) (mobile-home).

(c) FEMA Reports:

Upon request by the Federal Emergency Management Agency (FEMA), prepare and submit reports to FEMA concerning the County's participation in the National Flood Insurance Program.

7-27-1110 DUTIES AND RESPONSIBILITIES OF THE PUBLIC WORKS DIRECTOR:
The duties and responsibilities of the Public Works Director in his capacity as Engineer to the Tulare County Flood Control District shall include, but not be limited to:

(a) Alteration of Watercourses: Notify adjacent cities and counties and the California Department of Water Resources prior to any alteration or relocation of a watercourse, submit evidence of such notification to the Federal Emergency Management Agency (FEMA), and assure that the flood carrying capacity within the altered or relocated portion of said watercourse is maintained.

(b) Interpretation of Flood Insurance Rate Map (FIRM) Boundaries: Provide interpretations, where needed, as to the exact location of the boundaries of the areas of special flood hazards. Where there appears to be a conflict between a mapped boundary and actual field conditions, the applicant may file for a "Letter of Map Amendment" (LOMA) in accordance with the National Flood Insurance Program. The LOMA may be filed with the Public Works Director for transmittal to FEMA in the manner provided by law.

(Amended by Ord. No. 3425, effective 6-9-11)

7-27-1115 FLOOD CONTROL MASTER PLAN:
The Board of Supervisors, Planning Commission, Site Plan Review Committee and Zoning Administrator shall weigh all requests for future floodplain development against the Flood Control Master Plan of the Tulare County Control District. Consideration of the following elements are required before approval:

(1) Determination of whether or not a proposed development is in or affects a known flood plain.

(2) Inform the public of the proposed activity.

(3) Determine if there is a practicable alternative or site for the proposed activity.

(4) Identify the impact of the activity on the flood plain.

(5) Provide a plan to mitigate the impact of the activity in accordance with the provisions in section 7-27-1100 (a)(4).

ARTICLE 5. PROVISIONS FOR FLOOD HAZARD REDUCTION

7-27-1165 STANDARDS OF CONSTRUCTION:
In all areas of special flood hazard shown on the FIRM, the standards set forth in this Article shall be required.

7-27-1170 ANCHORING:
(a) All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure.

(b) All mobilehomes shall meet the anchoring standards of section 7-27-1210(a).

7-27-1175 CONSTRUCTION MATERIALS AND METHODS:
(a) All new construction and substantial improvements shall be constructed with flood resistant materials as specified in FEMA Technical Bulletin TB 2-93, and utility equipment resistant to flood damage.

(b) All new construction and substantial improvement shall use methods and practices that minimize flood damage.

(c) All elements that function as a part of the structure, such as furnace, hot water heater, air conditioner, etc., shall be elevated to or above the base flood elevation or depth number specified on the Flood Insurance Rate Map (FIRM).

(d) If within Zones AH or AO, so that there are adequate drainage paths around structures on slopes to guide floodwaters around and away from proposed structures.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1180 ELEVATION AND FLOODPROOFING:
(a) New construction and substantial improvement of any structure shall have the bottom of the lowest floor, including basement, elevated to or above the base flood elevation. Nonresidential structures may meet the optional standards in paragraph (d) of this Section. Prior to issuance of the occupancy permit or certificate, the elevation of the lowest floor, including the basement, shall be certified by a registered civil engineer or land surveyor that the elevation requirements have been met and verified by the County Surveyor. Notification of compliance shall be recorded as set forth in Section 7-27-1105(b).

(b) New construction and substantial improvement of any structure in Zone AO shall have the bottom of the lowest floor, including basement, elevated to or above the depth number specified on the Flood Insurance Rate Map (FIRM) as measured from the highest adjacent grade. Nonresidential structures may meet the optional standards in paragraph (d) of this Section. Prior to issuing the occupancy permit, compliance with the elevation requirement shall be certified by a registered civil engineer or land surveyor and verified by the County Surveyor. Notification of compliance shall be recorded as set forth in Section 7-27-1105(b).

(c) If no base flood elevation or depth number is provided on the FIRM (Zone A), any new construction or substantial improvement of any structure shall have the bottom of the lowest floor, including basement, elevated to:

(1) Said base flood elevation shall be determined by one of the methods in Section 7-27-1100 (b); or

(2) If the Planning and Development Director and Public Works Director determine that it is unreasonable to determine the base flood elevation pursuant to Section 7-27-1100(b) then the Planning and Development

Director and Public Works Director may require that any new construction or substantial improvement of any structure shall have the bottom of the lowest floor, including basement, elevated to:

(A) A height of at least two feet above the highest adjacent grade, or

(B) Eighteen (18) inches above the top of the curb across the front of the lot.

Nonresidential structures may meet the optional standards set forth in paragraph (d) of this section. Prior to issuing the occupancy permit, compliance with the elevation requirement shall be certified by a registered civil engineer or land surveyor, and verified by the County Surveyor. Notification of compliance shall be recorded as set forth in Section 7-27-1105(b).

(d) Nonresidential construction shall either be elevated in conformance with paragraph (a), (b) or (c) of this section or together with attendant utility and sanitary facilities, be floodproofed to the base flood elevation by one or more of the following:

(1) Installation of watertight doors, bulkheads, and shutters.

(2) Reinforcement of walls to resist water pressure.

(3) Use of paints, membrane, or mortars to reduce seepage through walls.

(4) Addition of mass or weight to structure to resist flotation.

(5) Armour protection of all fill materials from scour and/or erosion.

Certification by a registered civil engineer or architect that the standards of this paragraph are satisfied shall be provided to the Planning and Development Director as set forth in section 7-27-1105(b).

(e) Flood openings. All new construction and substantial improvements of structures with fully enclosed areas below the lowest floor (excluding basements) that are usable solely for parking of vehicles, building access or storage, and which are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwater. Designs for meeting this requirement shall follow the guidelines in FEMA Technical Bulletins TB 1-93 and TB 7-93, and must meet the following minimum criteria:

(1) For non-engineered openings:

(A) Have a minimum of two openings on different sides having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding;

(B) The bottom of all openings shall be no higher than one foot above grade;

(C) Openings may be equipped with screens, louvers, valves or other coverings or devices; provided, that they permit the automatic entry and exit of flood water; and

(D) Buildings with more than one enclosed area must have openings on exterior walls for each area to allow flood water to directly enter; or

(2) Be certified by a registered civil engineer or architect.

(Amended by Ord. No. 3212, effective 10-29-98; amended by Ord. No. 3425, effective 6-9-11; amended by Ord. No. 3436, effective 3-29-12)

7-27-1185 STANDARDS FOR ELEVATION CERTIFICATES:

(a) Certification of the elevation of the lowest floor or floodproofed elevation is required at that point where the footings are set and slab poured. Failure to submit an elevation certification shall be cause to issue a stop-work order for the project. As built plans certifying the elevation of the lowest adjacent grades is also required.

(b) Except within zones A and AO, the benches that are shown on the FIRM shall be used in calculating the elevation of the lowest floor.

(c) If fill is used to elevate a structure above the base flood elevation, the permit holder may apply for a Letter of Map Amendment (LOMA), as set forth in section 7-27-1110(b).

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1190 STANDARDS FOR ALLUVIAL FANS:

Areas subject to alluvial fan flooding have irregular flow paths that result in erosion of existing channels and the undermining of fill material. Those areas are identified on the Flood Insurance Rate Map (FIRM) as AO Zones with velocities.

(a) All structures must be securely anchored to minimize the impact of the flood and sediment damage.

(b) All new construction and substantial improvements must be elevated on pilings, columns, or armoured fill so that the bottom lowest floor beam is elevated at or above the depth number.

(c) Use of all fill materials must be armoured to protect the material from the velocity of the flood flow.

(d) All proposals for subdivision development must provide a mitigation plan that identifies the engineering methods used to:

(1) Protect structures from erosion and scour caused by the velocity of the flood flow.

(2) Capture or transport flood and sediment flow through the subdivision to a safe point of disposition.

(e) All mobilehomes shall be prohibited within the identified hazard area except within existing mobilehome parks or subdivisions.

7-27-1195 STANDARDS FOR STORAGE OF MATERIALS AND EQUIPMENT:

(a) The storage or processing of materials that are, in time of flooding, buoyant, flammable, explosive, or could be injurious to human, animal, or plant life, is prohibited.

(b) Storage of other materials or equipment may be allowed if not subject to major damage by floods and firmly anchored to prevent flotation or if readily removable from the area within the time available after flood warning.

7-27-1200 STANDARDS FOR UTILITIES:

(a) All new and replacement water supply and sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from systems into flood waters

(b) On site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

7-27-1205 STANDARDS FOR SUBDIVISIONS:

(a) All new subdivision proposals and other proposed development, including proposals for manufactured home parks and subdivisions, greater than 50 lots or 5 acres, whichever is the lesser, shall:

(1) Identify the Special Flood Hazard Areas (SFHA) and Base Flood Elevations (BFE).

(2) Identify the elevations of lowest floors of all proposed structures and pads on the final plans.

(3) If the site is filled above the base flood elevation, the following as-built information for each structure shall be certified by a registered civil engineer or licensed land surveyor and provided as part of an application for a Letter of Map Revision based on Fill (LOMR-F) to the Floodplain Administrator:

(A) Lowest floor elevation.

(B) Pad elevation.

(C) Lowest adjacent grade.

(b) All subdivision proposals and other proposed development shall be consistent with the need to minimize flood damage.

(c) All subdivision proposals and other proposed development shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.

(d) All subdivisions and other proposed development shall provide adequate drainage to reduce exposure to flood hazards.

(Amended by Ord. No. 3425, effective 6-9-11)

7-27-1210 STANDARDS FOR MOBILEHOMES AND MOBILEHOME PARKS AND SUBDIVISIONS:

(a) All new mobilehomes and additions to mobilehomes shall be anchored to resist flotation, collapse, or lateral movement by at least one of the following methods:

(1) By providing an anchoring system designed to withstand horizontal forces of 15 pounds per square foot and uplift forces of 9 pounds per square foot; or

(2) By the anchoring of the unit's system, designed to be in compliance to the Department of Housing and Urban Development Mobilehome Construction and Safety Standards: or

(3) By bolting the frame or undercarriage to a reinforced, permanent foundation such as a retaining wall or storm wall used to set the unit.

As set forth in section 7-27-1105(b), certification meeting the standards above is required of the installer or state agency responsible for regulating the placement, installation, and anchoring of individual mobilehome units.

(b) The following standards shall be required for mobilehomes not placed in mobilehome parks or subdivisions, new mobilehome parks or subdivisions, expansions to existing mobilehome parks or subdivisions, and repair, reconstruction, or improvements to existing mobilehome parks or subdivisions that equals or exceeds 50 percent of the value of the streets, utilities, and pads before the repair, reconstruction or improvement commences:

(1) Adequate surface drainage and access for a hauler shall be provided.

(2) All mobilehomes shall be placed on pads or lots elevated on compacted fill or on pilings so that the lowest floor of the mobilehome is at or above the base flood level. If elevated on pilings:

(i) The lots shall be large enough to permit steps.

(ii) The pilings shall be placed in stable soil no more than ten (10) feet apart.

(iii) Reinforcement shall be provided for pilings more than six (6) feet above ground level.

(c) Certification of compliance is required of the developer responsible for the plan or state agency responsible for regulating mobilehome placement.

(d) Upon the completion of the structure, the elevation of the lowest floor including basement shall be certified by a registered professional engineer or surveyor, and verified by the community building inspector to be properly elevated. Such certification and verification shall be provided to the Floodplain Administrator.

7-27-1211 STANDARDS FOR RECREATIONAL VEHICLES:

All recreational vehicles placed on sites within Zones A1-30, AH, and AE on the community's Flood Insurance Rate Map will either:

(a) Be on the site for fewer than 180 consecutive days, and be fully licensed and ready for highway use a recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the sit only by quick disconnect type utilities and security devices, and has no permanently attached additions, or

(b) Meet the permit requirements of Article 3 of this Chapter and the elevation and anchoring requirements for manufactured homes in Section 7-27-1210.

(Added by Ord. No. 3212, effective 10-29-98)

7-27-1215 FLOODWAYS:

Areas designated as floodways are located within areas of special flood hazard established in section 7-27-1020. Since the floodway is an extremely hazardous area due to the flood velocity of floodwaters which carry debris, potential projectiles, and erosion potential, the following provisions apply:

(a) Prohibit encroachments, including fill, new construction, substantial improvements, and other development, unless certification by a registered civil engineer is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

(b) Until a regulatory floodway is adopted, no new construction, substantial development, or other development (including fill) shall be permitted within Zones A1–30 and AE, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other development, will not increase the water surface elevation of the base flood more than 1 foot at any point.

(c) No mobilehome shall be placed in a floodway, except in an existing mobilehome park or existing mobilehome subdivision.

(d) The requirements of section 14.7 of the County Zoning Ordinance (Ordinance No. 352 as amended) shall also be applicable at such time that the County Zoning Map is amended to apply F I zoning within the floodway.

(Amended by Ord. No. 3425, effective 6-9-11)

ARTICLE 7. VARIANCES

7-27-1265 VARIANCES: AUTHORITY TO ACT:

If practical difficulties, unnecessary hardships or results inconsistent with the general purpose of this Chapter result through the strict interpretation and enforcement of this Chapter, then the Zoning Administrator shall have the authority to grant a variance from the provisions of this Chapter such as may be in harmony with its general purpose and intent, so that the spirit of this Chapter shall be observed, public safety and welfare served and substantial justice done.

7-27-1270 APPLICATIONS FOR VARIANCES: FEES:

(a) The Zoning Administrator shall grant a variance under the provisions of this Article only upon the filing of a written application therefore by the owner of the real property affected or his or her authorized agent. The Resources Management Agency Director shall prescribe the form of application for such variances.

(b) Unless otherwise provided, the Board of Supervisors shall adopt, from time to time by resolution, a schedule of fees to be paid by applicants with each application for a variance to defray the expenses incidental to the proceedings. No part of said fee shall be returned to the applicant if he or she subsequently withdraws the application, except in accordance with Section 130 of this Ordinance Code.

(c) An additional fee in the amount of Ten Dollars ($10.00) shall be collected for each variance application to defray the expenses incidental to maintaining and enhancing the automated permit processing equipment and software utilized in the Planning and Development Department for processing of planning and building permits and certificates.

(d) Unless otherwise provided herein, whenever there is a joint filing of multiple applications and the applicant consents to the consolidated processing of those applications, the applicable filing fees shall be reduced by twenty-five percent (25%). As used here in, the term "multiple applications" shall consist of two (2) or more applications for changes of zone, special use permits (including amendments thereto), variances, planned unit developments and planned developments, tentative subdivision maps, tentative parcel maps (including vesting maps), building line setback variances, flood variances, and surface mining permits and reclamation plans (including amendments thereto) which pertain to the same project.

(Amended by Ord. No. 3184, effective 6-7-97.) (Amended by Ord. No. 3262, effective 10-2-01)

7-27-1275 PROCEDURE FOR PROCESSING VARIANCES:

(a) Before acting on a variance the Zoning Administrator shall hold at least one (1) public hearing. Notice of such public hearing shall be given by publishing a notice of such hearing setting forth the time and place of the hearing and the nature of the variance requested, in a newspaper of general circulation published in the County, once, not less than ten (10) days prior to the date of such public hearing, and by mailing a copy of the notice of said hearing, not less than ten (10) days prior to the date of such public hearing, to the following persons or agencies:

(1) The applicant.

(2) County Flood Control Engineer.

(3) County Public Works Director.

(4) Supervisor of the Supervisorial District in which the property is located.

(5) State Reclamation Board.

(6) All owners of real property as shown on the latest equalized assessment roll within 300 feet of the real property which is the subject of the variance.

(b) The decision of the Zoning Administrator shall be in writing and shall include findings of facts relied on in making the decision.

(c) A copy of the decision of the Zoning Administrator shall be publicly posted at or near the door of the Planning and Development Department for a period of one (1) week following the making thereof. Not more than two (2) days after making the decision on the application, the Zoning Administrator shall cause a copy of the decision to be mailed to the applicant, to the Board of Supervisors, and to any other person who has expressed an interest therein and has deposited with the Zoning Administrator a self addressed, stamped envelope for that purpose. Failure to mail or to receive such notice, as a result of mistake or inadvertence, shall not affect the validity of the decision.

7-27-1280 VARIANCES: FACTORS TO CONSIDER:

(a) In passing upon such applications, the Zoning Administrator shall consider all technical evaluations and all relevant factors and standards specified in this Chapter, and:

(1) The danger that materials may be swept onto other lands to the injury of others.

(2) The danger to life and property due to flooding or erosion damage.

(3) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner.

(4) The importance of the services provided by the proposed facility to the County.

(5) The necessity to the facility of a waterfront location, where applicable.

(6) The availability of alternative locations for the proposed uses that are not subject to flooding or erosion damage.

(7) The compatibility of the proposed use with existing and anticipated development.

(8) The relationship of the proposed use to the County General Plan and the floodplain management program for that area.

(9) The safety of access to the property in times of flood for ordinary and emergency vehicles.

(10) The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site.

(11) The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water systems, and streets and bridges.

(b) Any applicant to whom a variance is granted shall be given written notice over the signature of the Zoning Administrator that:

(1) The issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as $24 for $100 of insurance coverage; and

(2) Such construction below the base flood level increases risks to life and property.

(Amended by Ord. No. 3212, effective 10-29-98)

7-27-1285 VARIANCES: PRIOR CONSENT:

No variance which is subject to the provisions of section 8414.2 of the California Water Code shall be approved without the prior written consent of the Department of Water Resources or State Reclamation Board and of the Engineer for the County Flood Control District.

7-27-1290 VARIANCES: LOT SIZE CONSIDERATIONS:

Generally, variances may be approved for new construction and substantial improvements to be erected on a lot of one half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, provided the factors set forth in section 7-27-1280 have been fully considered. As the lot size increases beyond one half acre, the technical justification required for issuing the variance increases.

7-27-1295 VARIANCES: AUTHORITY TO IMPOSE CONDITIONS:

Upon consideration of the factors set forth in section 7-27-1280 and the purposes of this Chapter, the Zoning Administrator may attach such conditions to the granting of variances as he or she deems necessary to further the purpose of this Chapter.

7-27-1300 VARIANCES: CONDITIONS:

(a) Variances may be granted for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this section.

(b) Variances shall not be granted within any floodway if any increase in flood levels during the base flood discharge would result.

(c) Variances shall only be granted upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

(d) Variances shall only be granted upon:

(1) A showing of good and sufficient cause such as renovation, rehabilitation, or reconstruction. Variances for reasons of economic considerations, aesthetics, or because variances have been used in past shall not be considered good and sufficient cause.

(2) A determination that failure to grant the variance would result in exceptional hardship to the applicant.

(3) A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization to the public, or conflict with existing County ordinances.

(e) Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest flood elevation below the base flood elevation and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation.

7-27-1305 USE PERMIT:
Notwithstanding the provisions of section 7-27-1265, no variance shall be required under this Article if the proposed construction or substantial improvements have been approved in accordance with the use permit requirements set forth in section 14.7 of the County Zoning Ordinance (Ordinance No. 352, as amended).

7-27-1310 REVOCATIONS:
Any variance which is granted subject to conditions may be revoked by the Zoning Administrator if any of the conditions are violated. The same procedures shall be followed for revocation of a variance as are followed for granting a variance, including the appeal procedures, except that notice of the public hearing by the Zoning Administrator on revocation need not be published in a newspaper.

7-27-1315 APPEALS:
(a) Except as herein provided, all appeals regarding decisions on variances shall be subject to the provisions of section 165 of this Ordinance Code.

(b) Any person adversely affected by a decision of the Zoning Administrator on the variance may appeal the decision to the Board of Supervisors. An appeal to the Board of Supervisors shall be in writing and filed with the Clerk of the Board of Supervisors within ten (10) days after the date on which the decision of the Zoning Administrator was made. An appeal shall specifically set forth the grounds for the appeal. In addition to the notice requirement of section 165 of this Ordinance Code, the Board shall give notice of the appeal hearing to the persons and agencies named in section 7-27-1275 of this Article for giving notice by the Zoning Administrator.

(c) At the time of filing the appeal, the appellant shall pay a fee of One Hundred and Fifty Dollars ($150) to the Planning and Development Director to defray the expenses incidental to the proceedings.

7-27-1320 RECORDS:
The Planning and Development Director as Floodplain Administrator shall maintain a record of all variance actions, including justification for their issuance and any appeal actions, and report any variances issued in its biennial report submitted to the Federal Insurance Administration of the Federal Emergency Management Agency.

(Amended by Ord. No. 3212, effective 10-29-98)

ARTICLE 9. NUISANCE, VIOLATIONS

7-27-1370 NUISANCE:
Any building, structure, substantial improvement, or other installation which is subject to this Chapter and which is not in full compliance with the requirements of this Chapter shall constitute a public nuisance.

7-27-1375 VIOLATIONS:
Any person violating any of the provisions of this Chapter which are declared to be unlawful shall be guilty of an infraction and shall be punishable as provided in section 125 of this Ordinance Code. Each such person shall be

deemed guilty of a separate offense for each and every day, or portion thereof, during which any violation of any such provision of this Chapter is committed, permitted or continued by such person, and shall be punishable therefore as provided hereinabove.

3. FEMA/FIRM Summary (Zones, Descriptions, Flood Risk, Encroachment, and Mitigation).

Definitions of FEMA Flood Zone Designations

Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

Moderate to Low Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

ZONE	DESCRIPTION See Note 1 Page 2
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.

High Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

ZONE	DESCRIPTION See Note 2 Page 2
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

High Risk - Coastal Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones.

ZONE	DESCRIPTION	**Tulare County does not have these zones.**
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.	
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	

Undetermined Risk Areas

ZONE	DESCRIPTION	**Tulare County does not have this zone.**
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.	

From FEMA Map Service Center:
http://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA%20Flood%20Zone%20Designations

NOTES:

1 Construction in these zones do not require any mitigation measures; however, structures in a shaded X zone are recommended to be elevated one foot above natural ground. Elevation certificates not required unless property owner wishes to use them for insurance rating purposes; for example, a preferred risk policy.

2 Construction in these zones require mitigation measures. Elevation certificates are required on all new structures/buildings being constructed. In Zone A, Tulare County Ordinance Code Section 7-27-1180 applies. All buildings/structures must be elevated to at least two (2) feet above the highest natural ground elevation on the site. There are some alternatives to this and are presented in said code; although not usually employed. According to 44 CFR 60.3 (b)(3), the NFIP participating community must require all new developments in an unnumbered A zone greater than 50 lots or 5 acres, whichever is the lesser, to include the development of a base flood elevation. A flood study prepared by a civil engineer will likely be required on such developments (special use permit, parcel map, building permit are examples).

In the other A zones, base flood elevations or depths are given on the FIRM panels and all new structures/ buildings are required to be elevated to those elevations. An elevation certificate is required to verify FEMA compliance.

Riverine floodplains are comprised of the floodway and the flood fringe. The floodway is comprised of the channel and adjacent overbank areas necessary to effectively convey floodwaters. The flood fringe are lands outside the floodway that are at or below the BFE that store, but do not effectively convey, floodwaters. Lands that compose the flood fringe will be inundated during a 1% chance flood event but, due to physical characteristics of the floodplain, do not effectively convey floodwaters. The floodway and the Base Flood Elevation (BFE) of the 1% chance flood are determined using hydraulic modeling techniques.

FEMA regulatory floodway limits:
FEMA's regulations (Section 9.4) state: "Floodway means that portion of the floodplain which is effective in carrying flow, within which this carrying capacity must be preserved and where the flood hazard is generally highest, i.e.,where water depths and velocities are the greatest. It is that area which provides for the discharge of the base flood so the cumulative increase in water surface elevation is no more than one foot."

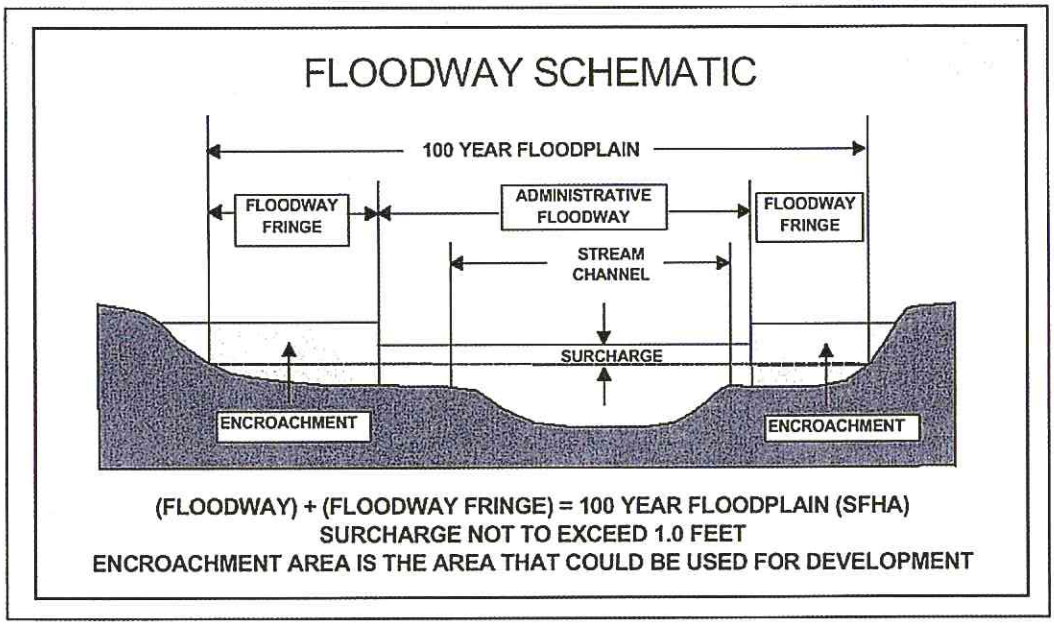
FEMA's Procedures for "No-Rise" Certificates:
Section 60.3 (d) (3) states Communities shall prohibit encroachments, fill, new development, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses that the proposed encroachment would not result in any increase in flood levels within the community of the base flood (100-year) discharge.

Floodway Encroachments

The floodway is the channel of a river or stream and the overbank areas that must remain open to carry the deeper, faster moving water during a flood. If the remainder of the floodplain, called the floodplain fringe, is completely obstructed, the 100-year flood elevation would not increase more than one foot. The regulatory floodway may be shown on the Flood Insurance Rate Map or on a separate Flood Boundary and Floodway Map. Because floodway boundaries are delineated using computer modeling, they often do not correspond to any features visible at the site.

Why Is the Floodway Different than Other Floodplain Areas?

A basic principle of floodplain management is that ***development must not increase the flood hazard on other properties.*** "Floodways" are areas where fill or other development is likely to divert flow and contribute to increased water depths during a flood. Floodways may also be subject to high velocities, which can cause severe damage to structures and high risks for occupants and emergency responders. ***Ideally, floodways should be undeveloped areas that can accommodate flood flows with minimal risk.*** Any new development in the floodway generally requires an engineering analysis of the impact on flood hazards.



What Is Meant by Encroachment?

An "encroachment" is any floodplain development that could obstruct flood flows, such as fill, a bridge, or a building. A driveway, road, or parking lot at grade (without any filling) would not cause an obstruction. Development of lakeshore floodplains, where there is no flow, is not considered an encroachment.

How Are Floodplain Encroachments Regulated?

The development standards for a floodplain encroachment depend on both the project location and the amount of information provided on flood hazard maps:

- Floodplain fringe: The modeling used to establish floodway boundaries indicated that any encroachment or obstruction in the fringe area (outside the floodway) would not result in a "significant" increase in flood levels (i.e. no more than one foot), so no encroachment analysis is required.
- Floodway: ***No new development is permitted within the regulatory floodway unless a licensed professional engineer demonstrates that the proposed encroachment shall not result in any rise in the 100-year flood elevation.*** This no-rise requirement is in addition to all other floodplain development standards applicable to the proposed project.

- Riverine floodplain with base flood elevations, but no floodway: When the flood hazard map designates base flood elevations (100-year flood heights) but no floodway is delineated, the applicant must demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated floodplain development, would not increase the water surface elevation of the 100-year flood more than one foot at any location.
- Approximate A Zones: When floodplain boundaries were established using approximate techniques (which produce neither floodways nor base flood elevations), the municipality may require an analysis to demonstrate that the project would not result in physical damage to any other property.

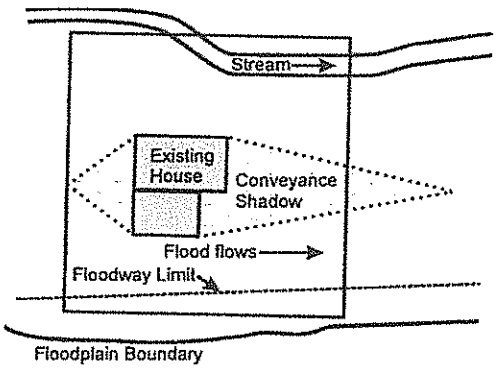
Are There Exceptions to the Encroachment Requirements?

Federal standards do not allow communities to issue variances for development within the floodway that would result in increased flood levels. However, there are some situations (such as dams, bridges, or roads) in which a project in the floodway may be justifiable even though it would cause a rise in the flood elevation. This necessitates that the flood hazard map be changed to reflect the new hazard. The applicant must apply to the Federal Emergency Management Agency (FEMA) for (1) a conditional map revision before the development occurs and (2) a final letter of map revision after the development has been completed.[1]

No-Rise Certification for Floodway Encroachments

Any proposed encroachment in the floodway requires a technical evaluation by a licensed professional engineer to demonstrate that the project will not affect flood heights. The results of this analysis must be maintained in the municipality's permit file. This can be in the form of a No-Rise Certification supported by technical data and signed by a registered professional engineer. The supporting technical data should be based on the standard step-backwater computer model used to develop the floodway shown on the flood hazard map. Hydraulic modeling of the pre-project and post-project conditions should demonstrate that the change in the 100-year flood height is 0.00 feet.

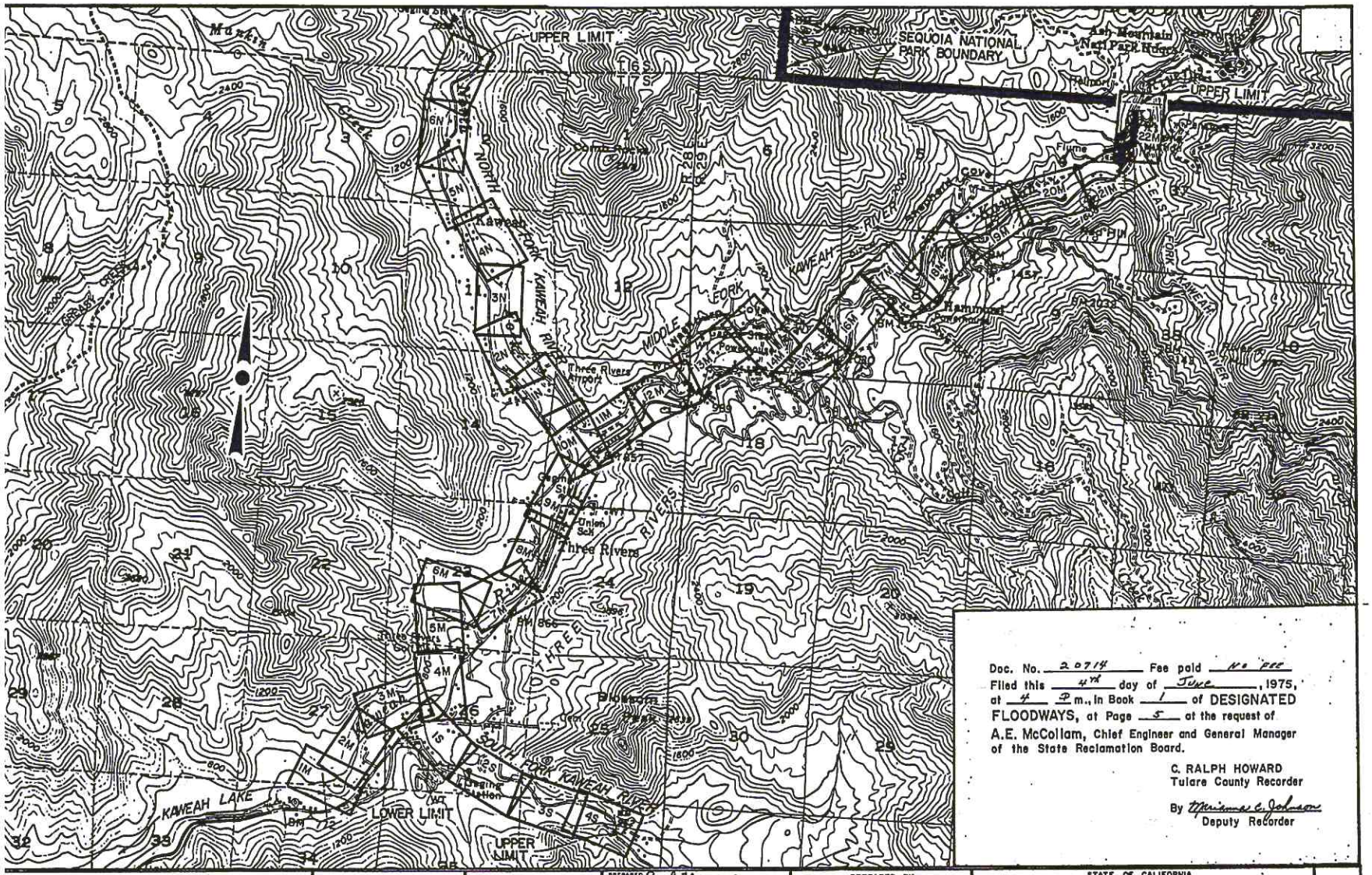
A detailed surface water profile analysis may not be necessary for a small project located completely within the "conveyance shadow" of an existing obstruction (because flood water is already flowing around the larger obstruction). The limits of this conveyance shadow can be determined as illustrated. However, an engineer must still certify that the floodway encroachment would not cause any rise in the flood elevation.



Additional Resources

- *Floodplain Development and Floodway Guidance*, prepared by the NYS Department of Environmental Conservation, available at http://www.dec.ny.gov/lands/24281.html, provides guidance on meeting the "no-rise" and "no adverse effect" criteria using hydraulic modeling techniques.
- *Procedures for Compliance with Floodway Regulations*, Floodplain Management Information Series Special Report; prepared by U.S. Army Corps of Engineers, Federal Emergency Management Agency, and Pennsylvania Department of Community Affairs (1990); available at http://www.nh.gov/oep/programs/floodplainmanagement/regulations/documents/floodway_regulations.pdf; describes the analyses needed to document floodway impacts and procedures for requesting floodway revisions.

[1] The MT-2 Form for floodplain map revisions that show changes to flood elevations is available at http://www.fema.gov/plan/prevent/fhm/dl_mt-2.shtm.



Doc. No. 20714 Fee paid No Fee
Filed this 4th day of June, 1975,
at 4 P m., in Book 1 of DESIGNATED
FLOODWAYS, at Page 5 at the request of
A.E. McCollam, Chief Engineer and General Manager
of the State Reclamation Board.

C. RALPH HOWARD
Tulare County Recorder

By Miriam C. Johnson
Deputy Recorder

chments within the designated floodway, as defined in the Rules and Regulations
ilistration of Designated Floodways and Floodway Encroachment Lines, must be
by The Reclamation Board before they will be permitted
ation forms for encroachment permits can be obtained from the Department of Public
lood Control District, 336 North Ben Maddox Way, Visalia, California or The
lon Board in Sacramento, California
thority to control floodways is vested in The Reclamation Board by Division 5,
f the California Water Code Procedures to administer the Designated Floodway
rth in Title 23, California Administrative Code, Sections 45 through 95

SCALE: APPROX 1" = 2000'
0 2000 4000

PREPARED: Paul Flanagan
PAUL FLANAGAN C.E. 15229
APPROVAL RECOMMENDED:
CARL R KING C.E. 9373
CHIEF-FLOOD CONTROL DEVELOPMENT BRANCH DWR
APPROVED: DATE:
A.E. McCOLLAM C.E. 17277
CHIEF ENGR & GEN MGR THE RECLAMATION BOARD
4/9/75

PREPARED BY
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES DEVELOPMENT

ADOPTED BY THE RECLAMATION BOARD:
DATE: OCT. 18, 1974

STATE OF CALIFORNIA
THE RESOURCES AGENCY
THE RECLAMATION BOARD

KAWEAH RIVER DESIGNATED FLOODWAY

TULARE COUNTY
THREE RIVERS AREA

INDEX

4. FEMA FIP Requirements.

UNIT 5:
THE NFIP FLOODPLAIN MANAGEMENT REQUIREMENTS

In this unit

This unit reviews the NFIP standards for floodplain development, including:

- What maps, base flood elevations and other flood data must be used,
- When permits are required,
- Ensuring that new development does not cause increased flooding elsewhere,
- Standards to ensure that new buildings will be protected from the base flood, and
- Additional requirements for certain types of development.

Unit 6 reviews more restrictive standards that may be required or recommended for your community. Units 7 through 10 provide guidance on how to administer a program that fulfills the requirements spelled out in this unit.

Contents

A. THE NFIP'S REGULATIONS

For a community to participate in the National Flood Insurance Program, it must adopt and enforce floodplain management regulations that meet or exceed the minimum NFIP standards and requirements. These standards are intended to prevent loss of life and property, as well as economic and social hardships that result from flooding.

The NFIP standards work – as witnessed during floods in areas where buildings and other developments are in compliance with them. Nationwide each year, NFIP-based floodplain management regulations help prevent more than $1 billion in flood damages.

This unit focuses on the minimum NFIP criteria. In some instances, more restrictive state standards may exist, and they must also be met by communities in the NFIP. They are the subject of the next unit.

NFIP REGULATIONS

The NFIP requirements can be found in Chapter 44 of the *Code of Federal Regulations* (44 CFR). Revisions to these requirements are first published in the *Federal Register*, a publication the Federal Government uses to disseminate rules, regulations and announcements.

Most of the requirements related to your community's ordinance are in Parts 59 and 60. These are included in Appendix E along with the mapping regulations of Parts 65 and 70.

Figure 5-1 shows how the regulations are organized. The sections are referred to in shorthand, such as 44 CFR 60.1—Chapter 44, *Code of Federal Regulations*, Part 60, Section 1. In this course, excerpts are shown in boxes:

> ***44 CFR 59.2(b)*** *To qualify for the sale of federally-subsidized flood insurance a community must adopt and submit to the Administrator as part of its application, flood plain management regulations, satisfying at a minimum the criteria set forth at Part 60 of this subchapter, designed to reduce or avoid future flood, mudslide (i.e., mudflow) or flood-related erosion damages. These regulations must include effective enforcement provisions.*

As noted in Unit 2, when your community joined the NFIP, it agreed to abide by these regulations. When your community's FIRM was published, it had to submit its ordinance to FEMA to ensure that it met these requirements.

Part 59—General Provisions

Subpart A—General

59.1 Definitions
59.2 Description of program
59.3 Emergency program
59.4 References

Subpart B—Eligibility Requirements

59.21 Purpose of subpart
59.22 Prerequisites for the sale of flood insurance
59.23 Priorities for the sale of flood insurance under the regular program
59.24 Suspension of community eligibility

Part 60—Criteria for Land Management and Use

Subpart A—Requirements for Flood Plain Management Regulations

60.1 Purpose of subpart
60.2 Minimum compliance with floodplain management criteria
60.3 Floodplain management criteria for floodprone areas
(a) When there is no floodplain map
(b) When there is a map, but not flood elevations
(c) When there are flood elevations
(d) When there is a floodway mapped
(e) When there is a map with coastal high hazard areas
60.4 Floodplain management criteria for mudslide (i.e., mudflow)-prone areas
60.5 Floodplain management criteria for flood-related erosion-prone areas.
60.6 Variances and exceptions
60.7 Revisions of criteria for floodplain management regulations
60.8 Definitions

Subpart B—Requirements for State Floodplain Management Regulations

Subpart C—Additional Considerations in Managing Flood-Prone, Mudslide (i.e., Mudflow)-Prone, and Flood-Related Erosion-Prone Areas

Figure 5-1. 44 CFR Parts 59 and 60

Many state NFIP coordinators have prepared model flood damage prevention ordinances to assist communities in meeting the NFIP requirements, so it is likely that your community adopted an ordinance based on the state model.

NOTE: Periodically, the NFIP regulations are revised to incorporate new requirements or clarify old ones. These changes are published in the *Federal Register*. Some revisions require local ordinance amendments. Your community may or may not have made the amendments needed to stay updated. Before you complete this unit, you should check with your state NFIP coordinator or FEMA Regional Office to verify that your ordinance is currently in full compliance with the latest NFIP requirements.

COMMUNITY TYPES

NFIP regulations identify minimum requirements that communities must fulfill to join and stay in the program. The requirements that apply to a particular community depend on its flood hazard and the level of detail of the data FEMA provides to the community. The specific requirements are in Section 60.3, and apply to communities as follows:

- 60.3(a) FEMA has not provided any maps or data.
- 60.3(b) FEMA has provided a map with approximate A Zones
- 60.3(c) FEMA has provided a FIRM with base flood elevations
- 60.3(d) FEMA has provided a FIRM with base flood elevations and a map that shows a floodway
- 60.3(e) FEMA has provided a FIRM that shows coastal high hazard areas (V Zones)

Two important notes:

The NFIP requirements are minimums. As noted in 44 CFR 60.1(d), "Any floodplain management regulations adopted by a State or a community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence."

These requirements are cumulative. A 60.3(c) community must comply with all appropriate requirements of sections 60.3(a) and (b). For example, 60.3(a) includes basic requirements for subdivisions and utilities that are not repeated in the later sections. *All* communities in the NFIP must comply with these subdivision and utility requirements.

For example, a 60.3(c) community must use the base flood elevations provided on the FIRM. If that community has an approximate A Zone without a BFE, it must comply with the requirements of 60.3(b) for that area.

The rest of this unit explores the requirements of 44 CFR 60.3. It is organized by subject matter, so it will not correspond with the sections in 44 CFR. Where appropriate, the specific section numbers are referenced.

You should be able to identify where the requirements discussed in this unit appear in your ordinance. If you cannot find a specific reference or if you are not comfortable with your ordinance's regulatory language, contact your state NFIP coordinator or FEMA Regional Office. FEMA and your state will expect you to enforce these minimum requirements as agreed to. If you don't think your ordinance language is clear or up to date, you should consider an amendment to remove any doubt.

This unit covers the minimum requirements for participation in the NFIP. As noted, communities are encouraged to enact regulatory standards that exceed these minimums and that are more appropriate for local conditions.

The Community Rating System (CRS) is a part of the NFIP that rewards communities that implement programs that exceed the minimums. It is explained in more detail in Unit 9, Section C. Where provisions that can receive CRS credit are mentioned in this course, they are highlighted with the CRS logo.

B. Maps and Data

Flood maps and flood data were discussed in Units 3 and 4. This section builds on that information, covering the NFIP requirements as to when and how a community must use those maps and data.

> ***Basic rule #1: Check to make sure you have the latest flood maps and data published by FEMA. You must use the latest maps to administer your floodplain management ordinance.***

NFIP Maps and Data

A community must adopt and enforce floodplain management regulations based on data provided by FEMA (44 CFR 60.2(h)). This includes the floodplain boundaries, base flood elevations, FIRM zones and floodway boundaries shown on your current Flood Insurance Rate Map, Flood Boundary Floodway Map and/or Flood Insurance Study.

> ***44 CFR 60.2(h):*** *The community shall adopt and enforce flood plain management regulations based on data provided by the [Federal Insurance] Administrator. Without prior approval of the Administrator, the community shall not adopt and enforce flood plain management regulations based upon modified data reflecting natural or man-made physical changes.*

This requirement does not prevent a community from adopting and enforcing regulations based on data more restrictive than that provided by FEMA. For example, a community may want to regulate to an historical flood which was higher than the BFEs shown on the FIRM. However, such data must be approved by the FEMA Regional Office before it is used.

This requirement also does not prevent a community from using other technical data to identify and regulate floodprone areas not shown on FEMA maps. For example, many cities and urban counties map and regulate areas on small tributary streams that are not shown on the FIRM.

The community always has a say in what the latest maps and data should be. FEMA will send you proposed revisions to the official FIRM and you will have time to review them and submit your comments to FEMA before they are published. You also have a formal 90-day appeals period during which to submit your appeals before BFEs are made final. If you disagree with the FEMA data at any time and have scientific or technical data to support your position, you should submit a request for a map revision as noted in Unit 4, Section D, *Maintaining and Revising NFIP Maps.*

Annexations: If a property is in a recently annexed area that does not show up on your community's map, use the county's map and base flood elevations

(BFEs) to determine the flood protection requirements. In fact, you should formally adopt the county's FIRM in your ordinance to strengthen your basis for regulating areas not currently shown on your FIRM.

Exceptions: The basic rule does not cover every situation. Four occasions where a community may vary from the effective FIRM and other data provided by FEMA are:

- When the FEMA data disagree with ground elevations.
- When the FEMA data are insufficient. This occurs in approximate A Zones where base flood elevations and floodway boundaries are not provided with the FIRM.
- When FEMA has provided draft revised data.
- When FEMA provides "advisory" flood hazard data.

These situations are discussed below.

Note: these situations only apply to the use of flood data for floodplain management purposes. Insurance agents and lenders must use the current FIRM when determining insurance rates and whether flood insurance is required. If a person wants to vary from the current FIRM to obtain different premium rates or to not have to purchase a flood insurance policy, the FIRM must be officially revised or amended.

WHEN FIRM AND GROUND DATA DISAGREE

The BFEs published in the Flood Insurance Study set the level for flood protection purposes. The maps are a graphic portrayal of that information.

Since FEMA usually does not have detailed topographic mapping to use in preparing the flood maps, the flood boundaries are interpolated between cross sections using whatever topographical information is available. This can result in inaccuracies in drawing the boundaries on the map.

The BFE in relation to the actual ground elevation sets the floodplain limits for regulatory purposes. When ground surveys show that a development site is above the BFE, you can record the data and issue the permit. Then, if the developer or owner wants the property removed from the Special Flood Hazard Area designation, he or she can request a Letter of Map Amendment.

It is up to them to apply for a map change, not you. The procedure is discussed in Unit 4, Section D.

Conversely, if site surveys show that areas considered outside the 100-year floodplain on published maps are in fact below the BFE, you should require protection of new buildings to the BFE. Even though a site may be technically out-

side the mapped SFHA, you are not doing future occupants any favors by ignoring the known flood hazard.

REGULATING APPROXIMATE A ZONES

The second occasion where you may vary from the data provided by FEMA is in approximate A Zones. Approximate A Zones are those areas not studied by the detailed hydrologic/hydraulic methods. These areas are shown as "unnumbered A zones" on the FIRM and "approximate 100-year flood zones" on the Flood Boundary Floodway Map. The FIS will not contain specific base flood elevations for approximate study areas nor will there be a floodway/fringe designation on the FBFM.

> ***44 CFR 60.3(b)*** *When the Administrator has designated areas of special flood hazards (A zones) by the publication of a community's FHBM or FIRM, but has neither produced water surface elevation data nor identified a floodway or coastal high hazard area, the community shall:...*
>
> *(3) Require that all new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, include within such proposals base flood elevation data;*
>
> *(4) Obtain, review and reasonably utilize any base flood elevation and floodway data available from a Federal, State, or other source, including data developed pursuant to paragraph (b)(3) of this section, as criteria for requiring that new construction, substantial improvements, or other development in Zone A on the community's FHBM or FIRM meet the standards ...*

Regulating development in approximate or unnumbered A Zones is one of the tougher jobs you'll face, especially in counties that have large areas of such zones. 44 CFR Section 60.3(b)(4) requires that you make every effort to use any flood data available in order to achieve a reasonable measure of flood protection. Further, many states and local ordinances require a base flood elevation before a permit can be issued for any development.

Here are some tips in obtaining data needed for unnumbered A Zones. Whichever method you use, be sure to record on the permit records where the flood elevation came from. This will help you be consistent with future development in the same area.

- Check with your state NFIP coordinator. Some states have regulations or guidance on how to obtain regulatory data. Some have repositories of data or may help conduct a new study.
- Check with local flood control, sanitary or watershed districts. Like state agencies, they may have their own programs for developing new flood data.

- If a body of water forms a boundary between two communities, the community on the other side may have a detailed study. Such base flood data are valid for both sides of a body of water.
- Ask the U.S. Army Corps of Engineers, U.S. Department of Agriculture/Natural Resources Conservation Service, or U.S. Geological Survey if they have knowledge of any flood studies, unpublished reports, or any data that may pertain to the area in question.
- If the property is along a stream that is near state highway structures such as bridges or culverts, the state highway department may have done a flood study to properly size the structure.
- If the property is on a river with a power-generating dam, the dam owner may have had to conduct a study for federal licensing.
- See if your engineer or the developer will conduct a study to calculate BFEs.

Data obtained from one of these other sources should be used as long as they:

- Reasonably reflect flooding conditions expected during the base flood,
- Are not known to be technically incorrect, and
- Represent the best data available.

The FEMA publication *Managing Floodplain Development in Approximate Zone A Areas: A Guide for Obtaining and Developing Base (100-Year) Flood Elevations* provides information on a number of methodologies for developing BFEs in approximate A zones. These methodologies range from detailed methods that produce BFEs and perform floodway analyses similar to those developed for a Flood Insurance Study to simplified methods that can be used in isolated areas where more costly studies cannot be justified.

If your community has approximate A Zones that are likely to be developed, you should get a copy of this document and have your engineer review it. You can also download FEMA's Quick-2 software for computing flood elevations from the FEMA flood hazard mapping website.

Small developments

If the project is an isolated building, such as a single-family home in an undeveloped area or a subdivision or other development that does not meet the thresholds in 44 CFR Section 60.3(b)(3), you still must ensure that the building is protected from flood damages by meeting the requirements of 44 CFR 60.3(a)(3). This paragraph requires you to determine if the site is reasonably safe from flooding and, if it is not, that you ensure the building is constructed with methods and practices that minimize flood damages and meets other construction requirements. In nearly all cases the only way to do this is to require that the building be elevated to above an elevation that you determine.

There are several possible ways of establishing this elevation:

- Walk the site with the property owner and find a site on high ground for the building. Sometimes by this method alone you can determine a safe building site or establish a safe building elevation, particularly in the floodplain of a small stream. Sometimes detailed topographic maps are available that may help.
- Use historical records or the flood of record (the highest known flood level for the area). It may be that a recent flood was close to the base flood. If records of the recent flood can be used, base your regulatory flood elevations on them (or add a foot or two to the historical flood levels to provide a margin of error). Before you do this, get a second opinion from your state NFIP coordinator, FEMA Regional Office or other agency that is familiar with the flood data you want to use.
- Require protection to a set elevation such as at least five feet above grade. Only use this approach if you feel confident that the five feet of elevation will provide adequate flood protection to the building.
- Require the permit applicant to develop a base flood elevation or develop one yourself using one of the methods in the FEMA publication *Managing Floodplain Development in Approximate Zone A Areas: A Guide for Obtaining and Developing Base (100-Year) Flood Elevations.* This will usually require the services of an engineer, but will be worth the additional expense if it is the only way to make sure the building is protected from flood damage. There are several methods of determining BFEs at varying costs and levels of detail.

The first three methods are not as good as requiring protection to a BFE. However, they may be more appropriate for small isolated projects where the costs of developing BFE information will be high relative to the cost of the building. The third approach will result in lower flood insurance rates than if the building had no protection, but the rates are not as favorable as they would be if a BFE were calculated. Examples of the possible rates are discussed in Unit 9, Section B.

Larger developments

You are encouraged to discuss the flood hazard as early as possible in discussions with subdividers and developers of large areas. If a subdivision or planned unit development will be partially in the floodplain, there may be ways to avoid building in the flood hazard area, which can save the developer the cost of a flood study.

> ***44 CFR 60.3(b)(3):*** *[Communities must] Require that all new subdivision proposals and other proposed development (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, include within such proposals BFE data.*

Any subdivision or other large development that meets this threshold must be evaluated to determine if the proposed site is in an approximate A Zone and whether BFEs are required. If BFEs are required, the developer must conduct the required study (the community, state or other agency may provide assistance). While the study must provide BFEs, you may want to require a floodway delineation and inclusion of other data needed to ensure that the building sites will be reasonably safe from flooding.

BFE data are required for the affected lots in the subdivisions shown in Figure 5-2 and Figure 5-3. Figure 5-2 shows a 76-lot subdivision with several lots clearly affected by an approximate Zone A area. The subdivision depicted in Figure 5-3 is only 12 lots, but BFEs are required because the subdivision covers more than five acres and clearly shows buildable sites affected by an approximate Zone A area.

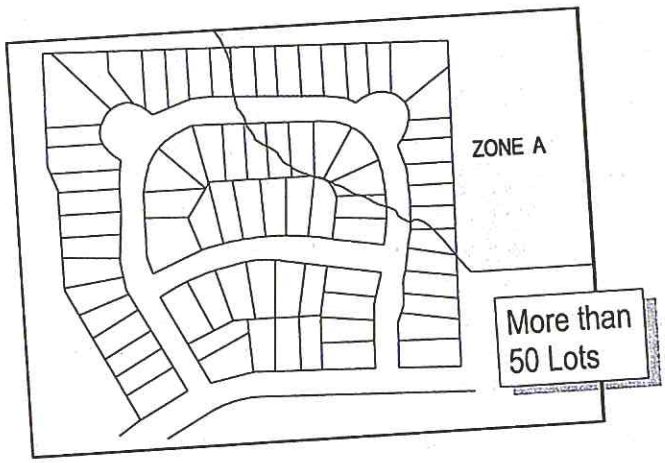


Figure 5-2: Proposed 76-lot subdivision

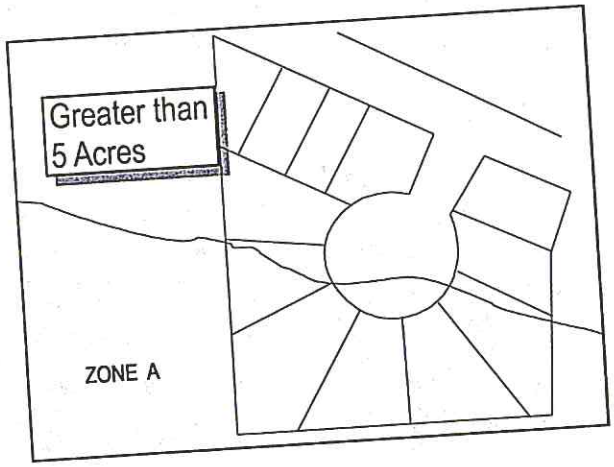


Figure 5-3: Proposed 6.7-acre subdivision

In Figure 5-4, the entire approximate Zone A area is to be left as open space. If the planned subdivision shows the floodplain is contained entirely within an open space lot, it may not be necessary to conduct a detailed engineering analysis to develop BFE data.

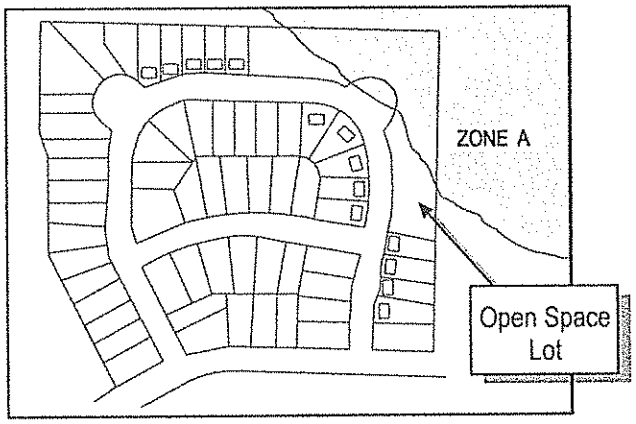


Figure 5-4: Proposed 76-lot subdivision

> ***44 CFR 65.3**: As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of [map] changes by submitting technical or scientific data in accordance with this part.*

When a developer prepares a detailed flood study in an approximate A Zone, you must submit the new flood information to FEMA within six months. The community can pass that cost on to the developer by requiring that he or she submit a request for a Letter of Map Revision as a condition of approving the development.

NFIP/CRS

CRS credit is provided if BFEs, floodways and related regulatory data are provided in areas not mapped by the NFIP. This credit can be found in Activity 410, Section 411, of the *CRS Coordinator's Manual* or the *CRS Application.*

DRAFT REVISED NFIP DATA

The third situation where a community may vary from the official FEMA data is when FEMA has sent some preliminary data to the community for review. Communities are required to "reasonably utilize" the data from a draft or preliminary FIRM or flood insurance study.

Four scenarios are possible:

- Where the original FIRM shows an A or V Zone with *no* BFEs: Use the draft information. In the absence of other elevation or floodway data, the draft information is presumed to be the best available.
- Where the original FIRM shows an AE or VE Zone *with* a BFE or floodway and the revision *increases* the BFE or *widens* the floodway: The draft revised data should be used. However, if the community disagrees with the data and intends to appeal, the existing data can be presumed to be valid and may still be used until the appeal is resolved.
- Where the original FIRM shows an AE or VE Zone *with* a base flood elevation or floodway and the revision *decreases* the BFE or *shrinks* the floodway: The existing data should be used. Because appeals may change the draft data, the final BFE may be higher than the draft. If you were to allow new construction at the lower level as shown in the draft, the owners may have to pay higher flood insurance premiums.
- Where the original FIRM shows a B, C or X Zone: NFIP regulations do not require that the draft revised data be used. However, you are encouraged to use the draft data to regulate development, since these areas are subject to a flood hazard.

If the community intends to appeal preliminary data, it must be done during the official appeals period. Otherwise, you will have to wait for the new map to become official and submit a request for a map amendment or revision.

For more information on this issue, see *Use of Flood Insurance Study (FIS) Data As Available Data*, FEMA Floodplain Management Bulletin 1-98.

CLOMRs: The above four scenarios are also relevant for a Conditional Letter of Map Revision or CLOMR. Note the *conditional* part of a CLOMR. A CLOMR provides that *if* a project is constructed as designed, the BFEs can be revised or modified (or the property in question can be removed from the SFHA) *AFTER* the as-built specifications are submitted *AND* the final LOMR is issued.

A permit cannot be issued based on a lower BFE proposed by a CLOMR until the final LOMR is issued. However, you can issue a permit for that part of the work not dependent on the changes that will result from the LOMR and condition the full permit upon receipt of the final LOMR.

ADVISORY FLOOD HAZARD DATA

Sometimes FEMA issues advisory data after a major flood where it was found that the FIRM and/or flood insurance study underestimated the hazard. This information is provided so communities can ensure that reconstructed buildings are protected from the true hazard, not the one shown on the FIRM.

When you receive such advisory information, you should "reasonably utilize" it. If your community agrees with the information, the ordinance should be re-

vised to adopt it. If it disagrees with the data, you should be ready to explain why the community is not requiring construction and reconstruction to be protected. You and your community are not helping residents if you allow them to rebuild without protection from a known hazard.

For more information on this issue, see *Use of Flood Insurance Study (FIS) Data As Available Data*, FEMA Floodplain Management Bulletin 1-98.

C. PERMIT REQUIREMENTS

Permits are required to ensure that proposed development projects meet the requirements of the NFIP and your ordinance. Once a person applies for a permit, you can review the plans and make sure the project complies.

Basic rule #2: A permit is required for all development in the SFHA shown on your FIRM.

The first step, therefore, is to get people to apply for a permit.

DEVELOPMENT PERMIT

44 CFR 59. *Definitions: "Development" means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.*

The NFIP requirements are keyed to "development" in the floodplain. "Development" means "any man-made change to improved or unimproved real estate." This includes, but is not limited to:

- Construction of new structures
- Modifications or improvements to existing structures
- Excavation
- Filling
- Paving
- Drilling
- Driving of piles
- Mining
- Dredging
- Land clearing
- Grading
- Permanent storage of materials and/or equipment

44 CFR 60.3(a)(1) *["60.3(a) communities" that do not have a FIRM must] Require permits for all proposed construction or other development in the community, including the placement of manufactured homes, so that it may determine whether such construction or other development is proposed within flood-prone areas;*

If you are a 60.3(a) community, you do not have a FIRM. Consequently, you must require a permit for all development projects throughout your community.

You must review each project's location to determine if it has a flood risk. If it does, the best way to protect a new building from flood damage is to obtain a BFE for the site and require that the building be elevated or protected to or above that BFE.

Building permits

Most communities have long had a system for issuing building permits, but many have not had a permit system for "development." Regulating all development in floodplains is essential because fill or other material can obstruct flood flows just as structures can.

Because a "building permit" often covers only construction or modifications of buildings, this study guide uses the term "development permit." You should check your permit system to ensure that in the floodplain, permits are being required for *ALL* projects that meet the definition of development, not just "building" projects. Make sure you regulate the following in addition to the traditional building projects:

- Filling and grading.
- Excavation, mining and drilling.
- Storage of materials.
- Repairs to a damaged building that do not affect structural members.
- Temporary stream crossings
- Activities by other government agencies, such as roads, bridges and school buildings

If your building permit system does not require permits for these activities, you need to revise your system, enact a new type of "development permit" or otherwise ensure that people apply for a permit for these non-building projects.

Small projects

You have some discretion to exempt obviously insignificant activities from the permit requirement, such as planting a garden, farming, putting up a mailbox or erecting a flagpole. You may also want to exempt routine maintenance, such as painting or re-roofing.

The key is whether the project will present a new obstruction to flood flows, alter drainage or have the potential to be a substantial improvement. These determinations can only be made by the permit official, not the builder, so make sure your exemptions are clear. There should be no possibility of a misunderstanding resulting in construction of a flood flow obstruction or a substantial improvement without a permit.

Some communities specifically exempt small projects in their ordinances. This is the recommended approach, as it avoids challenges that the permit official arbitrarily decides what projects need permits. Check with your state coordinating agency and/or FEMA Regional Office before you do this. You may be able to exempt projects (other than filling, grading or excavating) valued at less than, say, $500.

PERMITS FROM OTHER AGENCIES

44 CFR 60.3(a)(2) requires all NFIP communities to ensure that other federal and state permits have been obtained. You should not issue your local permit until you are certain that the other agencies' requirements are met.

The purpose of this requirement is to help assure that coordination occurs between various levels of government on projects impacting on floodplains. The requirement has the added benefit of protecting permit applicants by making sure they are aware of and obtain all of the permits necessary for a floodplain development prior to making irreversible financial investments. Permit applicants are not well served if they are allowed to proceed with a project only to have work stopped later by a Federal or State agency because they have not obtained proper permits.

Some communities allow their permit officials to issue the local permit on the condition that other required permits are obtained. However, this is not as effective as holding the local permit until the applicant can show that the other agencies have issued or will issue their permits.

Otherwise, the project may get under way before you are sure that it meets all legal requirements.

To implement this requirement, you're encouraged to develop a list of what permits are required in your jurisdiction. Your state NFIP coordinator should be able to help.

These development activities may require a state permit:

- Construction in the coastal zone.
- Construction in floodways or other designated areas.
- Stream crossings or projects that affect navigable rivers.
- Installation of septic systems.
- Subdivision standards or subdivision plat or lot filing requirements.
- Manufactured housing (mobile home) park or tie-down requirements.
- Public health facilities, such as hospitals and nursing homes.
- Alteration of sand dunes.

- Operating a landfill or hazardous materials storage facility.

The more common federal regulations that may require a permit include:

- U.S. Army Corps of Engineers Section 404—permits for wetlands filling
- U.S. Army Corps of Engineers Section 10—permits for work in navigable waterways
- U.S. Coast Guard—permits for bridges and causeways that may affect navigation.
- U.S. Fish and Wildlife Service—consultations required under Sections 7 and 10 of the Endangered Species Act of 1973.

You should also check with your county; sewer, sanitary or flood control district; water management district; and any other local or regional agency that may regulate certain types of development in the floodplain.

D. ENCROACHMENTS

Once a permit application is received and the proposed project is ready for review, the next job is to ensure that the project will not impose flood problems on other properties.

Basic rule #3: Development must not increase the flood hazard on other properties.

This is more of a concern in riverine situations where a project may dam or divert flowing water onto other properties or increase flood flows downstream. To prevent this, communities adopt floodways to designate those areas where flood flows are most sensitive to changes brought by development.

Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations. For streams and other watercourses where FEMA has provided BFEs, but no floodway has been designated, the community must review developments on a case-by-case basis to ensure that these increases do not occur.

REGULATORY FLOODWAYS

44 CFR 59.1 Definitions: "Regulatory floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

As explained in Unit 3, Section B, the floodway is the central portion of a riverine floodplain needed to carry the deeper, faster moving water. Buildings, structures and other development activities—such as fill—placed within the floodway are more likely to obstruct flood flows, causing the water to slow down and back up, resulting in higher flood elevations.

A floodway is included with most riverine Flood Insurance Studies and will generally be shown on the Flood Insurance Rate Map (FIRM). Some of the older Flood Insurance Studies will have a separate floodway map. The community officially adopts its "regulatory floodway" in its floodplain management ordinance.

ENCROACHMENT REVIEW

All projects in the regulatory floodway must undergo an encroachment review to determine their effect on flood flows and ensure that they do not cause problems. Development projects in the flood fringe by definition do not increase flood heights above the allowable level, so encroachment reviews are not needed.

> ***44 CFR 60.3(d)(3):*** *[In the regulatory floodway, communities must] Prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.*

The objective of this requirement and the floodplain management ordinance to ensure that the floodway is reserved to do its natural job: carrying floodwater. The preferred approach is to avoid all development there.

Once your community adopts its floodway, you must fulfill the requirements of 44 CFR 60.3(d). The key concern is that each project proposed in the floodway must receive an encroachment review, i.e., an analysis to determine if the project will increase flood heights. You may also want to require that this review determine if the project will cause increased flooding downstream. Note that the regulations call for preventing ANY increase in flood heights. This doesn't mean you can allow a foot or a tenth of a foot – it means zero increase. If you do not limit the increase to zero, small increases in flood heights from individual developments will cumulatively have significant impacts on flood stages and flood damages. Under NFIP minimum requirements, it is assumed that there will be no cumulative effects since the permissible rise for any single encroachment is zero.

Projects, such as filling, grading or construction of a new building, must be reviewed to determine whether they will obstruct flood flows and cause an increase in flood heights upstream or adjacent to the project site.

Projects, such as such as grading, large excavations, channel improvements, and bridge and culvert replacements, should also be reviewed to determine whether they will remove an existing obstruction, resulting in increases in flood flows downstream.

Your community may conduct the encroachment review, or you may require the developer to conduct it. Most local permit officials are not qualified to make an encroachment review, so most require that this be done by an engineer at the developer's expense.

As the permit reviewer, it is the community's job to ensure that an activity will not cause a problem. You have two options for doing this: For every project you could require the applicant's engineer to certify that there will be no rise in flood heights or you can make the determination for minor projects.

Encroachment certification: To ensure that the encroachment review is done right, you may want to require the developer to provide an encroachment certification. This is often called a "no-rise" certification because it certifies that the development project will not affect flood heights. An example of a form developed by the North Carolina state coordinating agency is shown in Figure 5-5.

The certification must be supported by technical data, which should be based on the same computer model used to develop the floodway shown on the community's map.

"NO-RISE" CERTIFICATION

This is to certify that I am a duly qualified registered professional engineer licensed to practice in the State of _____

It is further to certify that the attached technical data supports the fact that proposed _____ (Name of Development) will not impact the 100-year flood elevations, floodway elevations, or floodway widths on _____ ___ (Name of Stream) at published sections in the Flood Insurance Study for ____ _____(Name of Community) dated _____ (Study Date) and will not impact the 100-year flood elevations, floodway elevations, or floodway widths at unpublished cross-sections in the vicinity of the proposed development.

Attached are the following documents that support my findings:

_____

_____

Date: _____

Signature: _____

Title:_____ {SEAL}

Figure 5-5: Example no-rise certification

Although your community is required to review and approve the encroachment review, you may request technical assistance and review from the FEMA Regional Office or state NFIP Coordinator. If this alternative is chosen, you must review the technical submittal package and verify that all supporting data are included in the package before sending it to FEMA.

Minor projects: Some projects are too small to warrant an engineering study and the certification. Many of these can be determined using logic and common sense: a sign post or telephone pole will not block flood flows. Barbed wire farm fences that will be pushed over or ripped out early in the flood may also be permitted without a certification; however, larger more massive fences could be an obstruction to flood flows and may require an engineering study and certification. A driveway, road or parking lot at grade (without any filling) won't cause an obstruction, either.

Building additions, accessory buildings, and similar small projects can be located in the conveyance shadow. This is the area upstream and downstream of an existing building or other obstruction to flood flows. Flood water is already flowing around the larger obstruction, so the addition of a new structure will not change existing flood flow.

Determining the limits of the conveyance shadow is illustrated in Figure 5-6. Small structures located completely within the shadow can be permitted without the engineering analysis needed for a no-rise certification.

Note: Just because a small structure can be located in the conveyance shadow, it is still preferable to keep all development out of the floodway. Don't forget: all buildings must be elevated or otherwise protected from the base flood.

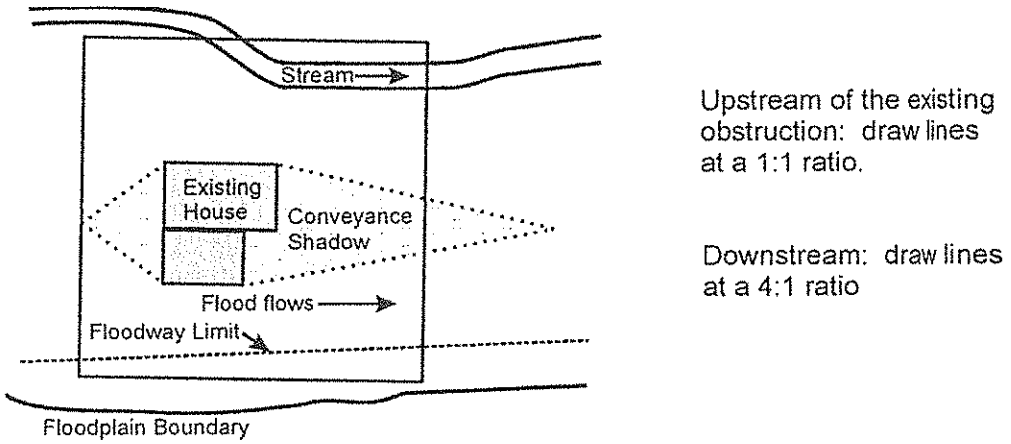


Figure 5-6. Determining the conveyance shadow

STREAMS WITHOUT FLOODWAY MAPS

If your community has a FIRM with base flood elevations along rivers or streams, but no mapped floodway, you must evaluate all development to ensure that it will not increase flood stages by more than one foot.

44 CFR 60.3(c)(10): *[Communities must] Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.*

For the purposes of administering your ordinance, you should treat the entire riverine floodplain as a floodway. You should require the same encroachment cer-

tification to ensure that a development project will not obstruct flood flows and cause increased flooding on other property. This approach is recommended for all other riverine floodplains without a mapped floodway.

In riverine floodplains where no floodway has been designated, the review must demonstrate that the *cumulative* effect of the proposed development, when combined with all other existing and anticipated development:

- Will not increase the water surface elevation of the base flood more than one foot at any point within the community, and
- Is consistent with the technical criteria contained in Chapter 5 (Hydraulic Analyses) of the Flood Insurance Study: Guidelines and Specifications for Study Contractors, FEMA-37, 1995.

This review must be required for all development projects, although you may make the same judgments on minor projects as for floodways. You should pay particular attention to developments that may create a greater than one-foot increase in flood stages, such as bridges, road embankments, buildings and large fills.

Note: In some states, floodways are mapped based on allowing flood heights to increase by less than one foot. In those states, the encroachment certification must be based on that more restrictive state standard, not the FEMA standard that allows a one-foot rise.

ALLOWABLE INCREASES IN FLOOD HEIGHTS

In some situations, it may be in the public interest to allow increase in flood heights greater than those allowed under the NFIP regulations.

For example, it would be hard to build a flood control reservoir without affecting flood heights. Because a dam would have a major impact on flood heights, there needs to be a way to permit such projects, especially those that are intended to reduce flooding.

However, when the project will change the flood level, maps must be changed to reflect the new hazard.

> ***44 CFR 60.3(d)(4)*** *Notwithstanding any other provisions of § 60.3, a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided that the community first applies for a conditional FIRM and floodway revision, fulfills the requirements for such revisions as established under the provisions of § 65.12, and receives the approval of the Administrator.*

If your community proposes to permit an encroachment in the floodway or the floodplain that will cause increases in the BFE in excess of the allowable level,

you're required to apply to the FEMA Regional Office for *conditional* approval of such action prior to permitting the project to occur.

As part of your application for conditional approval, you must submit:

- A complete application and letter of request for conditional approval of a change in the FIRM or a Conditional Letter of Map Revision (CLOMR), along with the appropriate fee for the change (contact the FEMA Regional Office for the fee amount).
- An evaluation of alternatives which, if carried out, would not result in an increase in the BFE more than allowed, along with documentation as to why these alternatives are not feasible.
- Documentation of individual legal notice to all affected property owners (anyone affected by the increased flood elevations, within and outside of the community) explaining the impact of the proposed action on their properties.
- Concurrence, in writing, from the chief executive officer of any other communities affected by the proposed actions.
- Certification that no structures are located in areas which would be affected by the increased BFE (unless they have been purchased for relocation or demolition).
- A request for revision of BFE determinations in accordance with the provisions of 44 CFR 65.6 of the FEMA regulations.

Upon receipt of the FEMA conditional approval of the map change and prior to approving the proposed encroachments, you must provide evidence to FEMA that your community's floodplain management ordinance incorporates the post-project condition BFEs.

E. New Buildings in A Zones Buildings

Basic rule #4: New, substantially improved or substantially damaged buildings must be protected from damage by the base flood.

In this course, the term "building" is the same as the term "structure" in the NFIP regulations. Your ordinance may use either term.

> ***44 CFR 59.1*** *Definitions: "Structure" means, for flood plain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.*

The term "building" or "structure" does not include open pavilions, bleachers, carports and similar structures that do not have at least two rigid walls and a roof.

How to determine if a building is substantially improved or substantially damaged is discussed in Unit 8. In this unit, consider the term "building" as an all-encompassing term that includes substantial improvements and repairs of substantial damage to a building.

Residential and nonresidential buildings are treated differently. A residential building must have a higher level of protection—if it is to be built in the floodplain, it must be elevated above the BFE. Nonresidential buildings, on the other hand, may be elevated or floodproofed (made watertight below the BFE).

Elevation

> ***44 CFR 60.3(c)(2)*** *[Communities must] Require that all new construction and substantial improvements of residential structures within Zones A1-30, AE and AH zones on the community's FIRM have the lowest floor (including basement) elevated to or above the base flood level…*

In Zones A1-A30, AE and AH, all new construction and substantial improvements of residential structures must be elevated so that the lowest floor (including the basement) is elevated to or above the BFE. This can be done in one of three ways:

- Elevation on fill.
- Elevation on piles, posts, piers or columns.
- Elevation on walls or a crawlspace.

Fill

Fill can be used by itself or in conjunction with other types of foundations to raise the lowest floor of a building above the BFE. However, restrictions to the

use of fill apply in floodways where fill would cause an increase in flood heights and in V zones where it would act as an obstruction to waves.

Some communities require or encourage the use of fill to elevate residential buildings because they consider fill a safer construction method since the building itself is not in contact with floodwaters. Other communities limit the use of fill in the flood fringe to protect flood storage capacity or require compensatory storage, which is discussed in Unit 6, Section C.

Where fill is the method of choice, it should be properly designed, installed in layers and compacted. Simply adding dirt to the building site may result in differential settling over time.

The fill should also be properly sloped and protected from erosion and scour during flooding. To provide a factor of safety for the building and its residents, it is recommended that the fill extend 10 – 15 feet beyond the walls of the building before it drops below the BFE.

Piles, posts, piers or columns

Piles, piers, posts or columns are appropriate foundations for elevating buildings above the BFE where there is deeper flooding, fill is not feasible or not allowed, or for areas with high velocity flooding. Where flooding is likely to have high velocities or waves, leaving the area below the building free of obstruction with no lower area enclosure is preferred. As illustrated in Figure 5-8, this permits unrestricted flow of floodwater under the building. There will be less force applied to the building by floodwaters and less impact on flood heights than if solid walls were used.

Figure 5-7. These two new buildings elevated on fill were not damaged by this 100-year flood.

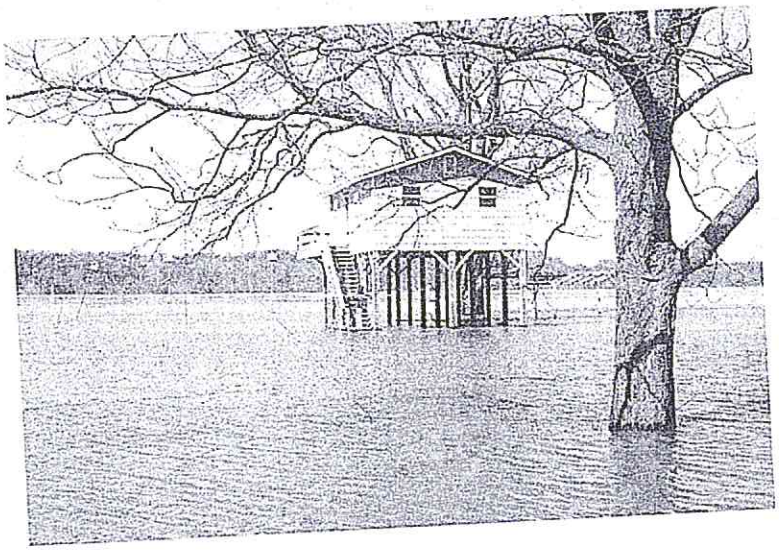


Figure 5-8. Elevation on piers

Walls or crawlspace

The third elevation technique is to build on solid walls. In shallower flooding areas, this elevation technique is the same as creating a crawlspace—a foundation of solid walls that puts the lowest floor above the flood level. In deeper flooding areas this often results in elevating the building a full story and creation of an enclosed area below the BFE.

When solid walls are used, care must be taken to ensure that hydrostatic or hydrodynamic pressure does not damage the walls. As discussed in Unit 1, Section B, these water pressures can cause a solid wall to collapse damaging the elevated portion of the building.

There are two ways to prevent this:

- Stem walls can be used on two sides parallel to the flow of water. The other two sides are kept open (Figure 5-9). This minimizes the obstruction to floodwaters and lessens pressure on the foundation.
- The walls can be built with openings large enough to allow floodwaters to flow in and out, preventing differential pressures on the walls. Openings are required any time there is a fully enclosed area below the BFE. This is discussed in more detail in the later section on enclosures.

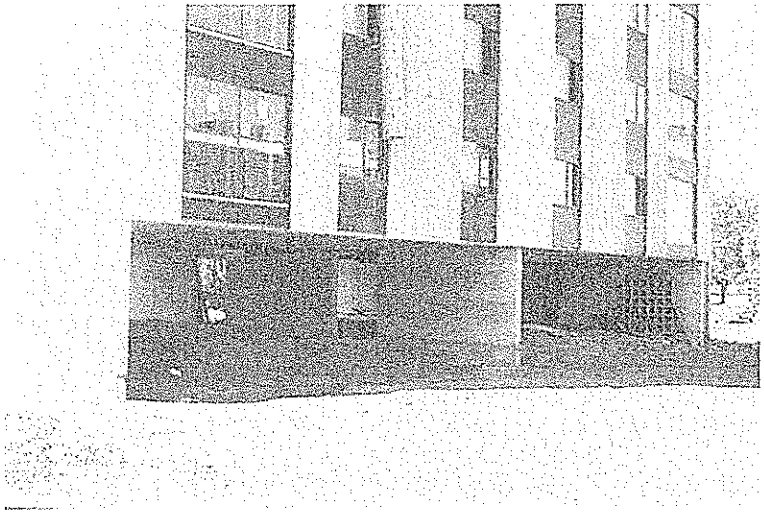


Figure 5-9: Building elevated on parallel stem walls.

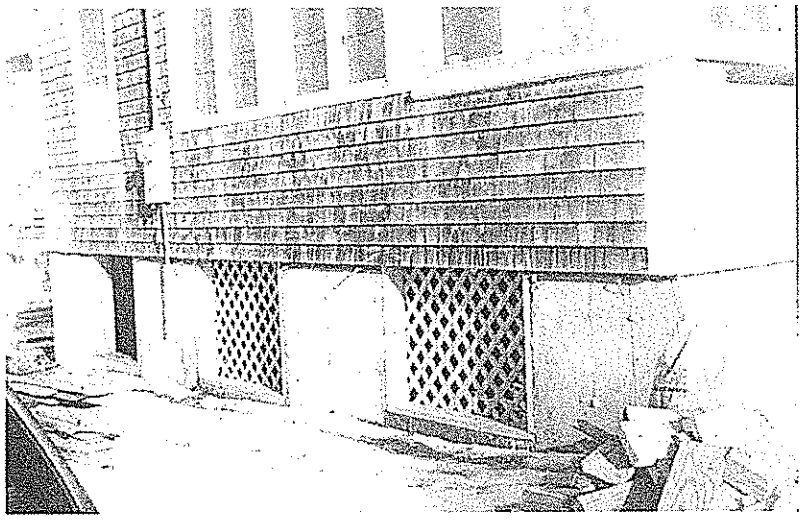


Figure 5-10: Building elevated on crawlspace with openings.

When a crawlspace is used to elevate the building above the base flood elevation, it creates an enclosed area below the BFE that must meet all requirements that apply to enclosures including the openings requirement (see the sections of this Unit on Enclosures and Openings). In addition the floor of the crawlspace must be at or above the lowest adjacent grade to the building to minimize hydro-

static pressures against the crawlspace walls and the ponding of water within the crawl space after a flood.

Recently FEMA issued a policy allowing communities to permit construction of crawlspaces with their floors below grade in the Special Flood Hazard Area (SFHA) under certain conditions. Communities that wish to allow below-grade residential crawlspace construction must require that the interior grade of the crawlspace is no more than two feet below the lowest adjacent grade, the height of the crawlspace measured from the interior grade of the crawlspace to the top of the crawlspace wall does not exceed four feet at any point, and the building meets other limitations. These communities must adopt these requirements as part of their floodplain management ordinance. Below-grade crawlspaces that meet these requirements will not be considered basements, but the buildings will still have higher flood insurance rates than if the same crawlspace had its floor at or above lowest adjacent grade.

Technical Bulletin 11-01 *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas* provides a best practices approach for crawlspace construction. While communities may allow below-grade crawlspace construction, the Technical Bulletin continues to recommend that the interior of the crawlspace be backfilled so that the interior grade is level to or higher than the lowest adjacent grade (LAG) to the building. The Technical Bulletin offers appropriate considerations and guidance for below-grade crawlspace construction. Communities that wish to allow below-grade crawlspaces should refer to the Technical Bulletin for the specific requirements that must be incorporated into their floodplain management ordinance.

How high?

NFIP regulations require that the lowest floor of a building must be elevated above the BFE. Note three things about this minimum requirement:

1. The term "lowest floor" includes a basement because all usable portions of a building must be protected from flood damage.

> ***44 CFR 59.1.*** *Definitions: "Lowest Floor" means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of section 60.3.*

2. The minimum requirement is to elevate to the BFE. In the next unit, we will discuss freeboard, an extra margin of protection that requires the lowest floors to be one or more feet above the BFE.

3. In A Zones, under the minimum NFIP requirement, the lowest floor is measured from the top of the floor (Figure 5-11). However, all portions of

the building below the BFE must be constructed with flood resistant materials and building utility systems (including ductwork) must be elevated above the BFE or floodproofed (made watertight) to that elevation. To meet these requirements, it is recommended that buildings on elevated foundations, such as piles or a crawlspace, have supporting beams or floor joists and building utility systems elevated to or above the BFE to protect them from flood damage. This is generally easier than using flood resistant materials for floor support systems or floodproofing building utility systems.

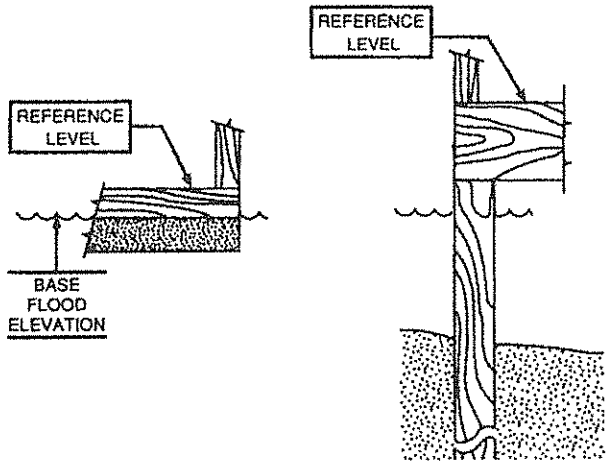


Figure 5-11. In A Zones: the top of the floor is the reference level

Elevation Certificate

Because most new buildings built in the floodplain are residences, elevating them is one of the most important requirements of the NFIP. To ensure that a building is elevated above the BFE, the lowest floor is surveyed and an elevation certificate is obtained and kept by the local permit office. This is discussed in more detail in Unit 7, Section G.

ENCLOSURES

Enclosures are areas created by a crawlspace or solid walls that fully enclose areas below the BFE. They deserve special attention for two reasons:

- The walls of enclosed areas are subject to flood damage from hydrostatic and hydrodynamic forces.
- People are tempted to convert enclosures that are intended to be flooded into areas that can sustain damage in a flood.

NFIP regulations allow certain uses in enclosures below the BFE because they can be designed so that they are subject to minimal flood damage. Three uses are allowed:

- building access
- vehicle parking
- storage.

The storage permitted in an enclosed lower area should be limited to that which is incidental and accessory to the principal use of the structure. For example, if the structure is a residence, storage should be limited to items such as lawn and garden equipment, bicycles, and snow tires which either have a low damage potential or that can be easily moved to the elevated portion of the building if there is a flood.

The floodplain regulation requirements can be easier to accept if owners and builders are encouraged to think about the enclosed lower areas as usable space. If a building has to be elevated, say, five feet above grade, the owner should be encouraged to go up eight feet. This allows the lower area to be used for parking—and provides three extra feet of flood protection.

However, if the lower area is enclosed, there is a tendency for the owner to forget about the flood hazard and convert the enclosure to a bedroom or other finished room. This must be prevented.

Since floodwaters are intended to enter the enclosure—it must be built of flood-resistant materials (see the section on flood-resistant materials do determine which are acceptable). Not allowed are finishings such as carpeting, paneling, insulation (both cellulose and fiberglass) and gypsum wallboard (also known as drywall and sheet rock).

Utilities that serve the upper level also must be protected from flood damage. Consequently, a furnace cannot be put in an enclosure unless it is located above the BFE. This is explained in more detail in *Engineering Principles and Practices for Flood Damage-Resistant Building Support Utility Systems*, FEMA 348, and November 1999. When the lower area enclosure is used to provide access to the upper level, a stairway can be designed that provides this access yet is resistant to flood damage. Installing an elevator is more difficult, but there are ways to design and install an elevator that will face minimal flood damage, as explained in *Elevator Installation for Buildings Located in Special Flood Hazard Areas*, FIA-TB-4, FEMA 1993.

Openings

As noted in Unit 1, solid walls can collapse from hydrostatic pressure if floodwaters get too deep outside the building. To prevent this, an enclosure must

have openings to allow floodwaters to enter and leave, thus automatically equalizing hydrostatic flood forces on both sides of the walls.

> ***44 CFR 60.3(c)(5)*** *[Communities must] Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria: A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.*

You can be sure the openings are adequate by using one of two methods.

The first method is to have the design meet or exceed the following three criteria:

1. The bottom of the openings must be no higher than one foot above grade (see Figure 5-12).

2. The openings shall be installed on at least two walls of the enclosure to ensure that at least one will work if others get blocked or plugged.

3. Provide a minimum of two openings having a net area of not less than one square inch for every square foot of enclosed area that is subject to flooding. If the area of the enclosure is 1,000 square feet, the area of the openings combined must total at least 1,000 square inches.

   For example, removing a concrete block from a block wall results in an 8" x 16" or 128 square inches opening (see Figure 5-12). To determine how many openings would be needed, divide the square footage of the floor area by 128.

   Example 1: $\frac{\text{1,280 square foot house}}{\text{128 square inches/opening}} = 10$ — 10 openings will be needed

   Example 2: $\frac{\text{2,000 square foot house}}{\text{128 square inches/opening}} = 15.62$ — 16 openings will be needed

   If the opening is covered by a standard crawlspace vent cover or grate, the net area of the opening must be used and the number of openings increased accordingly. Net areas can be found on manufacturers specifications or estimated if specifications are not available.

The second method of meeting the requirement is to have the design certified by a registered professional engineer or architect as meeting the requirement to automatically equalize hydrostatic forces on exterior walls by allowing for the entry and exit of floodwaters. Under some circumstances it may be possible to vary the size or location of the openings based on this certification.

Openings may be equipped with screens, louvers, valves or other coverings or devices to keep animals out of the enclosure. However, any covering must permit the automatic flow of floodwater in both directions.

The opening sizes in the previous examples and in Figure 5-12 are based on the size of standard crawlspace vents, which most building codes require to be installed in a crawlspace for ventilation purposes. Often these are located close to the floor in order to circulate air around the floor joists.

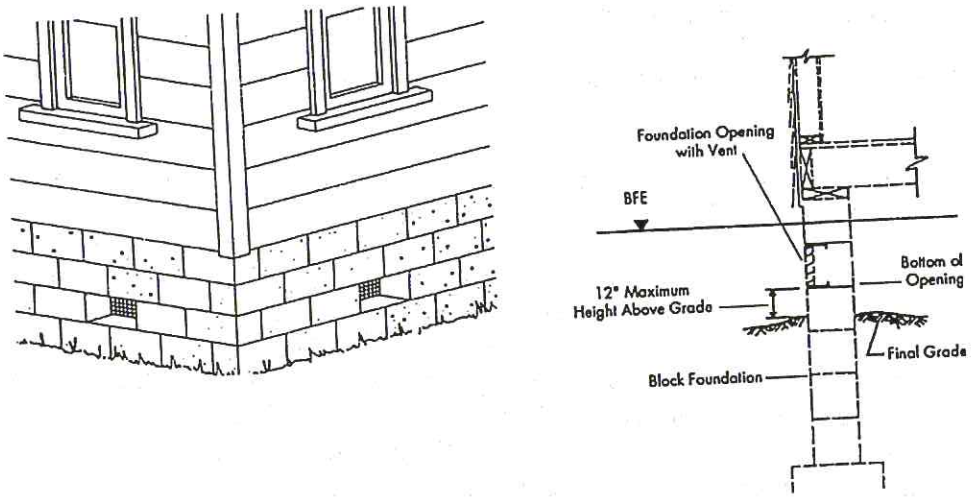


Figure 5-12. Opening location in solid foundation wall

Air vents are located well above the ground in an elevated house and would not meet the NFIP requirement that the bottom of the opening be within one foot of grade. However, NFIP requirements and building codes can be satisfied by the same vents if they meet the three criteria listed above.

Garage doors cannot be used to satisfy this requirement because they do not permit the automatic flow of floodwaters. However, garage doors may have vents in them that meet the above criteria.

Openings are not required for stem wall foundations that have been backfilled with a concrete floor slab poured that is supported by the fill.

For further guidance, refer to *Openings in Foundation Walls*, FIA-TB-1 (FEMA 1993).

Use

Enclosed areas are designed to be flooded and can be used only for parking vehicles, storage or access to the elevated living area—uses that can be designed so they are subject to little or no flood damage.

The type of storage permitted in an enclosed lower area should be limited to that which is incidental and accessory to the principal use of the structure. For instance, if the structure is a residence, the enclosure should be limited to storage of lawn and garden equipment, snow tires, and other low damage items, which can be conveniently moved to the elevated part of the building.

The interior portion of an enclosed area should not be partitioned or finished into separate rooms, except to separate the garage from the access and storage areas.

If a building is elevated eight feet or more, regulating the use of the enclosure presents special problems. Over time, the owner may forget the flood hazard and want to convert the floodable area into a finished room. Such an action would increase the flood damage potential for the building and violate the conditions of the building permit.

However, because the room is hidden behind walls, it can be very hard for the permit office to catch such a conversion. You should carefully check new building plans for signs, such as roughed in plumbing and sliding glass doors that indicate that the owner may expect to finish the area in the future. You should also clearly state on your permit what the limitations are on construction and use of the enclosed area.

One way to help prevent conversions is to have the owner sign a nonconversion agreement. An example developed by the North Carolina State NFIP Coordinator is in Figure 5-13.

This DECLARATION made this ___ day of _____, 20__, by _____ ("Owner") having an address at _____

WITNESSETH:

WHEREAS, the Owner is the record owner of all that real property located at _____ in the City of _____ in the County of _____, designated in the Tax Records as _____.

WHEREAS, the Owner has applied for a permit or variance to place a structure on that property that either (I) does not conform, or (2) may be noncompliant by later conversion, to the strict elevation requirements of Article _____ Section _____ of the Floodplain Management Ordinance of _____ ("Ordinance") and under Permit Number _____ ("Permit").

WHEREAS, the Owner agrees to record this DECLARATION and certifies and declares that the following covenants, conditions and restrictions are placed on the affected property as a condition of granting the Permit, and affects rights and obligations of the Owner and shall be binding on the Owner, his heirs, personal representatives, successors and assigns.

UPON THE TERMS AND SUBJECT TO THE CONDITIONS, as follows:

1. The structure or part thereof to which these conditions apply is: _____.

2. At this site, the Base Flood Elevation is _____ feet above mean sea level, National Geodetic Vertical Datum.

3. Enclosed areas below the Base Flood Elevation shall be used solely for parking of vehicles, limited storage, or access to the building. All interior walls, ceilings and floors below the Base Flood Elevation shall be unfinished or constructed of flood resistant materials. Mechanical, electrical or plumbing devices shall not be installed below the Base Flood Elevation.

4. The walls of the enclosed areas below the Base Flood Elevation shall be equipped and remain equipped with vents as shown on the Permit.

5. Any alterations or changes from these conditions constitute a violation of the Permit and may render the structure uninsurable or increase the cost for flood insurance. The jurisdiction issuing the Permit and enforcing the Ordinance may take any appropriate legal action to correct any violation.

6. Other conditions: _____

In witness whereof the undersigned set their hands and seals this _____ day of _____, 20 __.

_____ _____ (Seal)
Owner

_____ _____ (Seal)
Witness

Figure 5-13: Example Nonconversion agreement

FLOODPROOFING

Nonresidential buildings must be elevated or floodproofed. If they are elevated, they must meet the same standards as for residential buildings that were just reviewed. Elevation is the preferred method of flood protection because it is more dependable. Elevated commercial and industrial buildings can often be designed so that they can continue to operate during a flood reducing or eliminating business disruptions. Also, it will generally prove to be less expensive to elevate a non-residential building than to floodproof it. However, there will be situations where floodproofing may be the only feasible alternative for protecting a nonresidential building.

> ***44 CFR 59.1.*** *Definitions: "Flood proofing" means any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.*
>
> ***44 CFR 60.3(c)(3)*** *[Communities must] Require that all new construction and substantial improvements of non-residential structures within Zones A1-30, AE and AH zones on the community's firm (i) have the lowest floor (including basement) elevated to or above the base flood level or, (ii) together with attendant utility and sanitary facilities, be designed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;*
>
> ***44 CFR 60.3(c)(4)*** *[Communities must] Provide that where a non-residential structure is intended to be made watertight below the base flood level, (i) a registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the applicable provisions of paragraph (c)(3)(ii) or (c)(8)(ii) of this section, and (ii) a record of such certificates which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained with the official designated by the community under §59.22(a)(9)(iii);*

For the purposes of regulating new construction, floodproofing is defined measures incorporated in the design of the building so that below the BFE:

- Walls are watertight (substantially impermeable to the passage of water),
- Structural components can resist hydrostatic and hydrodynamic loads and effects of buoyancy, and
- Utilities are protected from flood damage.

Most floodproofing is appropriate only where floodwaters are less than three feet deep, since walls and floors may collapse under higher water levels.

A registered professional engineer or architect must prepare the building plans and certify the floodproofing measures, preferably using the FEMA Floodproofing Certificate form. This is discussed in more detail in Unit 7, Section G.

Floodproofing techniques that require human intervention are allowed but should be discouraged. Human intervention means that a person has to take some action before the floodwater arrives, such as turn a valve, close an opening or switch on a pump. There are many potential causes of failure for these techniques, including inadequate warning time, no person on duty when the warning is issued, the responsible person can't find the right parts or tools, the person is too excited or too weak to install things correctly, and/or the electricity fails.

Before you approve plans for a building that relies on human intervention to be floodproofed, you should make sure that there are plans and precautions to keep such problems from occurring. Techniques that rely on human intervention should only be allowed in areas with adequate warning time and in situations where there will be someone present who is capable of implementing or installing the required measures.

More information on floodproofing can be found in FEMA's Technical Bulletin 3-93, *Non-Residential Floodproofing Requirements and Certification for Buildings Located in Special Flood Hazard Areas* (FIA-TB-3. 1993)

How high?

The minimum NFIP requirement is to floodproof a building *to the BFE*. However, when it is rated for flood insurance, one foot is subtracted from the floodproofed elevation. Therefore, a building has to be floodproofed *to one foot above the BFE* to receive the same favorable insurance rates as a building elevated to the BFE. Unit 9, Section B, discusses this in more detail.

BASEMENTS

For the purposes of the NFIP, a basement is defined as any area that is subgrade on all sides. The "lowest floor" of a building is the top of the floor of the basement if there is a basement. Since the "lowest floor" of a residential building must be at or above the BFE, it will be highly unusual to construct a basement in a floodplain that met these requirements.

> ***44 CFR 59.1** Definitions: "Basement" means any area of the building having its floor subgrade (below ground level) on all sides.*

Note that "walkout basements," "daylight basements" or "terrace levels" are usually subgrade on only three sides, with the downhill side at or above grade. Thus, they are not considered basements for either floodplain management or flood insurance rating purposes (but they are still the lowest floor of a building for floodplain management and insurance rating purposes). If these areas are used only for parking, access, or storage and they meet other ordinance requirements, they can be regulated as enclosures below an elevated building and not be considered the lowest floor of the building.

On the other hand, cellars, the lower level of a split-level or bi-level house, garden apartments and other finished floors below grade are considered basements under NFIP regulations.

Since the lowest floor of a residential building must be above the BFE, the only way to build a residential basement in the floodplain under NFIP minimum requirements is if it is elevated on fill and surrounded by fill. Floodproofed nonresidential basement are allowed, provided they meet the requirements discussed in the previous section on floodproofing.

BASEMENT EXCEPTIONS

A few communities have obtained exceptions to the NFIP regulations that allow them to permit floodproofed residential basements. The soil types and flooding conditions in these communities allow construction of floodproofed basements that are not subject to damage by hydrostatic or hydrodynamic forces.

A community may apply for an exception to allow floodproofed residential basements if it can demonstrate flood depths are less than five feet, velocities are less than five feet per second, there is adequate warning time for the site and it has appropriate construction requirements. This exception is explained in 44 CFR 60.6(c).

Buildings with floodproofed basements must have their design certified by a registered engineer or architect and are more difficult and more expensive to construct than buildings elevated above the BFE. Improperly designed or constructed

basements can collapse or otherwise fail resulting in major damage to the structure.

BASEMENTS AND LOMR-F AREAS

It has become a common practice in some areas of the country to fill an area to above the BFE and then obtain a Letter of Map Revision based on fill (LOMR-F) to remove the land from the floodplain. Once the land is no longer in the floodplain, the builder obtains permits to build residences with basements below the BFE. This practice has raised a number of issues and concerns:

- The procedure was being used to get around community floodplain management ordinances.
- Buildings with basements below BFE were being built too close to the edges of these fills that could be subject to severe flood damage if the basement walls are subjected to hydrostatic pressure from surface water or groundwater during flooding.
- LOMR-Fs for nearly identical buildings were being granted or not granted based on the date the LOMR was applied for and not on the risk to the building.

FEMA issued a final rule on May 4, 2001 revising LOMR-F procedures to address these issues. The new procedure places responsibility back in the hands of the community by requiring that, before a LOMR-F is granted, the community sign a community acknowledgement form and make findings that:

- The project, including any buildings, meets all the requirements of the community's floodplain management ordinance, and
- Any existing or future development on the filled area is "reasonably safe from flooding".

FEMA will not act on a LOMR-F request without this acknowledgement.

> **44 CFR 65.2(c)** "Reasonably safe from flooding" means that base flood waters will not inundate the land or damage structures to be removed from the SFHA and that any subsurface waters related to the base flood will not damage existing or proposed buildings."

FEMA has issued Technical Bulletin 10-01 *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding* to provide guidance on how to make the determination that an area is "reasonably safe from flooding". The risk to buildings built in these areas will vary depending on soil conditions, the location of the building relative to the edge of the fill, and whether the building will have a basement below the BFE.

The safest method of constructing a building on filled land removed from the SFHA is to elevate the entire building above BFE. If basements are to be built in these areas, Technical Bulletin 10-01 provides a simplified method for determining whether those basements will be "reasonably safe from flooding".

Communities have asked for guidance on how they can ensure that future buildings placed on the property will be "reasonably safe from flooding" since, once the LOMR-F is issued, the land is no longer in the SFHA and generally is not subject to their floodplain management ordinance. Communities have several options they can use.

They can withhold signing the acknowledgement until the LOMR-F applicant provides sufficient information on the location and type of proposed buildings to evaluate those building sites against the criteria in Technical Bulletin 10-01. For example, the community could require submission of a subdivision plat or grading plan showing future building locations.

They could adopt or use other requirements that allow them to ensure any future buildings on the filled property remain reasonably safe from flooding. For example, a community may have building code requirements to ensure that any future basements are properly constructed to resist damage from groundwater.

Technical Bulletin 10-01 provides a number of other alternatives for ensuring that unimproved land is "reasonably safe from flooding" and stays that way. Communities have the option of requiring that the applicant submit any engineering information necessary to make the determination.

The criteria in Technical Bulletin 10-01 can also be used to ensure that buildings built with basements that are adjacent to the floodplain are constructed in a way that minimizes potential damages from groundwater during a flood.

For further information, see Technical Bulletin 10-01 *Ensuring that structures Built on Fill in or Near Special Flood Hazard Areas are Reasonably Safe from Flooding in Accordance with the National Flood Insurance Program (TB 10-01).*

ANCHORING

> ***44 CFR 60.3(a)(3)*** *...If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy...*

Both elevated and floodproofed buildings must be properly anchored to stabilize them against flood forces. This means anchoring the building to its foundation and ensuring that the foundation won't move. Therefore, you need to make sure there is adequate protection against hydrostatic and hydrodynamic forces and erosion and scour that can undercut the foundation.

In areas of shallow flooding and low flood velocities, normal construction practices suffice. Additional anchoring measures, such as reinforcing crawlspace walls, using deeper footings, using extra bolts to connect the sill to the foundation, or installing rods to connect the cap to the sill, should be required in three situations:

- Where the flood flows faster than five feet per second.
- In coastal areas subject to waves and high winds.
- In manufactured or mobile homes (see the section on Manufactured Homes for details).

In some areas it may be necessary to use foundations such as piles or piers which provide less resistance to floodwaters.

If your community has any of these conditions, you should see if there are state standards that take these into account, such as state coastal construction or manufactured housing (mobile home) tie-down regulations. If not, it is recommended that the builder's architect or engineer sign a statement saying the design of the building includes "anchoring adequate to prevent flotation, collapse and lateral movement" during the base flood.

FLOOD-RESISTANT MATERIAL

Whether a building is elevated or floodproofed, it is important that all parts exposed to floodwaters be made of flood-resistant materials (Figure 5-14). This includes all portions of the building below the BFE including foundation elements such as floor beams and joists and any below BFE enclosures.

> ***44 CFR 60.3(a) (3)*** *...If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (ii) be constructed with materials resistant to flood damage...*

"Flood-resistant materials" include any building product capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. "Prolonged contact" means at least 72 hours, and "significant damage" is any damage requiring more than low-cost cosmetic repair (such as painting).

- Concrete, concrete block or glazed brick
- Clay, concrete or ceramic tile
- Galvanized or stainless steel nails, hurricane clips and connectors (in areas subject to saltwater flooding)
- Indoor-outdoor carpeting with synthetic backing (do not fasten down)
- Vinyl, terrazzo, rubber or vinyl floor covering with waterproof adhesives.
- Metal doors and window frames.
- Polyester-epoxy paint (do not use mildew-resistant paint indoors, especially on cribs, playpens or toys because it contains an ingredient that is toxic)
- Stone, slate or cast stone (with waterproof mortar)
- Mastic, silicone or polyurethane formed-in-place flooring. Styrofoam insulation
- Water-resistant glue
- Pressure treated (.40 CCA minimum) or naturally decay resistant lumber, marine grade plywood

Figure 5-14: Flood-resistant materials

For further details on flood-resistant material requirements, refer to FEMA Technical Bulletin 2-93, *Flood-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas.*

ACCESSORY STRUCTURES

Certain accessory structures may not qualify as "buildings." For example, open structures, such as carports, gazebos and picnic pavilions that do not have at least two rigid walls, are not "buildings" and do not have to be elevated or floodproofed.

In some cases, low-cost accessory buildings may be wet-floodproofed and do not have to be elevated or dry floodproofed. These structures could include detached garages and small boathouses, pole barns and storage sheds. Such structures must meet these requirements:

- The owner must obtain a variance (contact your FEMA Regional Office on procedures for this type of variance),
- The building must be used only for parking or storage,

- The building must have the required openings to allow floodwaters in and out,
- The building must be constructed using flood resistant materials below the BFE,
- The building must be adequately anchored to resist floatation, collapse, and lateral movement, and
- All building utility equipment including electrical and heating must be elevated or floodproofed.

Wet floodproofing involves using flood-resistant materials below the BFE and elevating things subject to flood damage above the BFE. Items that should be installed above the BFE include electrical boxes, switches and outlets. Only the minimum amount of electrical equipment required by code may be located below the BFE, and that equipment must be flood damage resistant.

For additional guidance, see *Wet Floodproofing Requirements*, FIA-TB-7, FEMA 1994, and *Engineering Principles and Practices for Flood Damage-Resistant Building Support Utility Systems*.

MANUFACTURED HOMES

> ***44 CFR 59.1*** *Definitions: "Manufactured home" means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include a "recreational vehicle".*

Manufactured homes include not only manufactured homes that meet HUD manufactured home standards, but also older mobile homes that pre-date these standards.

Elevation

Generally, manufactured homes must meet the same flood protection requirement as "stick built" or conventional housing. Since they are usually residential buildings, they must be elevated so the lowest floor is above the BFE.

44 CFR 59.1 *Definitions: "Manufactured home park or subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.*

44 CFR 59.1 *Definitions: "Existing manufactured home park or subdivision" means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by the community.*

44 CFR 60.3(c)(6) *Require that manufactured homes placed or substantially improved within Zones A1-30, AH, and AE on the communities FIRM on sites (i) Outside of a manufactured home park or subdivision, (ii) In a new manufactured home park or subdivision, (iii) In an expansion to an existing manufactured home park or subdivision, or (iv) In an existing manufactured home or subdivision on which a manufactured home has sustained "substantial damage" as the result of a flood, be elevated on a permanent foundation such the lowest floor of the manufactured home is elevated to or above the base flood elevation and be securely anchored to an adequately anchored foundation system to resist floatation collapse and lateral movement.*

44 CFR 60.3(c)(12) *Require that manufactured homes to be placed or substantially improved on sites in an existing manufactured home park or subdivision within Zones A-1-30, AH, and AE on the community's FIRM that are not subject to the provisions of paragraph (c)(6) of this section be elevated so that either (I) the lowest floor of the manufactured home is at or above the base flood elevation, or (ii) the manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist floatation, collapse, and lateral movement.*

44 CFR Section 60.3(c)(6) establishes the basic elevation and anchoring requirements that apply to most manufactured home placements including those outside of manufactured home parks and subdivision and in new manufactured home parks and subdivisions. These manufactured homes must have their lowest floors at or above the BFE. These requirements also apply to manufactured homes placed in expansions to existing manufactured home parks and on sites where manufactured homes are substantially damaged by a flood. As with stick-built housing, all parts of the manufactured home below the BFE must be constructed with flood resistant materials and building utility systems must either be elevated or made watertight to the BFE. The best way to meet this requirement is to elevate the bottom of the manufactured home chassis to this elevation. See FEMA's *Manufactured Home Installation in Flood Hazard Areas*, FEMA-85, for additional guidance

44 CFR Section 60.3(c)(12) allows for a limited exemption to elevating to the BFE for sites in existing manufactured housing (mobile home) parks. These older

manufactured home parks were established before Flood Insurance Rate Maps (FIRMs) were issued for the community and before the community adopted a floodplain management ordinance that meets NFIP requirements. In such older parks, a newly placed manufactured home chassis must be "supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade."

This exemption does not apply to repairing or replacing a manufactured home on a site in an existing manufactured home park where a manufactured home has been substantially damaged by a flood.

This exemption is a compromise that tries to balance the flood hazard against the severe economic impacts on some manufactured home park owners that would result if elevation to the BFE were required. There are often practical difficulties in elevating manufactured homes to the BFE in many of the older parks due to small lot sizes and the split ownership of the manufactured home and the lot itself. The exemption may not be necessary or appropriate for your community, especially if manufactured home parks are able to meet the requirement to elevate to the BFE. In other areas, the flood hazard may be so severe that the exemption may put lives and property at too great a risk. Many states have not included this exemption in their model ordinances and it may not be in your regulations.

Anchoring

> *44 CFR 60.3(c)(6) ...[Manufactured homes must] be elevated on a permanent foundation ... and be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement.*

A "permanent foundation" means more than a stack of concrete blocks. It should include a below-grade footing capable of resisting overturning, the depth needs to account for frost depth and expected scour, the footing must be sized appropriately for the site's soil bearing capacity, and the design needs to account for seismic and other hazards.

The following types of permanent foundations can be used:

- Reinforced piers,
- Post-tensioned piers
- Posts,
- Piles,
- Poured concrete walls,
- Reinforced block walls, or
- Compacted fill.

"Adequately anchored" means a system of ties, anchors and anchoring equipment that will withstand flood and wind forces. The system must work in saturated soil conditions. Usually this means over-the-top or frame tie-downs in addition to standard connections to the foundation.

Most states have manufactured home tie-down regulations. Check with your state NFIP coordinator to see if your state's regulations also meet the NFIP anchoring standard. If so, you need only make sure that the state requirement is met for each new manufactured home installed in your floodplain.

If not, see FEMA's *Manufactured Home Installation in Flood Hazard Areas*, FEMA-85, for additional guidance on anchoring. The anchoring requirement does apply in an existing (pre-FIRM) manufactured housing or mobile home park. Even if the manufactured home is not elevated above the BFE, the anchoring system must still withstand the forces of a flood over the first floor.

Evacuation: In some areas, there is adequate warning time to remove a manufactured home from harm's way. Protecting such property should not be discouraged, so FEMA allows an evacuated manufactured home to be put back on the original site in an existing manufactured home park without having to meet the requirements for siting a new manufactured home. Since much can go wrong in trying to evacuate a manufactured home, evacuation is not a substitute for permanently protecting the manufactured home by elevating it to or above the BFE.

RECREATIONAL VEHICLES

> ***44 CFR 59.1** Definitions: "Recreational vehicle" means a vehicle which is:*
>
> *(a) built on a single chassis;*
>
> *(b) 400 square feet or less when measured at the largest horizontal projection;*
>
> *(c) designed to be self-propelled or permanently towable by a light duty truck; and*
>
> *(d) designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.*

A recreational vehicle placed on a site in an SFHA must:

- Meet the elevation and anchoring requirements for manufactured homes, OR
- Be on the site for fewer than 180 consecutive days, OR
- Be fully licensed and ready for highway use. "Ready for highway use" means that it is on its wheels or jacking system is attached to the site only by quick disconnect type utilities and has no permanently attached additions.

The purpose of this requirement is to prevent recreational vehicles from being permanently placed in the floodplain unless they are as well protected from flooding as a manufactured home.

The NFIP does not have minimum requirements for recreational vehicle parks or campgrounds other than the limitations on the placement of recreational vehicles. Recreational vehicle parks and campgrounds are often good uses for floodplains, particularly when flooding usually occurs during seasons when these facilities are not in use or where there is plenty of warning time prior to a flood. These facilities should not be permitted in flash flood areas since there may be loss of life if flooding occurs as well as loss of the recreational vehicles.

AO AND AH ZONES

AO Zones are shallow flooding areas where FEMA provides a base flood depth. Since there is no BFE, the rules read a little differently.

All new construction and substantial improvements of residential structures shall have the lowest floor (including basement) elevated above the highest adjacent grade:

- At least as high as the depth number specified in feet on the community's FIRM, or
- At least two feet if no depth number is specified.

All new construction or substantial improvements of nonresidential structures shall meet the above requirements or, together with attendant utility and sanitary facilities, be floodproofed to the same elevation.

AH Zones are also shallow flooding areas, but have BFEs. Buildings in AH zones must meet the same requirements as in AE zones.

In AO and AH Zones, adequate drainage paths are required around structures on slopes to guide floodwater around and away from proposed structures. (Requiring this throughout the community is a good idea, as it will prevent local drainage problems from causing surface flooding.)

A99 AND AR ZONES

An A99 Zone is an SFHA that will be protected by a Federal flood control project that is currently under construction and which meets specified conditions.

An AR Zone is an SFHA that used to be a B, C or X Zone that used to be protected by an accredited flood control system. The system has been decertified but is in the process of being restored to provide protection to the base flood level.

When the flood control systems are completed or restored, the areas in A99 and AR Zones are expected to be remapped and taken out of the SFHA. Until then, they are treated as SFHA for insurance purposes and there are some floodplain management requirements.

A99 and AR Zones are special situations—few exist. If you have one, you should contact your state NFIP coordinating agency or FEMA Regional Office for guidance on regulatory requirements for you situation.

F. New Buildings in V Zones

Zones V1-30, VE and/or V identified on FIRMs designate high hazard areas along coastlines that are subject to flooding from storm surge and wave impacts during coastal storms and hurricanes. Different construction standards apply in V-zones to help buildings withstand these wave impacts. See Unit 3 for information on how V-zones are designated. Many V Zones are also subject to erosion and scour which can undercut building foundations.

Basic rule #5: Due to wave impacts, V Zones have special building protection standards in addition to the requirements for A Zones.

This section identifies only those building protection requirements that differ from the A Zone criteria. Unless mentioned in this section, all A Zone standards apply for new and substantially improved buildings in V Zones. If your community contains V-zones, you will need more information than is contained in this section to adequately regulate coastal construction. You should obtain a copy of FEMA's *Coastal Construction Manual,* FEMA-55 (May 2000) and, if possible, attend a course on coastal construction offered by FEMA, your state, or a building code organization.

Building Location

New or substantially improved buildings in V Zones must be located landward of the reach of mean high tide. They cannot be built over water. In fact, it's best to be as far back from the shore as possible in order to avoid the more dangerous areas subject to waves and erosion. The ability of a building to withstand wave impacts increases the farther it is set back from the shore.

Avoid areas of sand dunes and mangroves. Human alteration of sand dunes and mangrove stands within V Zones is prohibited unless it can be demonstrated that such alterations will not increase potential flood damage.

Both of these natural features are protected against alteration because they are important first lines of defense against coastal storms and can do much to reduce losses to inland coastal development.

Generally, you can assume that any removal or other alteration of a sand dune will increase flood damage. The burden should be placed on the permit applicant to demonstrate that this will not occur. This will require a report by a coastal engineer or geologist.

Elevation on Piles or Columns

All new construction and substantial improvements to buildings in V Zones must be elevated on pilings, posts, piers or columns.

> ***44 CFR 60.3(e)(4)*** *[The community must] Provide that all new construction and substantial improvements in Zones V1-30 and VE, and also Zone V if base flood elevation data is available, on the community's FIRM, are elevated on pilings and columns so that (i) the bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to or above the base flood level...*

Other methods of elevating buildings —on fill, solid walls or crawlspaces— and floodproofing are prohibited because these techniques present obstructions to wave action. The force of a breaking wave is so great that these types of foundations would be severely damaged, resulting in collapse of the building. Waves can also ramp up on fill and reach the elevated portions of the building.

Construction on piles or columns allows waves to pass under the building without transmitting the full force of the waves to the building's foundation. A special case is made for installing breakaway walls between the pilings or columns, but such walls are not supporting foundation walls.

While fill is not allowed for structural support for buildings within V Zones because of the severe erosion potential of such locations, limited fill is allowed for landscaping, local drainage needs, and to smooth out a site for an unreinforced concrete pad. However, this fill cannot in any way obstruct the flow of water under the building.

How high? Within V Zones, the controlling elevation is the bottom of the lowest horizontal structural member of the lowest floor. (In comparison, within A Zones, the controlling elevation is the *top* of the lowest floor.) This is to keep the entire building above the anticipated breaking wave height of a base flood storm surge.

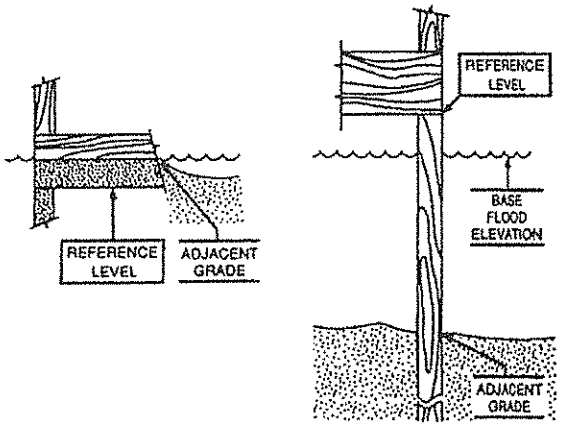


Figure 5-15: In V Zones, the lowest floor is measured from the bottom of the lowest horizontal structural member

Wind and water loads

The design of the supporting foundation must account for wind loads in combination with the forces that accompany the base flood. Cross bracing and proper connections are key to doing this.

44 CFR 60.3(e)(4) *...(ii) [The community must ensure that] the pile or column foundation and structure attached thereto is anchored to resist flotation, collapse and lateral movement due to the effects of wind and water loads acting simultaneously on all building components. Water loading values used shall be those associated with the base flood. Wind loading values used shall be those required by applicable State or local building standards. A registered professional engineer or architect shall develop or review the structural design, specifications and plans for the construction, and shall certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the provisions of (e)(4)(i) and (ii) of this section.*

Piles made of wood, steel, or pre-cast concrete are preferred over block columns and similar foundations that are less resistant to lateral forces. Pilings are necessary in areas subject to erosion and scour, but it is critical that they be embedded deep enough (Figure 5-16).

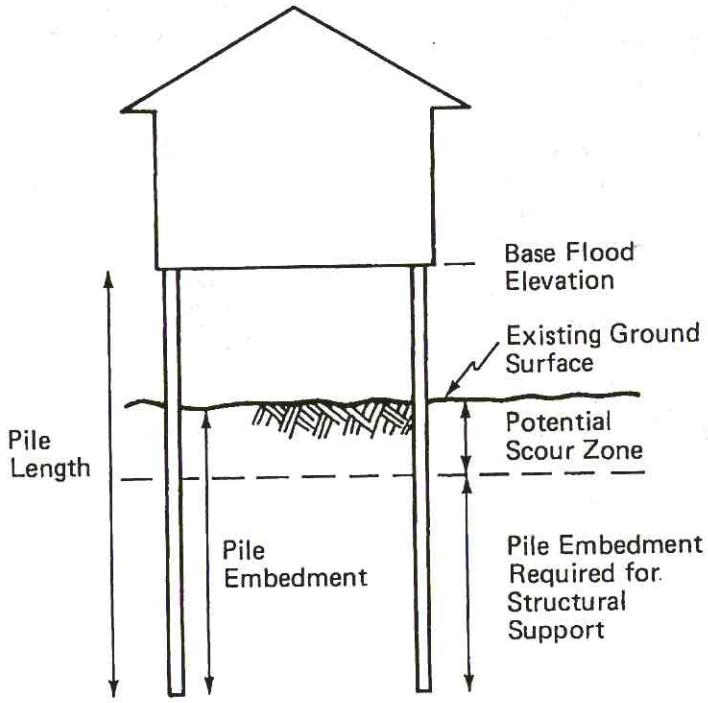


Figure 5-16: Piles must be embedded well below the scour depth

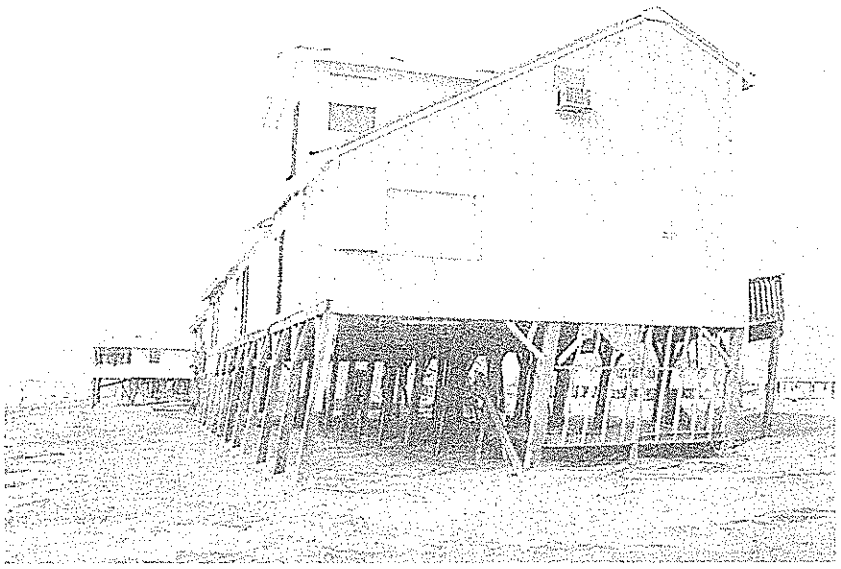


Figure 5-17: This house had inadequate pile embedment and cross bracing

Certification

Designing and constructing a V-zone building requires the involvement of a design professional to ensure that the building will withstand the combined forces of wind and wave impact. A registered professional engineer or architect must develop or review the structural design, specifications and plans for the construction, and certify that the design and planned methods of construction are in accordance with accepted standards of practice for meeting the above provisions.

You must maintain a copy of the engineer's or architect's certification in the permit file for all structures built or substantially improved in the V Zone.

The North Carolina Division of Emergency Management has prepared a V-Zone certification form (Figure 5-18) to ensure that these requirements are met. This is provided as an example. Check with your state NFIP coordinator to see if your state has developed a V Zone certification form.

BREAKAWAY WALLS

The preferred method of constructing a V-zone building is to leave the area below the elevated floor free of obstruction or to enclose the area only with latticework or insect screening. That way waves can freely flow under the building without placing additional loads on the foundation. The only solid walls allowed below the lowest floor in a building in a V Zone are breakaway walls that will give way under wind and water loads without causing collapse, displacement or other damage to the elevated portion of the building or the supporting pilings or columns. Just as in A Zones, this space enclosed by these walls is to be used

solely for parking of vehicles, building access or storage, and must be constructed of flood-resistant material.

V-Zone Certification

Property Information	For Insurance Company Use
Name of Building Owner	Policy Number
Building Address or Other Description	
City	State Zip Code

SECTION I: FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Note: to be obtained from appropriate FIRMs

Community Number	Panel Number	Suffix	Date of FIRM Index	FIRM Zone

SECTION II: ELEVATION INFORMATION

Note: This form is not a substitute for an Elevation Certificate. Elevations should be rounded to nearest tenth of a foot.

1. Elevation of the Bottom of Lowest Horizontal Structure Member ..... _____feet
2. Base Flood Elevation ..... _____feet
3. Elevation of Lowest Adjacent Grade ..... _____feet
4. Approximate Depth of Anticipated Scour/Erosion Used for Foundation Design ..... _____feet
5. Embedment Depth of Pilings or Foundation Below Lowest Adjacent Grade ..... _____feet
6. Datum Used: _____ NGVD '29 _____ NAVD '88 _____ Other

SECTION III: FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Note: This section must be certified by a registered professional engineer or architect

I certify that I have developed or reviewed the structural design, plans and specifications for construction and that the methods of construction to be used are in accordance with accepted standards of practice for meeting the following provisions:

a) The bottom of the lowest horizontal structure member of the lowest floor (excluding the pilings or columns) is elevated to or above the BFE; and,

b) The pile or column foundation and structure attached thereto is anchored to resist flotation, collapse and lateral movement due to the effects of the wind and water loads acting simultaneously on all building components. Water loading values used are those associated with the base flood including wave action. Wind loading values used are those required by the applicable State or local building code. The potential for scour and erosion at the foundation has been anticipated for conditions associated with the flood, including wave action.

SECTION IV: FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Note: This section must be certified by a registered professional engineer or architect

I certify that I have developed or reviewed the structural design, plans and specifications for construction and that the design and methods of construction to be used for the breakaway walls are in accordance with accepted standards of practice for meeting the following provisions:

c) Breakaway collapse shall result from water load less than that which would occur during the base flood; and,

d) The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (wind and water loading values defined in Section III)..

SECTION V: CERTIFICATION

(Check: Section III ____ and/or Section IV ____)

Name of Certifier	Title	License Number
Firm Name		Phone Number ( )
Street Address		
City	State	Zip Code
Signature		Date

Figure 5-18: Sample V Zone certification

> ***44 CFR 60.3(e)(5)*** *[The community must] Provide that all new construction and substantial improvements within Zones V1-30, VE, and V on the community's FIRM have the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system. For the purposes of this section, a breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. Use of breakaway walls which exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by local or State codes) may be permitted only if a registered professional engineer or architect certifies that the designs proposed meet the following conditions:...*

Solid breakaway walls are allowed, as are garage doors that meet the same breakaway requirements. Solid breakaway walls are intended to collapse under the force of wave impacts without damaging the buildings foundation or the elevated portion of the building. All solid breakaway walls should have their designs certified by a registered professional engineer or architect. This can be done as part of the anchoring certification discussed earlier in this section.

The area enclosed by solid breakaway walls should be limited to less than 300 square feet because:

- Flood insurance rates increase dramatically for enclosures larger than 300 square feet.
- Larger areas encourage conversion to habitable living areas, which are difficult to detect and enforce as violations and which can sustain significant damage during a storm.

COASTAL AE ZONES

NFIP regulations apply the same minimum requirements to both coastal AE zones and riverine AE zones. FEMA has concluded that these standards may not provide adequate protection in coastal AE zones subject to wave effects, velocity flows, erosion, scour, or combinations of these forces. Wave tank studies have shown that breaking waves considerably less than the 3-foot criteria used to designate VE zones can cause considerable damage.

FEMA's *Coastal Construction Manual*, FEMA-55 (May 2000) and other recent FEMA publications have introduced the concept of Coastal AE Zone to encourage use of V-zone construction methods and standards in these areas. For example, pile or column or other open foundations are more likely to withstand wave impacts than other types of foundations. If your community contains Coastal AE Zones, you are encouraged to revise your ordinances to apply all or some of the VE zone standards to these areas.

G. OTHER REQUIREMENTS

The primary thrust of the NFIP regulations is to protect insurable buildings and reduce future exposure to flood hazards. However, there are some additional requirements that help ensure that the buildings stay habitable and additional flood problems are not created.

SUBDIVISIONS

As noted in Section B of this unit, once you obtain base flood elevations for a subdivision or other large development, new buildings must be properly elevated or floodproofed. These subdivisions and developments must also be reviewed to ensure they are reasonably safe from flood damage.

> ***44 CFR 60.3(a)(4)*** *[The community must] Review subdivision proposals and other proposed new development including manufactured home parks or subdivisions, to determine whether such proposals will be reasonably safe from flooding. If a subdivision proposal or other proposed new development is in a floodprone area, any such proposals shall be reviewed to assure that (i) all such proposals are consistent with the need to minimize flood damage within the floodprone area, (ii) all public utilities and facilities, such as sewer, gas, electrical, and water systems are located and constructed to minimize or eliminate flood damage, and (iii) adequate drainage is provided to reduce exposure to flood hazards;*

This review applies to subdivisions and other development, such as apartments, parks, shopping centers, schools and other projects.

If a site is floodprone, the builder should:

- Minimize flood damage by locating structures on the highest natural-ground.
- Have public utilities and facilities located and constructed so as to minimize flood damage.
- Provide adequate drainage for each building site.

The site plans of new development and proposed plats for subdivisions can usually be designed to minimize the potential for flood damage while still achieving the economic goals of the project. For example, lot size could be reduced and the lots clustered on high ground, with building sites having views of the floodplain. See Unit 6 for ideas on how subdivisions can be designed to minimize flood damages.

WATER AND SEWER SYSTEMS

> ***44 CFR 60.3(a)(5)*** *[The community must] Require within flood-prone areas new and replacement water supply systems to be designed to minimize or eliminate infiltration of flood waters into the systems; and*
>
> ***44 CFR 60.3(a)(6)*** *[The community must] Require within flood-prone areas (i) new and replacement sanitary sewage systems to be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters and (ii) onsite waste disposal systems to be located to avoid impairment to them or contamination from them during flooding.*

The objective of these requirements is to ensure that a building that is protected from flood damage can still be used after the flood recedes.

In most instances, these criteria can be met through careful system design. Manholes should be raised above the 100-year flood level or equipped with seals to prevent leakage. Pumping stations should have electrical panels elevated above the BFE.

On-site waste disposal systems should be located to ensure they will not release contamination in a flood and can be used after flood waters recede. The first objective should be to locate the system outside the flood hazard area, if that is feasible. At a minimum, an automatic backflow valve should be installed to prevent sewage from backing up into the building during flooding.

WATERCOURSE ALTERATIONS

> ***44 CFR 60.3(b)(6)*** *[The community must] Notify, in riverine situations, adjacent communities and the State Coordinating Office prior to any alteration or relocation of a watercourse, and submit copies of such notifications to the [Federal Insurance] Administrator;*

The community must notify adjacent communities and the appropriate state agency prior to altering or relocating any river or stream within its jurisdiction. Copies of such notifications must be submitted to the FEMA Regional Office.

> ***44 CFR 60.3(b)(7)*** *[The community must] Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained;*

Any alteration or relocation of a watercourse should not increase the community's flood risks or those of any adjacent community. This could happen if the watercourse's capacity to carry flood flow is reduced because a smaller or less-efficient channel is created, or by modifications to the floodway as a result of the project. You must ensure that the altered or relocated channel has at least the capacity of the old channel. For any significant alteration or relocation, you should consider requiring the applicant to have an engineer certify that the flood-flow

carrying capacity is maintained and that there will be no increase in flood flows downstream.

After altering a watercourse, the developer has created an artificial situation and must assume responsibility for maintaining the capacity of the modified channel in the future. Otherwise, flooding is likely to increase as the channel silts in, meanders or tries to go back to its old location.

Federal and state permits may be required for any alteration or relocation activity. It is recommended that the community require the submittal and approval of a CLOMR from FEMA for large-scale proposals (see CLOMR procedures discussion in Unit 4, Section D).

5. Tulare County Zoning Districts F-1 Primary Flood Plain Zone and F-2 Secondary Flood Plain Combining Zone (Descriptions, Flood Risk, Encroachment, and Mitigation).

SECTION 14.7: "F-1" PRIMARY FLOOD PLAIN ZONE

(Added by Ord. No. 1371, effective 4-16-70; amended by Ord. No. 2741, effective 12-4-86)

PURPOSE: A. The purpose of the Primary Flood Plain Zone shall be the prevention of loss of life, the minimization of property damage, and the maintenance of satisfactory conveyance capacities of waterways through the prevention of encroachments by obstructions in the floodway which may diminish the ability of the floodway to carry overloads during periods of flooding. This Zone is to be used in concert with the flood damage prevention regulations established in Chapter 8 of Part VII of the Ordinance Code of Tulare County. However, it shall only be delineated on the County Zoning Map when necessary to conform to the County General Plan or when necessary to establish flood plain regulations after completion of a Federal project report pursuant to Section 8411 of the California Water Code.

APPLICATION B. This zone may function either as an exclusive zone or in combination with other zones and may be applied only to those areas within the boundaries of the Selected Flood which have been determined to be the floodway area through an analysis of flood frequency, natural topography, bank erosion, channel shifts, flood profiles, velocity of flood waters or other applicable factors.

USE C. 1. When the Zoning Map indicates that the F-1 Zone is an exclusive zone, only the following uses shall be permitted provided such uses are authorized pursuant to the procedures set forth in Chapter 8 of Part VII of the Ordinance Code of Tulare County:

The growing and harvesting of field crops, vines, vegetables and horticultural specialties, excluding trees.

The operation of apiaries.

The grazing of sheep, goats, horses, mules, swine, bovine animals and other similar domesticated quadrupeds.

The raising of poultry.

Wildlife preserves.

One (1) non-expandable recreation vehicle having no permanently attached or detached accessory structures, for each parcel of property under separate ownership, for use only by the owner of the property and/or his guests. Said recreation vehicles shall be maintained in a readily movable state and shall be located on the property only during the months of May through November, inclusive, and shall be removed from the property during the months of December through April, inclusive.

Public utility facilities, except those structures for which a use permit is required as specified under Subsection "D" of this Section.

Flood control channels, surface water spreading grounds, stream bed retarding basins, and other similar facilities which have been approved by the Tulare County Flood Control District.

Parking lots provided any grading or structures do not significantly restrict the carrying capacity of the floodway.

2. When the Zoning Map indicates that the F-1 Zone is combined with other zones, only the following uses shall be permitted:

All those uses listed under Paragraph 1 of this subsection which are allowed in the underlying or base zone.

Single family dwellings, mobilehomes and accessory residential and agricultural structures shall be allowed if they are allowed in the underlying or base zone, provided that all construction or installations are approved in accordance with the procedures referred to in Chapter 8 of Part VII of the Ordinance Code of Tulare County.

All uses allowed in the underlying or base zone which are not allowed under Paragraph 1 of this subsection if approved in accordance with the procedures referred to in Chapter 8 of Part VII of the Ordinance Code of Tulare County.

USE PERMITS

D. The following uses, buildings and structures shall be permitted in this zone only if a Use Permit is approved pursuant to the procedures referred to in Paragraph B of Part II of Section 16 of this Ordinance.

1. When the Zoning Map indicates that the F-1 Zone is an exclusive Zone:

Private and public recreational uses such as: parks, aquatic facilities, campgrounds, recreation vehicle parks, playgrounds, athletic fields, golf courses, golf driving ranges, fishing and hunting clubs.

Temporary and readily removable structures accessory to agricultural uses.

Public utility structures.

Excavation and removal of rock, sand, gravel and other materials; provided, however, that no Use Permit shall be required if a surface mining permit and/or reclamation plan is required under the provisions of Section 7-25-1000 et seq. of the Ordinance Code of Tulare County.

2. When the Zoning Map indicates that the F-1 Zone is combined with other zones:

All those uses listed under Paragraph 1 of this subsection which are allowed in the underlying or base zone.

All uses which may be permitted subject to the granting of a Use Permit in the underlying or base zone.

Said Use Permit shall be granted only if it is found that any building or structure to be constructed will conform to the requirements set forth in Chapter 8 of Part VII of the Ordinance Code of Tulare County.

SECTION 14.8: "F-2" SECONDARY FLOOD PLAIN COMBINING ZONE

(Added by Ord. No. 1371, effective 4-16-70; repealed by Section 8 of Ord. No. 2741, effective 12-4-86.)

ORDINANCE NO. 2741

Section 9 of Ordinance No. 2741 states as follows:

"It is the intent of the Board of Supervisors of the County of Tulare that Section 8 of this Ordinance not be effective until the County Zoning Map has been amended to change all existing "F-2" zoning designations to other zoning classifications, in accordance with the procedures established in Section 17 of Ordinance No. 352 for changing zone boundaries or classifications."

PURPOSE

A. The purpose of the Secondary Flood Plain Combining Zone shall be the protection of life and property from the hazards and damages which may result from flood waters of the selected flood magnitude. This zone is intended for application to those areas of the County which lie within the fringe area of the flood plain and are subject to less severe inundation during flooding conditions than occur in the F-1 Zone.

APPLICATION

B. This zone is intended to be combined with other zones and may be applied only to those areas located within the boundaries of the selected flood which lie outside the "F-1" Primary Flood Plain Zone, as determined through an analysis of flood frequency, natural topography, bank erosion, channel shifts, flood profiles, velocity flows or other applicable factors.

USE

C. Only the following uses are allowed in the F-2 Zone:

1. All those uses listed under Subsection C of Section 14.7 of this Ordinance which are allowed in the underlying or base zone.

2. Single family dwellings and accessory residential and agricultural structures shall be allowed if they are allowed in the underlying or base zone, only if they comply with one or more of the following conditions:

   a. The bottom of the structural floor of any such building will be above the selected flood profile level as shown on the Zoning Map for the building site; or,

   b. All permanent buildings will be protected from

flooding by dikes, levees or other flood protection works whose design has been approved by the Tulare County Flood Control District.

USE PERMITS

D. The following uses, buildings and structures shall be permitted in the "F-2" Zone only if a Use Permit is approved subject to the procedures referred to in Paragraph B of Part II of Section 16 of this Ordinance:

1. All uses allowed in the underlying or base zone which are not allowed under Subsection C of this Section.

2. All uses which may be permitted under USE Permit in the underlying or base zone.

3. Additions or structural modifications to all existing structures and accessory structures which do not comply with the requirements in Subsection C of this Section.

Said Use Permit shall be granted only if it is found that any building or structure to be constructed will be so constructed or located, or will be so protected by levees or other methods of flood proofing as to render them either resistant to flotation or immune to extensive damage by flooding, and to prevent peripheral flooding of other properties as a result of such construction.

6. General Plan Policies (Flooding).

FLOOD CONTROL

TULARE COUNTY GENERAL PLAN 2030 UPDATE POLICIES

LAND USE ELEMENT

LU-3.6 Project Design
The County shall require residential project design to consider natural features, noise exposure of residents, visibility of structures, circulation, access, and the relationship of the project to surrounding uses. Residential densities and lot patterns will be determined by these and other factors. As a result, the maximum density specified by General Plan designations or zoning for a given parcel of land may not be attained.

HEALTH AND SAFETY ELEMENT

HS-1.4 Building and Codes
Except as otherwise allowed by State law, the County shall ensure that all new buildings intended for human habitation are designed in compliance with the latest edition of the California Building Code, California Fire Code, and other adopted standards based on risk (e.g., seismic hazards, flooding), type of occupancy, and location (e.g., floodplain, fault).

HS-1.5 Hazard Awareness and Public Education
The County shall continue to promote awareness and education among residents regarding possible natural hazards, including soil conditions, earthquakes, flooding, fire hazards, and emergency procedures.

HS-1.11 Site Investigations
The County shall conduct site investigations in areas planned for new development to determine susceptibility to landslides, subsidence/settlement, contamination, and/or flooding.

HS-5.1 Development Compliance with Federal, State, and Local Regulations
The County shall ensure that all development within the designated floodway or floodplain zones conforms with FEMA regulations and the Tulare County Flood Damage Prevention Ordinance. New development and divisions of land, especially residential subdivisions, shall be developed to minimize flood risk to structures, infrastructure, and ensure safe access and evacuation during flood conditions.

HS-5.2 Development in Floodplain Zones
The County shall regulate development in the 100-year floodplain zones as designated on maps prepared by FEMA in accordance with the following:
1. Critical facilities (those facilities which should be open and accessible during emergencies) shall not be permitted.
2. Passive recreational activities (those requiring non-intensive development, such as hiking, horseback riding, picnicking) are permissible.
3. New development and divisions of land, especially residential subdivisions, shall be developed to minimize flood risk to structures, infrastructure, and ensure safe access and evacuation during flood conditions.

HS-5.3 Participation in Federal Flood Insurance Program
The County shall continue to participate in the National Flood Insurance Program (NFIP).

HS-5.4 Multi-Purpose Flood Control Measures
The County shall encourage multipurpose flood control projects that incorporate recreation, resource conservation, preservation of natural riparian habitat, and scenic values of the County's streams, creeks, and lakes. Where appropriate, the County shall also encourage the use of flood and/or stormwater retention facilities for use as groundwater recharge facilities.

HS-5.5 Development in Dam and Seiche Inundation Zones
The County shall review projects for their exposure to inundation due to dam failure. If a project presents a direct threat to human life, appropriate mitigation measures shall be taken, including restriction of development in the subject area.

HS-5.6 Impacts to Downstream Properties
The County shall ensure that new County flood control projects will not adversely impact downstream properties or contribute to flooding hazards.

HS-5.7 Mapping of Flood Hazard Areas
The County shall require tentative and final subdivision maps and approved site plans to delineate areas subject to flooding during a 100-year flood event.

HS-5.8 Road Location
The County shall plan and site new roads to minimize disturbances to banks and existing channels and avoid excessive cuts and accumulations of waste soil and vegetative debris near natural drainage ways.

HS-5.9 Floodplain Development Restrictions
The County shall ensure that riparian areas and drainage areas within 100-year floodplains are free from development that may adversely impact floodway capacity or characteristics of natural/riparian areas or natural groundwater recharge areas.

HS-5.10 Flood Control Design
The County shall evaluate flood control projects involving further channeling, straightening, or lining of waterways until alternative multipurpose modes of treatment, such as wider berms and landscaped levees, in combination with recreation amenities, are studied.

HS-5.11 Natural Design
The County shall encourage flood control designs that respect natural curves and vegetation of natural waterways while retaining dynamic flow and functional integrity.

HS-7.3 Maintain Emergency Evacuation Plans
The County shall continue to create, revise, and maintain emergency plan for the broad range of natural and human-made disasters and response activities that could foreseeably impact Tulare County. This shall include, but not be limited to, flooding, dam

failure, extreme weather, evacuation/transportation, mass care and shelter, and animal evacuation and sheltering. Emergency Planning projects shall be in line with the County's Strategic Plan and Emergency Operations Plan, and incorporate current guidance and initiatives from State and Federal Emergency Management Agencies.

ENVIRONMENTAL RESOURCES MANAGEMENT ELEMENT

ERM-2.7 Minimize Adverse Impacts
The County will minimize the adverse effects on environmental features such as water quality and quantity, air quality, flood plains, geophysical characteristics, biotic, archaeological, and aesthetic factors.

PUBLIC FACILITIES AND SERVICES ELEMENT

PFS-4.1 Stormwater Management Plans
The County shall oversee, as per Community Plan Content Table PF-2.1 and Specific Plan Content, Hamlet Plans Policy PF-3.3, and Table LU-4.3, the preparation and adoption of stormwater management plans for communities and hamlets to reduce flood risk, protect soils from erosion, control stormwater, and minimize impacts on existing drainage facilities, and develop funding mechanisms as a part of the Community Plan and Hamlet Plan process.

PFS-4.3 Development Requirements
The County shall encourage project designs that minimize drainage concentrations and impervious coverage, avoid floodplain areas, and where feasible, provide a natural watercourse appearance.

PFS-4.6 Agency Coordination
The County shall work with the Army Corps of Engineers and other appropriate agencies to develop stormwater detention/retention facilities and recharge facilities that enhance flood protection and improve groundwater recharge.

FOOTHILL GROWTH MANAGEMENT PLAN

FGMP-4.1 Identification of Environmentally Sensitive Areas
The County shall identify and protect those environmentally sensitive areas in the foothill development corridors which should be maintained as open space, such as areas characterized by floodplains, steep slopes (30 percent or greater), unstable geology, unique archaeological/historical sites, habitat of special status species, and scenic vistas.

FGMP-8.3 Development in the Floodplain
The County shall prohibit development of residences or permanent structures within the 100-year floodway.

FGMP-8.6 Development in the Frazier Valley Watershed
The County shall ensure that projects proposed in the Frazier Valley watershed portion of the Tule River Development Corridor do not aggravate the downstream flooding problem by generating additional runoff from the project site.

7. Agency Responsibilities and Coordination (County of Tulare, FEMA, Reclamation Board/Central Valley Flood Protection Board , California Fish & Wildlife, Army Corps of Engineers).

(Discussion)