FLOOD INSURANCE STUDY

SOLANO COUNTY, CALIFORNIA
AND INCORPORATED AREAS
VOLUME 1 OF 3

COMMUNITY NAME	COMMUNITY NUMBER
BENICIA, CITY OF	060368
DIXON, CITY OF	060369
FAIRFIELD, CITY OF	060370
RIO VISTA, CITY OF	060371
SUISUN CITY, CITY OF	060372
VACAVILLE, CITY OF	060373
VALLEJO, CITY OF	060374
SOLANO COUNTY (UNINCORPORATED AREAS)	060631

REVISED: JUNE 9, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
06095CV001C

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Select Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross-sections). Former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
B	X
C	X

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: May 4, 2009
Revised Countywide FIS Effective Dates: August 2, 2012
June 9, 2014

TABLE OF CONTENTS

Table of Contents – Volume 1 – June 9, 2014

Page

1.0 INTRODUCTION 1

1.1 Purpose of Study 1

1.2 Authority and Acknowledgments 1

1.3 Coordination 5

2.0 AREA STUDIED 6

2.1 Scope of Study 6

2.2 Community Description 9

2.3 Principal Flood Problems 18

2.4 Flood Protection Measures 25

3.0 ENGINEERING METHODS 30

3.1 Hydrologic Analyses 30

3.2 Hydraulic Analyses 47

3.3 Vertical Datum 66

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS 67

4.1 Floodplain Boundaries 67

4.2 Floodways 72

FIGURES

Figure 1 – Floodway Schematic 75

TABLES

Table 1 – Initial and Final CCO Meetings 6
Table 2 – Flooding Sources Studied by Detailed Methods 7
Table 3 – Flooding Sources Studied by Approximate Methods 8
Table 4 – Letters of Map Change 9
Table 5 – Drainage Areas and Stream Gradients 12
Table 6 – Frequencies of Past Floods or Tidal Stages 25
Table 7 – Tidal Gages 36
Table 8 – Summary of Discharges 39
Table 9 – Summary of Stillwater Elevations 47
Table 10 – Manning's "n" Values 59
Table 11 – List of Structures Requiring Flood Hazard Revisions 63
Table 12 – List of Accredited Levees 66
Table 13 – Topographic Map Information 71
Table 14 – Floodway Data Tables 76

TABLE OF CONTENTS, continued

Table of Contents – Volume 2

		Page
5.0	INSURANCE APPLICATIONS	90
6.0	FLOOD INSURANCE RATE MAP	91
7.0	OTHER STUDIES	93
8.0	LOCATION OF DATA	93
9.0	BIBLIOGRAPHY AND REFERENCES	93

TABLES, continued

Table 15 – Community Map History 92

EXHIBITS

Exhibit 1 – Flood Profiles

Alamo Creek	Panels 01P–04P
Panels Not Printed	Panels 05P–12P
Blue Rock Springs Creek	Panel 13P
Bucktown Creek	Panels 14P–16P
Cache Slough – Maine Prairie Slough	Panel 17P
Chabot Creek	Panels 18P–21P
Clayton Creek	Panel 22P
Dan Wilson Creek	Panels 23P–25P
Encinosa Creek	Panel 26P
Gibson Canyon Creek	Panels 27P–31P
Gordon Valley Creek	Panels 32P–33P
Green Valley Creek	Panels 34P–39P
Horse Creek	Panels 40P–43P
Industrial Creek	Panel 44P
Lagoon Drain	Panel 45P
Laguna Creek	Panels 46P–48P
Laurel Creek	Panels 49P–52P
Laurel Creek Diversion Channel	Panel 53P
Ledgewood Creek	Panels 54P–60P
Lemon Street Canal	Panels 61P–64P
Magazine Street Canal	Panel 65P
Panels Not Printed	Panels 66P-67P
Marina Creek	Panels 68P–69P
Marina Creek Tributary	Panel 70P

TABLE OF CONTENTS, continued

Table of Contents – Volume 3

EXHIBITS, continued

McCoy Creek	Panels 71P–76P
Middle Branch Horse Creek	Panels 77P–78P
Middle Swale To South Branch Horse Creek	Panel 79P
Miller Ditch	Panels 79Pa-79Pc
Miner Slough	Panel 80P
North Branch Horse Creek	Panel 81P
Panels Not Printed	Panels 82P–83P
Old Alamo Creek	Panels 84P–88P
Pennsylvania Avenue Creek	Panels 89P–91P
Pine Tree Creek	Panels 92P–93P
Pine Tree Creek Split	Panel 94P
Rindler Creek	Panels 95P–98P
Rindler Creek – Parking Overflow	Panel 98Pa
Sacramento River	Panels 99P
South Branch Gibson Canyon Creek	Panels 100P–102P
South Branch Horse Creek	Panel 103P
South Fork Rindler Creek	Panel 104P
Panel Not Printed	Panel 105P
Steamboat Slough	Panel 106P
Suisun Creek	Panels 107P–115P
Sulphur Springs Creek	Panels 116P–118P
Sulphur Springs Creek Overflow	Panel 119P
Sutter Slough	Panel 120P
Panel Not Printed	Panel 121P
Ulatis Creek (Above Cache Slough)	Panels 122P–123P
Ulatis Creek (Above Leisure Town Road)	Panels 124P–126P
Union Avenue Creek	Panels 127P–136P
Union Avenue Creek Diversion Channel	Panels 137P–138P
Union Creek	Panels 139P–143P
Watson Hollow	Panel 144P
Wild Horse Creek	Panel 145P
Yolo Bypass	Panel 146P
Sweeney Creek	Panels 147P-148P

Published Separately – Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
SOLANO COUNTY, CALIFORNIA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of Solano County, California, including: the Cities of Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, Vallejo, and the unincorporated areas of Solano County (hereinafter referred to collectively as Solano County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by Solano County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to update the Solano County countywide FIS with the addition of a new limited detailed study on Sweeney Creek. The authority and acknowledgments prior to this countywide FIS, were compiled from the previously identified FIS reports for flood prone jurisdictions within Solano County and are shown below:

Benicia, City of: The hydrologic and hydraulic analyses for this study were performed by Gill & Pulver Engineers, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-85-C-1891. This study was completed in June 1986. A revised hydrologic analysis for the Sulphur Springs Creek was performed by Camp Dresser and McKee (CDM) for the City of Benicia. This study was completed

in October 1987 and was accepted by FEMA on May 1988. The revised hydraulic analysis, which incorporated the revised CDM discharges, was performed by Baker Engineer, Inc. for FEMA. This study was completed in December 1988.

Dixon, City of: The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (USACE), for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12. This work, which was completed in September 1979, covered all significant flooding sources affecting the City of Dixon.

The behind levee analyses for this study was performed by URS Corporation, for FEMA, under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Fairfield, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12. This work, which was completed in September 1979, covered all significant flooding sources affecting the City of Fairfield.

This study was revised on April 16, 1991, to modify the flood hazard information along Laurel Creek, and to include the restudy of hydraulic conditions on Union Creek. The hydraulic analysis for Laurel Creek was performed by Mackay & Somps; the hydrologic and hydraulic analysis for Union Creek was performed by Gill & Pulver Engineering, Inc., for FEMA, under Contract No. EMW-89-C2846, and completed in February 1990.

A third revision was completed on September 15, 1993, to modify the flood hazard information along Dan Wilson Creek. The hydraulic analysis was performed by Creegan and D'Angelo.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for FEMA, under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Rio Vista, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project

Rio Vista, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12 and Interagency Agreement No. EMW-E-1153, Project Order No. 1, Amendments No. 22 and 22(a). This work was completed in September 1979 and revised in November 1985.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for FEMA, under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Suisun City, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12. This work, which was completed in September 1979, covered all significant flooding sources affecting the City of Vacaville.

Vacaville, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12. This work, which was completed in September 1979, covered all significant flooding sources affecting the City of Suisun City.

This study was revised on January 17, 1997, to incorporate the new detailed hydrologic and hydraulic analyses for Alamo Creek, Encinosa Creek, Laguna Creek, Ulatis Creek, and Bucktown Creek. The analyses were performed by Borcalli & Associates, Inc., for FEMA, under Contract No. EMW-92-C-3818. The work was completed in February 1994.

A third revision was completed on May 7, 2001 to incorporate detailed flood-hazard information along Gibson Canyon Creek, South Branch Gibson Canyon Creek, Horse Creek, Middle Branch Horse Creek, Pine Tree Creek, South Branch Horse Creek, Middle Swale to South Branch Horse Creek, North Branch Horse Creek, and Pine Tree Creek Split. The hydrologic and hydraulic analyses for this restudy were performed for FEMA by Borcalli & Associates, Inc. under Contract No. EMW-96-CO-0095. This work was completed in November 1997.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for FEMA, under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

Vallejo, City of: The hydrologic and hydraulic analyses for this study were performed by the USACE for FEMA, under Interagency Agreement No. IAA-1-1-15-72, Project Order No. 7. This work, which was completed in August 1972, covered all significant flooding sources affecting the City of Vallejo.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

This study was revised on June 9, 2014, to revise the hydrologic and hydraulics analyses for Miller Ditch, Rindler Creek, Rindler Creek – Parking Overflow, South Fork Rindler Creek, Blue Rock Springs Creek, Lake Dalwigk/Lemon Street Canal, and Magazine Street Canal, by BakerAECOM, for FEMA, under Contract No. HSFEHQ-09-D-0368.

Solano County (Unincorporated areas): The hydrologic and hydraulic analyses for the original study were performed by the USACE, Sacramento District, for FEMA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 12. The original study was completed in September 1979. This work covered all significant flooding sources affecting Solano County.

This study was revised on September 27, 1991, to add flooding from Union Creek. The hydrologic and hydraulic analyses for this study were performed by Gill & Pulver Engineers, Inc., for FEMA, under Contract No. EMW-89-C-2846. This work was completed in February 1990.

A third revision was completed on July 16, 1996, to incorporate new detailed hydrologic and hydraulic analyses for Alamo Creek, Encinosa Creek, Laguna Cree, Ulatis Creek, and Bucktown Creek. The analyses were performed by Borcalli & Associates, Inc., for FEMA under Contract No. EMW-92-C-3818. This work was completed in February 1994.

A fourth revision was completed on May 7, 2001, to incorporate detailed flood-hazard information along Gibson Canyon Creek and South Gibson Canyon Creek. The hydrologic and hydraulic analyses for this restudy were performed for FEMA by Borcalli & Associates, Inc. under Contract No. EMW-96-CO-0095. This work was completed in November 1997.

The behind levee analyses for this study were performed by Nolte Engineering Company, for FEMA. This work was completed in June 2007.

The behind levee analyses for this study were also performed by URS Corporation, for FEMA, under Contract No. EMF-2003-CO-0047. This work was completed in October and November 2007.

MAP IX-Mainland was contracted; contract number EMF-2003-CO-0047, in February of 2005 by FEMA to create a Solano Countywide FIS and DFIRM.

BakerAECOM was contracted in 2009; contract number HSFEHQ-09-D-0368, Task Order HSFE09-09-J-0001, to perform a Physical Map Revision (PMR). This PMR was contracted to incorporate a community-supplied flood study on Sweeney Creek, prepared by West Yost and Associates for the Solano County Water Agency (Reference 62). This work was completed in June 2014.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009 (Reference 64).

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 10N. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zone used in the production of FIRMs for adjacent jurisdictions may result in slight positional differenced in map features across jurisdiction boundaries. These differenced do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

Consultation Coordination Officer's (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for Solano County and the incorporated communities within its boundaries are shown in the following tabulation:

Table 1 – Initial and Final CCO Meetings

Community	Initial CCO Date	Intermediate CCO Date	Final CCO Date
City of Benicia	January 14, 1985	[1]	July 24, 1986
City of Dixon	September 2, 1976	November 21, 1978	June 24, 1980
	August 13, 2010	[1]	June 22, 2011
City of Fairfield	September 1, 1976	May 29, 1979	January 8, 1981
	June 29, 1988	December 28, 1988	[1]
City of Rio Vista	September 2, 1976	November 3, 1978 / January 25, 1979	June 24, 1980
	July 25, 1983	November 7, 1985	November 8, 1985
City of Suisun City	September 1, 1976	May 29, 1979	January 8, 1981
City of Vacaville	September 2, 1976	January 4, 1979	May 1, 1981
	February 10, 1992	[1]	September 29, 1995
	September 20, 1994	[1]	February 17, 2000
	August 13, 2010	[1]	June 22, 2011
City of Vallejo	June 23, 2011	[1]	February 28, 2013
Unincorporated Areas	September 1, 1976	May 9, 1979	May 1, 1981
	July 25, 1983	November 7, 1985	November 7, 1985
(Solano County)	July 22, 1988	December 28, 1988	[1]
	February 10, 1992	[1]	August 9, 1995
	September 20, 1994	[1]	February 17, 2000
	[1]	[1]	February 21, 2008
	January 12, 2010 and	[1]	June 22, 2011
	August 13, 2010	[1]	
	June 23, 2011	[1]	February 28, 2013

[1]*Data not available*

For this PMR, initial and final CCO meetings were held on June 23, 2011, and February 28, 2013, respectively. Both were attended by representatives of FEMA, the community, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Solano County, California.

All or portions of the flooding sources listed in Table 2 "Flooding Sources Studied by Detailed Methods" were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Published Separately).

Table 2 – Flooding Sources Studied by Detailed Methods

Alamo Creek
Bucktown Creek
Carquinez Strait
Cat Slough
Chabot Creek
Cache Slough
Chadbourne Slough
Champion Slough
Clayton Creek
Cordelia Slough
Cutoff Slough
Dan Wilson Creek
Duck Slough
Encinosa Creek
First Mallard Branch
Frank Horan Slough
Frost Slough
Gibson Canyon Creek
Goodyear Slough
Gordon Valley Creek
Green Valley Creek
Hass Slough
Hill Slough
Horse Creek
Howard Slough
Hunter Cut
Ibis Cut
Industrial Creek
Island Slough
Laguna Creek
Laguna Drain
Lake Dalwigk
Laurel Creek
Ledgewood Creek
Lemon Street Canal
Lindsey Slough
Lookout Slough
Magazine Street Canal
Maine Prairie Slough
Marina Channel
Middle Branch Horse Creek
Miller Ditch
Miner Slough
Montezuma Slough
Mud Slough North Fork Rindler Creek
Northern Slough
Noyce Slough
Old Alamo Creek
Peltier Slough
Pennsylvania Avenue Creek
Peytonia Slough
Pine Tree Creek
Prospect Slough
Putah South Canal
Rindler Creek
Roaring River Slough
Rock Creek
Roos Cut
Sacramento River
Sacramento River Deep Water Ship Channel
Sacramento Street Creek
Second Mallard Branch
South Branch Gibson Canyon Creek
South Branch Horse Creek
Southhampton Bay
Spoonhill Creek
Steamboat Slough
Suisun Bay
Suisun Creek
Suisun Slough
Sulphur Springs Creek
Sulphur Springs Creek Overflow
Sutter Slough
Sweeney Creek
Tree Slough
Ulatis Creek
Union Avenue Creek
Union Creek
Unnamed Stream
Volanti Slough

Table 2 – Flooding Sources Studied by Detailed Methods, continued

Marina Creek	Watson Hollow
Marina Creek Tributary	Wells Slough
McCoy Creek	Wild Horse Creek

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the communities. All or portions of the flooding sources listed in Table 3, "Flooding Sources Studied by Approximate Methods," were studied by approximate methods.

Table 3 – Flooding Sources Studied by Approximate Methods

Airport Drainage Channel	Little Harker Bay
Alamo Creek	Luco Slough
Alamo A-1 Channel	Maine Prairie Slough
American Canyon Creek	McCune Creek
Barker Slough	Montezuma Slough
Boynton Slough	Napa River
Calhoun Cut	North Fork Rindler Creek
Chabot Creek	Nurse Slough
Cordelia Slough	Old Ulatis Creek
Cross Slough	Peltier Slough
Cutoff Slough	Pine Tree Creek
Dan Wilson Creek	Pleasants Creek
Denverton Slough	Pudley Creek
Dickson Creek	Putah Creek
Dry Arroyo	Sacramento Street Creek
Dutchman Slough	San Pablo Bay
Encinosa Creek	Sheldrake Slough
First Mallard Branch	South Fork Putah Creek
Gibson Canyon Creek	South Slough
Hass Slough	Suisun Slough
Hastings Cut	Sulphur Springs Creek
Hasting Slough	The Big Ditch
Hill Slough	Ulatis Creek
Hopkins Ravine	Union Creek
Horse Creek	Unnamed Stream
Lake Dalwigk	Watson Hollow
Lake Herman	Wells Slough
Laurel Creek	

This countywide FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision – LOMR), as shown in Table 4 "Letters of Map Change."

Table 4 – Letters of Map Change

Community	Case Number	Project Identifier	Effective Date	Type
Solano County	09-09-0858P	McCune Creek	May 5, 2009	LOMR
City of Vallejo	09-09-3023P	Tributary to American Canyon Creek	October 16, 2009	LOMR
City of Vallejo	12-09-2640P	North Fork Rindler Creek	February 1, 2013	LOMR

The following LOMRs are not incorporated in this Physical Map Revision since they are outside the panels affected by the studies that were incorporated into the Physical Map Revision: 09-09-2128P, 09-09-2366P, 10-09-0523P, 11-09-1451P, 11-09-1452P, 11-09-1453P, 11-09-1570P, 11-09-4207P, and 12-09-1553P. These unincorporated LOMRs remain effective.

2.2 Community Description

Solano County is in the west-central sector of California. Its eastern portion comprises the lower western edge of the Sacramento Valley portion of the Sacramento-San Joaquin Basin (Central Valley Basin) of California. The county extends into low-lying foothills and steeper uplands of the coastal ranges along the western edge.

Its central portion is approximately 45 miles northeast of San Francisco and approximately 40 miles southwest of Sacramento, the state capital. Los Angeles is approximately 400 miles to the south-southeast.

Except on the west, most of Solano County is bordered by waterways. Putah Creek forms the northern boundary, Steamboat Slough and the Lower Sacramento River form the southeastern boundary, and Suisun and San Pablo Bays (easterly extending arms of San Francisco Bay) form the southern boundary. Solano County is bounded by Yolo County on the north and northeast, Sacramento County on the southeast, Contra Costa County on the south, and Sonoma and Napa Counties on the west.

During the 1970s, Solano County experienced a building boom. Available, affordable land and proximity to the San Francisco and Sacramento metropolitan areas have made it an attractive location for thousands of new homes, and the population of most cities has increased rapidly.

Much of the unincorporated area is devoted to agricultural uses, and there is little concentrated development outside incorporated areas except for a few rural-residential communities. Principal of these area Allendale and Elmira, just north and east, respectively, of Vacaville; Cordelia, along the southwestern edge of Fairfield; and Upper Green Valley and Rockville, northwest of Fairfield. However, single-family residences are scattered throughout the greater portion of the unincorporated area. Other development in the unincorporated area includes Solano Community College near Fairfield, Voice of America, American Telephone and Telegraph, and U.S. Navy transmission facilities near Dixon; and scattered commercial establishments along Interstate Highway 80. Gas wells dot the southeastern sector of the county. Irrigation facilities are common throughout and include Putah South Canal, a major U.S. Bureau of Reclamation conveyance facility that traverses the northwestern and west-central sectors of the county. Collinsville, once an active fishing village but now essentially abandoned, is located along the right bank of Sacramento River at the southern edge of the county. A coal-fired power plant is being evaluated for construction in the area.

Surface transportation facilities serving Solano County are extensive and include interstate and state highways, a network of county roads, one local railroad, and one railroad in the transcontinental system. Most Solano County communities are within one hour by highway of either Sacramento or San Francisco, both of which have major airports served by numerous national and regional airlines. Deep-draft terminal facilities at Sacramento (Sacramento County), Stockton (San Joaquin County), and in the San Francisco Bay area afford access to overseas markets. Suisun Channel, which connects Suisun City with Suisun Bay, accommodates barge traffic.

Topography in Solano County is characterized by level to gently sloping valley floor land in the eastern portion, and foothills and steeper uplands of the Coast Ranges in the west. Suisun Marsh is in the south-central sector, and the Delta portion in the southeast. A large area of low, rolling hills, the Montezuma Hills, lies southwest of Rio Vista. The Potrero Hills are isolated along the northern rim of Suisun Marsh. Elevations range from -7 feet in the Delta region to approximately 380 feet in isolated hill areas and 2800 feet at the top of the highest mountains along the northwest edge. Elevation of the valley flood area varies from approximately 15 feet to 100 feet. The general upward slope of the land is from east to west and from south to north.

Suisun Marsh comprises a vast tidal area of marshlands, sloughs, and bays in south-central Solano County. It serves as a major wintering ground for migratory waterfowl in the Pacific Flyway and may be used by as many as 1 million birds in early winter. In addition, it provides critical habitat for a variety of other wildlife,

including endangered, rare, and unique species. Suisun Marsh is the largest contiguous marsh in the continental United States and constitutes almost 10 percent of the wetlands remaining in California. Legislation to preserve the marsh as a wildlife area was enacted by the State of California in 1977.

A portion of eastern Solano County is part of a vast low-lying tidal area known as the Delta of Sacramento and San Joaquin Rivers. Commonly referred to as the "Delta," it consists of highly productive farmland reclaimed from swamp by levees that divide it into tracts, locally known as "islands." The lower end of Yolo Bypass, a leveed floodway that is part of a joint Federal-State improvement of lower Sacramento River and its tributaries for flood control, is located in the Delta region of Solano County. Four tidal tracts are situated in the lower bypass, and the levees protecting them are designed to fail during large floods to permit floodwaters to pass without endangering highly developed adjacent tracts. All the lands in the bypass are either owned by the State of California or are covered by flowage easements held by the state. These lands are intensively farmed except during winter when floodflows are normally expected.

Sacramento River is the principal stream in Sacramento Valley. It rises in the Trinity Mountains, and below Shasta Dam flows southerly for approximately 300 miles to its terminus at Suisun Bay. Other than its headwater streams (Sacramento River above the Shasta Dam and Pit and McCloud Rivers), the principal stream systems are those of Feather and American Rivers, which flow from the east. Upstream from Solano County, a number of lesser tributary streams, including Cottonwood, Stony, and Cache Creeks, drain areas west of the river. The principal lesser tributaries draining from the east are Cow, Battle, Antelope, and Deer Creeks, Three distributaries of the Sacramento River in the tidal area on the eastern border with Sacramento County are Sutter Slough, Miner Slough, and Steamboat Slough.

Approximately two-thirds of Solano County drains east-southeasterly to lower Sacramento River. In general, Putah Creek drains a narrow band along the far northern boundary of the county; the streams of the Ulatis Creek system drain the greater northern sector; Dickson and Dudley Creeks and several other small streams drain the northeastern corner; and Cache and Lindsay Sloughs, smaller waterways of the Delta, and Marina and Industrial Creeks, and several other small tributary streams drain the southeastern sector. The remainder of Solano County drains generally southward into Suisun Bay by way of Suisun Marsh. The Fairfield-Suisun City area is drained by McCoy, Union, Pennsylvania Avenue, Ledgewood, Laurel, and Union Avenue Creeks, which discharge into tidal channels tributary to Suisun Slough. American Canyon, Suisun, Jameson Canyon, and Green Valley Creeks drain the area generally west and north of Fairfield and discharge into tidal channels tributary to Cordelia Slough.

The drainage basins of all the streams under study except Sacramento River are located entirely within Solano County or Solano County and Napa Counties. The basins are small, draining areas from less than 1 square mile to approximately 50

square miles. The Suisun and Ledgewood basins are related in that major floodflows along upper Suisun Creek can escape across a low divide to discharge into the Ledgewood Creek basin. The natural drainage patterns of many streams in Solano County have been modified by agricultural operations, irrigation facilities, or control structures. Alamo Creek downstream from Nut Tree Road is carried in a manmade channel. It was built by the Natural Resources Conservation Service (NRCS) as part of a flood-control project in the Ulatis creek basin. Large sections of Dickson Creek in Dixon, and Pennsylvania Avenue and Union Avenue Creeks in Fairfield, flow in underground conduits. Pertinent information on drainage areas and stream gradients for selected streams studied by detailed methods are shown in Table 5, "Drainage Areas and Stream Gradients."

Table 5 – Drainage Areas and Stream Gradients

	Drainage Area		
Stream	**Index Point**	**Square Miles**	**Average Gradient[1] (Feet per Mile)**
Alamo Creek	Pleasants Valley Road	6.0	19
Dickson Creek	Interstate Highway 80	0.8	7
Gibson Canyon Creek	Browns Valley Road	1.2	15
Green Valley Creek	Country Club Drive	11.3	39
Horse Creek	Putah South Canal	1.1	21
Industrial Creek	St. Francis Way	1.4	26
Laurel Creek	Putah South Canal	4.6	24
Ledgewood Creek	Putah South Canal	12.9	22
Marina Creek	Second Street	1.8	22
McCoy Creek	Union Pacific Railroad	6.0	13
Pennsylvania Avenue Creek	Holiday Lane	2.3	14
Pine Tree Creek	Browns Valley Road	0.6	28
Sacramento River	Rio Vista	26,600.0[2]	0.4
Suisun Creek	Wooden Valley Bridge	42.8	19
Sweeney Creek	At McCune Creek	15.5	11
Ulatis Creek	Bucktown Lane	7.3	26
Union Avenue Creek	Air Base Parkway	2.3	36

[1]*In Study Reach*

[2]*Approximate*

The climate of Solano County is characterized by the two well-defined seasons of winter and summer. Winters are mild with frequent rain, and summers are warm

to hot with practically no precipitation. Normal annual precipitation ranges from approximately 17 inches in the southern and eastern portions of the county to approximately 31 inches in the highest mountain areas in the northwest. Most of the seasonal precipitation occurs as rain during October through April. Snow falls only infrequently in the higher elevations of the mountainous region, and no snowpack accumulates. Mean temperature in the Fairfield-Suisun City area varies from 45 degrees Fahrenheit in January to 70 degree Fahrenheit in July, but extremes of 23 degrees Fahrenheit in winter and 112 degrees Fahrenheit in summer have been recorded. In valley floor areas (Vacaville-Dixon vicinity), the temperature may reach or exceed 100 degrees Fahrenheit for extended periods during the summer and often falls below freezing during winter nights. In the southern and western portions, temperature is moderated by cool, moist winds from the ocean.

Except in the mountainous areas, the native vegetation in Solano County has been essentially obliterated by agriculture operations, urbanization, and reclamation. Annual grasses, oak trees, and chaparral characterize vegetation in the mountainous uplands.

With the exception of portions of Suisun and San Pablo Bays, there are no major bodies of water in Solano County. Suisun Bay borders Suisun Marsh on the south and forms part of the southern county limits. San Pablo Bay borders the southwestern corner of the county. The only other major body of water nearby is Lake Berryessa, which is on Putah Creek in Napa County near the northwest corner of Solano County. This U.S. Bureau of Reclamation development provides water for irrigation and municipal supply to many Solano County areas.

The City of Benicia was built on the southern tip of Sulphur Springs Mountain, bordering Carquinez Strait. Benicia was incorporated in 1847 and served as the state capital of California in 1853. At that time the city consisted primarily of a large warehouse facility for the U.S. Army.

Benicia is served by Interstate 680 and Intestate 780, which join Interstate 80.

The predominant feature of the Benicia climate is its approximately 275 days of sunshine annually. Annual average temperatures range from minimums of 41.3 degrees Fahrenheit in January to 56.8 degrees Fahrenheit in July, and maximum average temperatures range from 50 degrees Fahrenheit in January to 81.4 degrees Fahrenheit in July. Precipitation averages 2.38 inches in January and 0 inches in July. The yearly average precipitation is 14.38 inches. The prevailing wind is normally from the west with a mean speed of 9.2 miles per hour (Reference 1).

The soils in the Benicia area are mainly of the Dibble-Los Osos association, with approximately 60 percent Dibble soils and 30 percent Los Osos soils. The remaining 10 percent is Altamont and Millsholm soils.

The Dibble soils have a pale-brown loam or clay loam surface layer. The subsoil is dark yellowish-brown heavy clay loam and light olive-brown clay. The parent material is light olive-brown sandstone at a depth of 20 to 40 inches.

The Los Osos soils have a brown loam or clay loam surface layer. The subsoil is brown heavy clay loam and light clay. The parent material is light olive-brown sandstone at a depth of 20 to 40 inches.

The soils are gently sloping to steep, well-drained loams and clay loams formed from sandstone, on mountainous uplands. These soils area moderately deep, formed in materials weathered from sandstone with slopes from 2 to 50 percent. Vegetation is mainly annual grasses, forbs, and scattered oaks. These soils area used for range, pasture, grass hay, and limited dryfarmed small grain. Wildlife in the area consists mainly of deer (Reference 2). Elevations decrease gradually from 620 feet NAVD near the northern corporate limits to approximately 8 feet NAVD near the waterfront along the Carquinez Strait along the south shore.

Approximately 40 percent of the area within the City of Benicia is urbanized. The area within the floodplain of the lower Sulphur Springs Creek basin is primarily industrial. The economy of the city is also primarily industrial, with oil refining and automobile importing being key businesses.

The City of Dixon was established in 1868 as an outgrowth of a small trading center approximately 3 miles to the west known at that time as Silveyville. Then California Pacific (now Union Pacific) Railroad established a route through Solano County, much of the Silveyville community moved to the Dixon site to be closer to the railroad. Dixon was incorporated in 1878, and became the center of a major grain-producing area. I surrounding areas, irrigation wells drilled around 1900 furnished the water needed to expand the agricultural base, and sheep production and dairying grew to become very important businesses.

The economic base of the community consists of agriculture and related enterprises such as meatpacking plants, grain processing and storage facilities, and agricultural and livestock transporting firms. Principal farm products are sugar beets, milo, tomatoes, grains, hay, and alfalfa.

Elevations in Dixon range from 40 to 70 feet. However, these values represent extremes, and on the average Dixon are very flat. The average gradient of Dickson Creek is 7 feet per mile through the city.

Normal annual precipitation is approximately 17 inches in Dixon. Most of the seasonal precipitation occurs as rain from October through April. Temperatures may reach or exceed 100 degree Fahrenheit for extended periods during summer, and often fall below freezing during winter nights.

The native vegetation has been essentially obliterated by agricultural operations, urbanization, and reclamation.

Dickson Creek, providing the major drainage in Dixon, flows northwesterly to southeasterly with an average gradient of 7 feet per mile. Large sections of Dickson Creek flow in underground conduits. Dudley Creek flows through the northeastern corner of Dixon.

The City of Fairfield was established in approximately 1856 and has been the county set since 1858. The city was incorporated in 1903 and has developed primarily as an urban center with a broadening commercial and industrial base. For many years, agriculture was the major element of the Fairfield economy.

Fairfield population growth was given particular impetus in 1942 when Travis Air Force Base was built to the east of the city. The base, which was annexed to Fairfield in 1966, is the largest single employer in central Solano County. It is served by approximately 10,000 military personnel and employs approximately 2,900 civilians. Other significant sectors of the Fairfield economy include a brewery, which employs more than 500 people; prefabricated home building; fruit dehydration plants; a metal container manufacturer; retail trade; and the city and county government.

Elevations in Fairfield range from approximately 5 to 350 feet.

Fairfield is drained by McCoy, Union, Pennsylvania Avenue, Ledgewood, Laurel, and Union Avenue Creeks, which discharge into tidal channel tributaries to Suisun Slough, and by American Canyon, Suisun, Jameson Canyon, Green Valley, and Dan Wilson Creeks, which discharge into tidal channel tributaries to Cordelia Slough. Information on drainage areas and stream gradients for selected streams studied by detailed methods are shown in Table 5, "Drainage Areas and Stream Gradients."

The climate in Fairfield is characterized by the two well-defined seasons of winter and summer. Winters are mild with frequent rain. Summers are warm to hot with little precipitation. Normal annual precipitation is approximately 17 inches. Most of the seasonal precipitation occurs as rain during October through April. Mean temperature varies from 45 degrees Fahrenheit in January to 70 degrees Fahrenheit in July, but extremes of 23 degrees Fahrenheit in winter and 112 degrees Fahrenheit in summer have been recorded. Temperatures are moderated by cool, moist winds from the ocean.

The native vegetation has been essentially obliterated by agricultural operations, urbanization, and reclamation.

The City of Rio Vista originated in 1857 as a small settlement near the junction of Cache Slough and the Sacramento River. Until 1860, it was known as "Brazos del Rio" (Arms of the River). For 5 years it flourished as a shipping point for salmon. In the fall of 1861, prolonged rains fell over the entire Sacramento River basin, and on January 8, 1892, the town was completely washed away by floodwaters. Rio Vista was relocated approximately 3 miles downstream to its

present site and developed as an important agricultural center for the area. A variety of vegetables were grown on delta lands to the north. Grains were grown in the Montezuma Hills area to the west. The town was incorporated in 1893. In 1936, natural gas was discovered nearby.

Diversified agriculture, the extraction of natural gas, and services associated with both industries continue as significant elements in the economic base of the community. Another important segment of the economy is recreation associated with the delta waterways.

Topography in Rio Vista is characterized by a level to gently sloping valley flood. Elevations range from approximately 5 to 70 feet. The low, rolling Montezuma Hills lie southwest of Rio Vista.

Rio Vista is drained east-southeasterly by Marina Creek, Marina Creek Tributary, and Industrial Creek as they flow toward Sacramento River, which drains the northern half of the Central Valley of California, also called the Delta area. The Sacramento River flowing from the north conveys runoff from approximately 21,000 square miles of mountain and foothill tributaries that influence flood conditions in the Delta.

The climate in Rio Vista is characterized by the two well-defined seasons of winter and summer. Winters are mild with frequent rain. Summers are warm to hot with little precipitation. Normal annual precipitation is approximately 17 inches with most of the rain occurring during October through April. Temperatures may reach or exceed 100 degrees Fahrenheit for several consecutive days, but not for extended periods. Nighttime temperatures in summer are usually moderated by cool, moist ocean winds.

The City of Suisun City was established in the early 1850s and incorporated in 1868. It served as the business and transportation center of the surrounding area until the early 1900s. The first depot of the Central Pacific Railroad was established there in the late 1860s, and the railroad between Suisun City and Benicia was completed in 1879.

Public and private marinas are located at the head of Suisun Slough, which is maintained as a shallow-draft navigation project by the USACE.

Travis Air Force Base is an important part of the economy of the community.

Elevations in Suisun City range from approximately 5 to 15 feet.

Suisun City is drained by Laurel Creek, McCoy Creek, Pennsylvania Avenue Creek, and Union Avenue Creek that discharge into tidal channel tributaries to Suisun Slough. Information of drainage areas and stream gradient for selected streams studied by detailed methods are shown in Table 5, “Drainage Areas and Stream Gradients.”

Climate in Suisun City is characterized by the two well-defined seasons of winter and summer. Winters are mild with frequent rain. Summers are warm to hot with little precipitation. Normal annual precipitation is approximately 17 inches. Most of the seasonal precipitation occurs as rain during October through April. Mean temperature varies from 45 degrees Fahrenheit in January to 70 degrees Fahrenheit in July, but extremes of 23 degrees Fahrenheit in winter and 112 degrees Fahrenheit in summer have been recorded. Temperatures are moderated by cool, moist winds from the ocean.

The native vegetation has been essentially obliterated by agricultural operations, urbanization, and reclamation.

The City of Vacaville originated as an agricultural center. Grain farming was the dominant activity from the late 1850s until approximately 1880 when the fruit industry originated from many varieties of fruit being planted for commercial purposes. The fruit industry flourished until the depression of the 1930s when greater production and better fruit from irrigated orchards elsewhere considerably reduced fruit production in the area. Today, agricultural pursuits are more diversified and include cattle grazing and the production of grains, truck crops, and early-maturing fruit. Food-processing plants comprise an important related enterprise. In recent years, Vacaville, which was incorporated in 1892, has grown as an urban center. Many Vacaville residents are employed at nearby Travis Air Force Base; the California Medical Facility, a state correctional institution built in 1955; or the nationally know Nut Tree Restaurant. Other significant sectors of the community economy include a recreational-vehicle manufacturer, a major supermarket distribution center, and retail trade.

Topography in Vacaville is characterized by gently sloping valley floors and steeper foothills of the California Coast ranges. Elevations range from approximately 80 feet to 800 feet.

Vacaville is drained east-southeasterly by the streams of the Ulatis Creek system as the flow toward Cache Slough and Sacramento River. The natural drainage patterns of many streams in the area have been modified by agricultural operations, irrigation facilities, or control structures. Alamo Creek downstream from Nut Tree Road is carried in a manmade channel. It was built by the NRCS as part of a flood-control project in the Ulatis Creek basin. Information on drainage areas and stream gradients for selected streams studied by detailed methods are shown in Table 5, “Drainage Areas and Stream Gradients.”

Climate in Vacaville is characterized by the two well-defined seasons of winter and summer. Winters are mild with frequent rain. Summers are warm to hot with little precipitation. Normal annual precipitation is approximately 17 inches in the southern and eastern portions of the county to approximately 31 inches in the highest mountain areas in the northwest. Most of the seasonal precipitation occurs as rain during October through April. Snow falls only infrequently in the higher elevations of the mountainous region, and no snowpack accumulates.

In valley floor areas, temperature may reach or exceed 100 degrees Fahrenheit for extended periods during the summer and often falls below freezing during winter nights.

Except in the mountainous areas, the native vegetation in the Vacaville area has been essentially obliterated by agricultural operations, urbanization, and reclamation. Annual grasses, oak trees, and chaparral characterize vegetation in the mountainous uplands.

The City of Vallejo, one of the major commercial and industrial centers in the northern San Francisco Bay area, is served by a deep water channel and an interstate highway, as well as state highways and railroads. The principal industrial activity is centered at the Mare Island Naval Shipyard on the western side of Mare Island Strait.

The streams and tributaries that lie within the City of Vallejo comprise four drainage areas. In the northern part of the city, the Chabot area contains about 5600 acres, of which 4400 acres drain to Lake Chabot, an artificial lake. In the central part of the city, the Austin Creek area contains about 3400 acres on which 1800 acres lie east of Interstate Highway 80. The Lemon Street area, in the southern part of the city, contains about 1600 acres, and the White Slough area, which is located between the Chabot area and the Austin Creek area, contains about 1400 acres. In all these areas, the ground surface slopes generally from east to west. The greater part of the city drains into Mare Island Strait and the Napa River. Elevations within the four drainage areas range fro 0 to over 1000 feet about sea level.

2.3 Principal Flood Problems

General rain floods can occur in Solano County at any time from October through April. This type of flood results from prolonged heavy rainfall and is characterized by high peak flows of moderate duration and large volume runoff. Flooding is more severe when antecedent rain has resulted in saturated ground conditions and minimal infiltration.

Cloudburst storms, sometimes lasting as long as 6 hours, can occur at any time from late spring to early fall, and may occur as an extremely severe sequence within a general rainstorm. Cloudbursts are high-intensity storms that can produce floods characterized by high peak flows, a short duration of floodflows, and a small volume of runoff. In Solano County, cloudbursts can produce peak flows substantially greater than those of general rainstorms.

City of Benicia

Recent notable flooding in Benicia occurred in January 1983 and February 1986. The 1983 flood caused minor damages to the mobile home park east of H Street. The 1986 flood caused damages to the industrial complex and automobile storage areas along Sulphur Springs Creek (Reference 3). Flooding along Sulphur

Springs Creek results from lack of channel capacity and shallow flooding parallel to the channel. The other flooding area is along the waterfront in the southeast part of town by the wastewater treatment plant. At higher tide levels the water will overflow into some of the streets in the Benicia Junior High School area. However, this is expected to be eliminated with the development of a Marina at the foot of East Fifth Street. The rest of the waterline is in the bay itself; a small six to twelve inches of water at infrequent times coming into the lower portions of the town facing on the waterfront. In the southwest portion of town, Southampton Bay is also affected by tidal flooding.

City of Dixon

The flood history of Dixon is not well documented, but minor flooding is reported to have occurred in December 1955, April 1958, and January 1965. In 1955, floodwater surrounded a few homes in a subdivision is the northwestern sector of town, but no damage was reported. Overflow from Dickson Creek probably contributed to the flooding. In 1958, a cloudburst left water standing in a few streets, but no homes were known to have been flooded. Minor flooding also occurred in 1965, but no damage was reported.

Most of Dickson Creek in Dixon flows through underground storm drains. The drains can carry runoff from a storm expected to occur once in approximately 10 years on the long-term average. Less frequent (greater) runoff flows over streets and may pond behind natural or manmade barriers.

City of Fairfield

Suisun Slough is under the influence of tides. The most severe flooding along this waterway would result when very high tides and a large volume of stream outflow occur coincidently. In Fairfield, restrictive outlets into slough areas cause floodflows to pond in low-lying areas, and high tides may delay drainage for several days.

Flooding in Fairfield occurred in 1940, 1950, 1955, 1958, 1963, 1966, 1967, 1969, 1970, and 1973.

Before 1950, flood damage in Fairfield was minor because development in floodplains was limited to areas along Pennsylvania Avenue and Union Avenue Creeks. There was no urban development in the floodplains of Laurel, Ledgewood, and McCoy Creeks at that time. Extensive flooding, particularly along State Highway 12, occurred in December 1955. The December 1955 flood, with a recurrence interval of 50 years, produced flows estimated at 2300, 500, and 5000 cubic feet per second (cfs) along the lower reaches of Green Valley, Dan Wilson, and Suisun Creeks, respectively. Green Valley and Dan Wilson Creeks flooded approximately 800 acres of land and caused damage estimated at $40,000. Damage data for other streams in the area are not available. Floodflows in April 1958 peaked at approximately 900, 200, and 2000 cfs along Green

Valley, Dan Wilson, and Suisun Creeks, respectively, at U.S. Highway 40 (now Interstate Highway 80). Approximately 1000 acres of farm and orchard land were flooded by these streams. Because of prolonged inundation, field and orchard crops were destroyed or yields were drastically reduced. Flood damage totaled approximately $100,000. Minor damage to suburban residences in the Suisun Creek floodplain occurred, and large amounts of clippings dumped along the stream were picked up by floodwaters and carried downstream to jam on bridges and at other restricted channel sections.

In January 1967, several streets in Fairfield were flooded, and telephone service was interrupted. A high tide and overflow from Suisun, Ledgewood, Union Avenue, and Laurel Creeks flooded approximately 1100 acres of land in January 1970. Many streets were inundated, and a few homes and businesses were evacuated. Damage was estimated at $71,000. Approximately 70 homes in Fairfield were damaged by the January 1973 flood. Water flowed along many streets, and several major roads had to be closed.

In 1955, flooding from Suisun, Green Valley, and Dan Wilson Creeks had a recurrence interval of 50 years. The 1958 flood from Suisun and Green Valley Creeks had a recurrence interval of 8 years. The 1958 flood from Dan Wilson Creek had a 10-year recurrence interval. In 1967, flooding from Pennsylvania Avenue and Union Avenue Creeks had a recurrence interval of 15 years.

City of Rio Vista

The lower reaches of the Sacramento River are under the influence of tides. Severe flooding along this waterway could result when very high tides and a large volume of stream outflow occur coincidentally, and strong onshore winds generate wave action that would increase the flood hazard above that of the tidal surge alone.

The most damaging flood in Rio Vista since 1900 occurred in March 1907. A portion of the town was flooded by high flow in the Sacramento River and concurrent high tides. All the buildings in the Waterfront district were flooded, and Front Street was submerged, except at the high southern end. Flooding also occurred in 1904. Between 1917 and 1927, the river channel downstream from Rio Vista was enlarged and straightened, so water-surface levels have been greatly reduced since that time. Minor flooding occurred along the waterfront in December 1955, April 1958, and January 1973. Several buildings were flooded, but no serious damage was reported. The most recent severe flooding occurred in February 1986, which caused serious damage to the city.

The tide gaging station at Rio Vista, with a period of record from 1925 to 1986, had a maximum recorded peak stage of 8.8 feet on February 20, 1986.

Recurrence intervals were estimated for tide stages along the Sacramento River. The computed frequency for the 1955 flood was 20 years; for the 1958 flood, 10

years; and for the 1973 flood, 25 years. The February 1986 flood was far in excess of the 1-percent annual chance flood frequency.

There are no streamflow records for the other streams under study.

City of Suisun City

Suisun Slough is under the influence of tides. The most severe flooding along this waterway would result when very high tides and a large volume of stream outflow occur coincidently. In Suisun City, restrictive outlets into slough areas cause floodflows to pond in low-lying areas, and high tides may delay drainage for several days.

Flooding occurred in Suisun City in 1940, 1950, 1955, 1963, 1966, 1967, 1969, 1970, and 1973. Extensive flooding along State Highway 12 occurred in December 1955. Floodwater rose to waist depth in a residential development when high tides slowed drainage. In January 1967, floodwater covered one-third of the streets, and was approximately 2 feet deep in the southern part of town. Flooding from Pennsylvania Avenue Creek and Union Avenue Creek had a recurrence interval of 15 years for the 1967 flood. A high tide and overflow from Laurel Creek and Union Avenue Creek caused flooding in January 1970.

City of Vacaville

In urbanizing areas, flood problems are intensified because new homes and other structures, and new streets, driveways, parking lots, and other paved areas decrease the amount of open land available to absorb rainfall and runoff, thus increasing the volume of water that must be carried away by waterways.

Thirty-one floods are reported to have occurred in the Ulatis Creek basin, which includes the streams studied, from 1880 through 1959. Severe flooding occurred in 1937, 1941, 1943, 1948, 1952, 1955, and 1958. Since 1959, flooding has occurred in 1962 (two periods), 1963, 1964 to 1965, 1967, 1969, and 1973. In 1958 and 1963, respectively, streams in the basin flooded approximately 20,000 and 26,000 acres of land. During both floods, most of the overflow was below the Union Pacific Railroad and was the result of a commingling of floodflows from several streams. In 1958, the flooded area extended southeast from the railroad fro approximately 11 miles, and damage was estimated at $170,000. In 1963, the flooded area extended for approximately 9 miles, and damage was approximately $136,000. Since 1964, flooding has been reduced substantially by a NRCS project comprising channel improvements and levees along selected stream reaches below Interstate Highway 80. It is estimated that the 1967 and 1973 floods have a recurrence interval of 30 years, and the 1969 event has a 7-year recurrence interval.

The most severe floods in Vacaville occurred in February and March 1940, January 1967, and January 1973. In 1940, Alamo and Ulatis Creeks flooded residential properties, requiring evacuation of homes, blocked roads, and

disrupted traffic. The 1967 and 1973 floods were of similar magnitude and are considered the largest in recent years. During both flood periods, Alamo Creek overflowed its banks in several locations and flooded streets and lawns, stranded residents, and deposited debris and garbage. Several families were forced to evacuate their homes or apartments when floodwaters covered the lower floors.

City of Vallejo

In the lower sections of the Austin Creek-White Slough-Chabot areas, flooding occurs due to the occasional breaching of the levees. This results in shallow flooding conditions.

Runoff from the area east of Interstate Highway 80 is diverted to a storm drain that discharges into Mare Island Strait at the foot of Solano Avenue. However, during periods of high flows, part of the runoff from the Austin Creek area diverted to the Solano Avenue drain overflows into Lake Dalwigk, a holding basin, in the Lemon Street area.

Solano County (Unincorporated Areas)

Flood conditions in the Delta are influenced by Pacific Ocean tides, high flood outflow from tributary streams, and strong onshore winds. A single island or a group of islands may flood when the levees protecting them are overtopped or fail as a result of the separate or coincidental occurrence of higher high tides and high stream outflow through the Delta.

A fundamental flood problem in the Delta results from the fact that for every square mile of land reclaimed, there is one square mile less of floodplain to contain the volume of the rising tide and outflow from the rivers of the Central valley.

Suisun Slough, the lower reaches of streams tributary to Suisun Bay, and the lower reaches of Sacramento River are under the influence of tides. The most severe flooding along these waterways would result when very high tides and a large volume of stream outflow occur coincidentally and strong onshore winds generated wave actions. In the Fairfield-Suisun City area, restrictive outlets into slough areas cause floodflows to pond in low-lying areas, and high tides may delay drainage for several days.

In urbanized areas, flood problems are intensified because new homes and other structures, new streets, driveways, parking lots, and other paved areas all decrease the amount of open land available to absorb rainfall and runoff, and thus increase the volume of water that must be carried away by waterways.

Solano County has a long history of flooding, but little definitive data area available for specific floods. Streamflow records are essentially nonexistent for the streams under study, and the rural nature of most past flooding precluded detailed news coverage. Information on past floods is based primarily on

historical accounts, brief newspaper descriptions, and various published and unpublished reports.

The earliest floods mentioned in accounts of the area occurred in 1842, 1861, and 1862. As described by General Mariano Vallejo, a government official, flooding in December 1842 was widespread:

> "…the whole country was overflowed, as well as all that level part of the country out to the hills at Vacaville. On that day I sailed in a schooner of twenty tons from the present site of Sacramento in a southwesterly direction, passing over what is now elevated farming lands in that section. The Montezuma hills and other highlands were not submerged, but all the other country was. I was able to, and did, sail over with ease where now fine farms are. Several hunters and their horses were drowned, and afterwards found at Benicia when the water subsides. The overflow lasted for several weeks. No crops were then raised, as there were no settlers in the whole region at that date, only a few cattle herders and hunters" (Reference 4).

Severe flooding again occurred in 1861 and 1862. Floodwaters swept away the original settlements of Maine Prairie (at the head of navigation on Maine Prairie Slough, now Cache Slough) and Rio Vista. Some Maine Prairie inhabitants rebuilt at the original site, but Rio Vista was relocated approximately 3 miles downstream to its present site.

Thirty-one floods are reported to have occurred in the Ulatis Creek basin from 1880 through 1959. Severe flooding occurred in 1937, 1941, 1943, 1948, 1952, 1955, and 1958. Since 1959, flooding has occurred in 1962 (two periods), 1963, 1964-1965, 1967, 1969, and 1973. In 1958 and 1963, respectively, streams in the basin flooded approximately 20,000 and 26,000 acres of land. During both floods, most of the overflow was below the Union Pacific Railroad and was the result of a commingling of floodflows from several streams. In 1958, the flooded area extended southeast from the railroad for approximately 11 miles, and damage was estimated at $170,000. In 1963, the flooded area extended for approximately 9 miles, and damage was approximately $136,000. Since 1964, flooding has been reduced substantially by a NRCS project comprising channel improvements and levees along selected stream reaches below Interstate Highway 80.

The most recent flooding in the Suisun Creek floodplain occurred in 1973. Agricultural lands were inundated, and several homes were damaged. Floodwater was reported to be 24 to 30 inches deep at Solano Community College.

The eastern portion of Solano County contiguous to the Delta area has a long history of flooding. The major cause of the latest floods was levee instability. The most recent major flood events were those that occurred in 1950, 1955, 1964-1965, 1969, 1972, 1981, 1982, and 1983.

The first damaging flood in Rio Vista since the turn of the century occurred in March 1907. Flooding also occurred in 1904, 1955, 1958, 1973, and 1986. In 1907, a portion of the city was flooded by high flow in Sacramento River and the concurrent high tides. All the buildings in the waterfront district were flooded, and Front Street was submerged except at the high southern end. Between 1917 and 1927, the river channel downstream from Rio Vista was enlarged and straightened, so water-surface levels have been greatly reduced since that time. Minor flooding occurred along the waterfront in December 1955, April 1958, and January 1973. Several buildings were flooded, but no serious damage was reported.

The highest recorded stages along Sacramento River at Collinsville occurred in January 1909, December 1955, and January 1973. In 1955, a combination of high river outflow, high tides, and adverse winds caused a small levee south of Collinsville to fail, and an area was flooded for approximately 5 days. Approximately 1,000 acres of land were flooded along the river upstream from Collinsville. Most of this area is not protected by levees. Information on other flood events of record (1950, 1952, and 1958) is not available.

In mid-January 1980, severe rainstorms over central California precipitated high river outflow through the Delta, which, coinciding with gale force winds over the Delta and high tides, resulted in the levee failure and flooding of two tracts (placing approximately 9,600 acres under water). Continued high inflow to the Delta and wind-generated waves increased erosion on all Delta levees, necessitating intensive flood fighting and the temporary curtailment of boat traffic. Then, in late February 1980, three islands at the lower end of the Yolo Bypass and one additional tract were inundated.

On February 20, 1986, flooding along the Sacramento River at Rio Vista reached an elevation of 8.8 feet and was estimated to have exceeded the 1-percent annual chance flood.

There are no streamflow records for the streams under study. Estimated frequencies of major floods along selected streams and computed frequencies of tidal stages along Sacramento River are shown in Table 6, “Frequencies of Past Floods or Tidal Stages.”

In general, major floods have inundated highly developed agricultural lands, urban and rural residential properties, and commercial and public facilities. Flooding has damaged orchards, vineyards, pasturelands, and croplands; damaged or destroyed growing crops; deposited debris on agricultural lands; destroyed livestock and poultry; and damaged farm equipment and agricultural improvements such as fences and irrigation systems. Floodwater has entered basements or lower floors of dwellings and commercial structures and deposited debris on lawns and gardens. Numerous streets have been flooded; bridges, roadbeds, and culverts damaged or destroyed; and stream channels and flood control works eroded.

Table 6 – Frequencies of Past Floods or Tidal Stages

Stream or Stream System	Year	Recurrence Interval (Years)
Stream Flooding		
Vacaville Group		
Ulatis Creek Stream System	1967	30
Ulatis Creek Stream System	1969	7
Ulatis Creek Stream System	1973	30
Fairfield-Suisun City Group		
Green Valley and Suisun Creeks	1955	50
Green Valley and Suisun Creeks	1958	8
Dan Wilson Creek	1955	50
Dan Wilson Creek	1958	10
Pennsylvania Avenue and Union Avenue Creeks	1967	15
Tidal Flooding		
Rio Vista-Collinsville Group		
Sacramento River at Collinsville	1909	25
Sacramento River at Collinsville	1950	10
Sacramento River at Collinsville	1952	10
Sacramento River at Collinsville	1955	10
Sacramento River at Collinsville	1958	10
Sacramento River at Rio Vista	1955	20
Sacramento River at Rio Vista	1958	10
Sacramento River at Rio Vista	1973	25

2.4 Flood Protection Measures

City of Benicia

There are no designated flood protection facilities existing on Sulphur Springs Creek in Benicia. Lake Herman Reservoir is located on Sulphur Springs Creek but has no provisions for flood control storage. The city is enacting a zoning ordinance, which controls new construction.

City of Dixon

Two small ponding basins are located just north of Dickson Creek, near the intersection of West H and North Almond Streets. These basins collect runoff

from a subdivision area and funnel it through an uncontrolled outlet into an underground conduit carrying Dickson Creek. A small ponding basin is also located on Dudley Creek south of Interstate Highway 90.

City of Fairfield

A small flood-control project on Green Valley and Dan Wilson Creeks was completed by the USACE in 1962. The project consists of approximately 2.5 miles of channel improvement work on Dan Wilson Creek downstream from Rockville Road, a short reach of levee along the stream, and approximately 2 miles of channel improvement work on Green Valley Creek in the vicinity of Cordelia. The project was designed to provide protection against a flood that could be expected to occur once in approximately 40 years, on the long-term average. Maintenance of the project is the responsibility of Solano County.

The Fairfield Vicinity Streams Project, comprising channel improvements, diversion channels, drop structures, and appurtenant new bridges and culverts, was authorized in 1970 for construction by the USACE. The project was designed to provide protection from the 0.5-percent annual chance flood along reaches of McCoy, Pennsylvania Avenue, Ledgewood, Laurel, and Union Avenue Creeks. Due to lack of local support and unresolved environmental issues, preconstruction planning was discontinued and the project classified "deferred" in 1977. Project construction began in 1986 following appropriated that same year. The project was completed in September of 1992.

A natural detention basin is located on McCoy Creek upstream from Air Base Parkway. Outflow is regulated by two ungated corrugated metal culverts 6 feet in diameter. Downstream, private interests have improved McCoy Creek from approximately Prosperity Lane downstream to State Highway 12. The improved channel will contain the 1-percent annual chance flood.

A detention reservoir on Pennsylvania Avenue Creek just north of Interstate Highway 80 was built by the California Department of Highways. The basin was designed to regulate a 15-year flood so that floodwaters can pass under the highway without inundating adjacent areas.

Private interests have improved the channel of Ledgewood Creek from the north side of Interstate Highway 80 upstream from approximately 1.1 miles. This improved channel was designed to pass a 2-percent annual chance floodflow, including inflow from a proposed diversion from Pennsylvania Avenue Creek. The improved channel protects against the 1-percent annual chance flood. These channel improvement works were based on the Fairfield Vicinity Streams flood-control project described previously. An improved channel has also been added from Interstate Highway 80 downstream to the Union Pacific Railroad spur.

Channel improvements along Laurel Creek have been constructed as part of the Fairfield Vicinity Streams Project from just north of Air Base Parkway extending

upstream for approximately 1.1 miles. These improvements along with channel improvements by private interests, upstream from this reach, will provide 1-percent annual chance flood protection to the land along both banks of the stream beginning approximately 1100 feet upstream from Air Base Parkway and extending upstream for approximately 1.3 miles.

Fairfield has adopted a floodplain regulation ordinance, which provides for primary, secondary, and tertiary floodplain zones, and prescribes limitations on land use. The requirements of the ordinance are intended to apply to lands along streams and diversions included in the Fairfield Vicinity Stream flood-control project.

City of Rio Vista

Rio Vista is bordered by the Sacramento River, the principal river draining the northern half of the Central Valley. Areas adjacent to the river are thus afforded flood protection directly or indirectly by every flood-control storage project in the Sacramento River Basin. These include five major dams and reservoirs on main stem and tributary streams from the Sacramento River in Shasta County on the north to the American River in Sacramento County on the south. Other major storage projects in the basin are authorized but have not been started.

The Sacramento River Flood Control Project consists of a comprehensive system of levees, overflow weirs, pumping plants, bypass channels, and channel enlargement along the river from its mouth upstream to Chico Landing (Butte County); levees along the lower reaches of its primary and secondary tributaries; and levees along certain major delta sloughs. A basic operational function of the project is the transfer of excess floodwater to leveed bypasses. Operation and maintenance of the project works are responsibilities of varied local interests.

The Rio Vista zoning ordinance provides for floodway districts and prescribes use and development of land therein, and for regulating use of other floodplain areas. A floodway has been designated along the lower 0.75 mile of Industrial Creek.

City of Suisun City

A flood-control project on Laurel Creek, McCoy Creek, Pennsylvania Avenue Creek, and Union Avenue Creek (Fairfield Vicinity Streams Project) was authorized in 1970 for construction by the USACE. The project, comprising channel improvements, diversion channels, drop structures, and appurtenant new bridges and culverts, was designed to provide protection against the 0.5-percent annual chance flood. Preconstruction planning was discontinued and the project was classified as “deferred” in 1977 due to lack of local support and unresolved environmental issues.

A natural detention basin is located on McCoy Creek upstream from Air Base Parkway. Outflow is regulated by two ungated corrugated metal culverts 6 feet in diameter. Private interests have improved McCoy Creek from approximately

Prosperity Lane downstream to State Highway 12. The improved channel will contain the 1-percent annual chance flood.

Several sumps are located in the portion of Suisun City below State Highway 12. Flood and storm waters collected in the sumps are pumped out into nearby tidal channels. Low, discontinuous levees along Marina Channel and other areas near or adjacent to Suisun Slough protect parts of Suisun City from minor flood tides.

Suisun City has adopted a floodplain regulation ordinance, which provides for primary, secondary, and tertiary floodplain zones, and prescribes limitations on land use. The requirements of the ordinance are intended to apply to lands along streams and diversions included in the now-deferred flood control project.

City of Vacaville

A NRCS project in the Ulatis Creek basin was designed to provide protection against a 10-percent annual chance flood. Project works extend from Cache Slough upstream to approximately Interstate Highway 80 and consist of channel improvements of Ulatis, Old Alamo, Horse, and Gibson Canyon Creeks; a new channel on Alamo Creek downstream from Nut Tree Road; stabilization structures on Ulatis, Alamo, and Horse Creeks; and levees along lower Ulatis Creek and lower Old Alamo Creek. Additional improvements are proposed for Alamo, Sweeney, McCune Creeks and Dry Arroyo. Maintenance of the project is the responsibility of Solano County.

At present, Vacaville requires developers to elevate building pads to protect against the 1-percent annual chance flood.

City of Vallejo

A levee system constructed by local interests along the eastern side of Napa River and Mare Island Strait protects the city and adjacent areas from inundation by high tides.

Solano County (Unincorporated Areas)

Part of southeastern Solano County is ordered by lower Sacramento River, the principal river draining the northern half of the Central Valley. Areas adjacent to the river are thus afforded flood protection directly or indirectly by every flood-control storage project in the Sacramento River basin. These include five major dams and reservoirs on main stem and tributary streams from upper Sacramento River in Shasta County on the north to American River in Sacramento County on the south. Other major storage projects in the basin are authorized but not started. In should be noted that each flood-control storage project in the Sacramento River basin is a unit of a comprehensive, integrated system that includes levees, channel improvements, floodway bypasses, and other improvements for flood control, as well as storage projects.

Levees exist in the study areas that provide the community with some degree of protection against flooding. However, it has been ascertained that these levees may not protect the community from rare events such as the 1-percent annual chance flood. The criteria used to evaluate protection against the 1-percent annual chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not provide protection from the 1-percent annual chance flood are not considered in the hydraulic analysis of the 1-percent annual chance floodplain.

Levees in the Delta areas of the Sacramento and San Joaquin Rivers are classified as direct agreement, project, or nonproject. Direct agreement levees were either constructed as part of a navigation project or were rebuilt by the Federal Government after a flood and are maintained by local reclamation districts to Federal standards. These levees constitute only about 10 percent of the total levee system. Project levees were either constructed by local interests and then rebuilt to Federal standard or were adopted as part of a Federal flood control project. About 15 percent of the Delta levee system falls into this category and is maintained to Federal standards by local interests. Nonproject levees were privately constructed, maintained by private owners or local agencies, and often receive minimal maintenance that is rarely performed to any kind of uniform standards. About 75 percent of the Delta levees are in this category.

The Sacramento River Flood Control Project consists of a comprehensive system of levees, overflow weirs, pumping plants, bypass channels, and channel enlargement along the river from its mouth upstream to Chico Landing (Butte County); levees along the lower reaches of its direct and indirect tributaries; and levees along certain major Delta sloughs. A basic operation function of the project is the transfer of excess floodwater to leveed bypasses. Operation and maintenance of the project works are the responsibilities of varied local interests. The principal improvement in Solano County is the lower portion of Yolo Bypass.

Privately constructed levees along Sacramento River at Collinsville provide a minor degree of flood protection. Maintenance of these levees is the responsibility of a local levee district.

Lakes Madigan and Frey (Wild Horse Creek, Solano County) and Lake Curry (Suisun Creek, Napa County) have a combined storage capacity of approximately 13,500 acre-feet. These reservoirs are operated by the City of Vallejo for domestic water supply and provide incidental flood control by storing runoff that occurs early in the flood season.

Private interests have also improved Laurel Creek from the north side of Cement Hill Road upstream for approximately 0.5 mile. The improved channel will provide 1-percent annual chance flood protection to land along the west bank, which has been raised with fill. The east bank has not been raised and is subject to overtopping.

The flood hazard ordinance for Solano County provides for special flood hazard areas and describes standards for new construction, substantial improvements to existing structures, and other developments in flood hazard areas.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude, which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood, which equals or exceeds the 1-percent annual chance flood in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

Procedures used included the USACE Standard Project rainfall and flood concept and the unit hydrograph method of analysis. A Standard Project Flood would result from the most severe combination of meteorologic and hydrologic conditions considered reasonably characteristic of the geographic area in which the drainage basin is located, excluding extremely rare combinations. Both the 96-hour general rain and the 3-hour local Standard Project storms were evaluated. Precipitation amounts and distribution were computed according to methodology developed by the USACE (Reference 5).

Loss rates were based on the initial and constant loss concept. The unit hydrograph – excess rainfall method was used to compute flood hydrographs. Because there are no streamflow records available for the streams under study, unity hydrographs were synthetically derived.

For each community within Solano County that had a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below.

City of Benicia

Rainfall Flooding

Peak discharge-drainage area relationships for Sulphur Springs Creek were developed using a Solano County publication, "Hydrology and Drainage Design Procedure" (Reference 6). This publication presents a uniform methodology for hydrologic analysis for Solano County, inducing the City of Benicia, and includes the presentation of rainfall data, a unit hydrograph methodology, and flow routing procedures, which were used for this study. The peak discharges for the 10-, 2-, 1-, and 0.2-percent annual chance flood recurrence intervals was taken from the revised hydrologic study prepare by CDM (Reference 7). CDM performed HEC-1 analyses using lower loss rates, high base flows and more conservative routing procedure to determine the peak discharges from the Lake Herman/Sulphur Springs Creek Watershed.

Tidal Flooding

Tidal elevations were obtained from the USACE publication "San Francisco Bay, Tidal Stage vs. Frequency Study" (Reference 8). Data for Benicia were adopted by interpolation between the data for the Bay Area Tide Stations at Crockett, Carquinez Strait, and Port Chicago, Suisun Bay. The 1-percent annual chance tide elevation is elevation 6.3. The 10-percent annual chance tide elevation is 5.8.

City of Dixon

For streams in Dixon, rainfall amounts for computation of cloudburst floods other than the Standard Project Flood were computed from a precipitation-frequency analysis of the Sacramento City Weather Service Office precipitation station (period of record, 128 years).

Ratios (of the computed Standard Project Flood) developed from peak flow-frequency curves for regional streams were used to compute the 10-, 2-, 1-, and 0.2-percentannual chance general rain floods.

The computational methods and techniques used area acceptable procedures for hydrologic analyses and produced results considered reasonable for Dixon. Unexpected findings were not encountered in carrying out the hydrologic analyses for this Flood Insurance Study.

Fluctuations occur in the peak discharge-drainage area relationships for Dickson Creek due to ponding behind restrictive structures and inflow from Dudley Creek overbank flooding.

City of Fairfield

For streams studied by detailed methods, rainfall amounts were computed from a precipitation-frequency analysis of the Fairfield 3 NNE precipitation station (period of record, 5 years).

Ratios of the computed Standard Project Flood developed from peak flow-frequency curves for regional streams were used to compute the 10-, 2-, 1-, and 0.2-percent annual chance floods. Ratios for the drainage basins of Suisun, Green Valley, Dan Wilson, and Ledgewood Creeks were based on the frequency curve for San Ramon Creek near San Ramon, near the City of Walnut Creek, Contra Costa County. Ratios for other drainage basins were based on the frequency curve for Dry Creek near Roseville, Placer County.

The 1-percent annual chance floodflow for the restudy in Union Creek was computed using the USACE HEC-1 computer program (Reference 9).

City of Rio Vista

For streams in Rio Vista (excluding the Sacramento River), rainfall amounts for computation of cloudburst floods other than the Standard Project Flood were computed from a precipitation-frequency analysis of the Sacramento City Weather Service Office precipitation station (period of record, 128 years).

Ratios (of the computed Standard Project Flood) developed from peak flow-frequency curves for regional stream were used to compute the 10-, 2-, 1-, and 0.2-percent annual chance general rain floods.

Tidal action, tributary basin runoff, and meteorologic conditions (barometric pressure, wind direction, and velocity) are the major factors influencing water-surface elevations associated with the Sacramento River.

Frequency analyses of water-surface elevations in the Sacramento River were performed using an analytical study of higher high stage-frequency relationships from 24 gaging stations located throughout the delta area (Reference 10). The selected period of record for the analyses (1945 to 1974) is subsequent to construction of Shasta Dam on the Sacramento River and covers the maximum length of record for the majority of the gages. Also, the Delta hydraulic pattern has not changed significantly during that period.

Originally, the stage data were statistically analyzed using the Pearson Type III distribution method included in U.S. Water Resources Council guidelines (Reference 11). The resultant curves did not reflect either levee overtopping or levee breaks resulting in extensive areal inundation. Therefore, the shape of the curves was graphically developed to include those conditions. The stage-frequency relationship for each gage was compared with the stage-frequency relationships developed for adjacent gages and, if necessary, adjusted to obtain consistency.

Flood elevations on watercourses in the Sacramento-San Joaquin Delta area were determined using a tidal hydrodynamics computer model. Based on a network of nodes and a grid of channels connecting the nodes, the model solves two basic equations of one-dimensional dynamic fluid flow. The first is the equation of continuity; the second is the equation of motion. Through numerical integration of these equations using the modified Runge-Kutta or modified Euler methods, the model computes water surface elevations.

City of Suisun City

For streams in Suisun City, rainfall amounts were computed from a precipitation – frequency analysis of the Fairfield 3 NNE precipitation station (period of record, 5 years).

Ratios (of the computed Standard Project Flood) developed from peak flow-frequency curves for regional streams were used to compute the 10-, 2-, 1-, and 0.2-percent annual chance general rain floods.

Tidal stages for Suisun City were estimated from a stage-frequency relationship developed for the tidal gage on Peytonia Slough at the Union Pacific Railroad with a period of record 1976 through 1977. The record at Peytonia Slough was extended by correlation with the tidal gage on Suisun Bay at Benicia Arsenal. The tidal gage at Benicia Arsenal has a period of record of from 1929 to 1979, with a maximum recorded peak stage of 5.7 feet in April 1958.

City of Vacaville

For streams in Vacaville, rainfall amounts were computed from a precipitation-frequency analysis of the Fairfield 3 NNE precipitation station (period of record 5 years).

Ratios (of the computed Standard Project Flood) developed from peak flow-frequency curves for regional streams were used to compute the 10-, 2-, 1-, and 0.2-percent annual chance general rain floods. Ratios were based on the frequency curve for Dry Creek, near Roseville, Placer County, California.

The hydrologic analyses for the revised streams were conducted using the USACE HEC-1 hydrologic computer model. Storms having duration of 24 hours were developed using regional depth-duration-frequency information related to mean annual precipitation. The precipitation depths were distributed based on the 24-hout NRCS Type 1A distribution according to the NRCS National Engineering Handbook. The Snyder unit hydrograph method was selected to simulate the rainfall-runoff process. Because the 1-percent annual chance flood discharges exceed the capacity of the channel, an iterative approach to the hydrology was used to account for the overflow.

The hydrologic analyses for the second restudy were carried out to establish peak discharge-frequency relationships for streams studies in detail. The USACE

HEC-1 computer program (Reference 12) was used to establish peak discharges having recurrence intervals of 10, 50, 100, and 500 years. No stream gages were available for the streams being restudied.

Precipitation was estimated using a synthetic storm distribution with 240-hour duration. Synthetic precipitation depths were obtained from a report entitled "Solano and Yolo county Design Rainfall" (Reference 13). The precipitation depths were distributed based on the NRCS (NRCS) 24-hour, Type 1A distribution according to the NRCS "National Engineering Handbook" (Reference 14). Adjustments to precipitation depths were made in accordance with the National Oceanic and Atmospheric Administration (NOAA) "Precipitation-Frequency Atlas of the Western United States" (Reference 15). The initial uniform loss rate methods were used to reflect precipitation loss according to the Sacramento City and County Drainage Manual.

The Snyder unit hydrograph method was used for the rainfall runoff in the HEC-1 modeling. Lag parameters were based on the methods shown in the U.S. Bureau of Reclamation "Flood Hydrology Manual." Hydrograph routing was performed with the Muskingum and Muskingum-Cunge methods, depending on the availability of stream information.

City of Vallejo

For studies of tidal flooding along Napa River-Mare Island Strait and Carquinez Strait, peak elevation-frequency relationships were established by integration of analyses of San Francisco Bay, and the Sacramento Delta (Reference 16) with NOAA data for San Francisco and San Pablo Bays, November 14, 1980.

Unit hydrographs for a number of index points were developed synthetically, making use of basin characteristics (stream length, distance to center of gravity of drainage area, and overall basin channel slope), a lag curve relationship, and an average S-curve hydrograph derived by the USACE. From these unit hydrographs and the results of rainfall-frequency analyses, frequency-discharge relationships for the streams were computed. The rainfall-frequency analyses were based on depth-duration-frequency of precipitation studies made by the State of California Department of Water Resources for stations in the San Francisco Bay area. A storm of 3 hours duration for various rainfall depths was adopted for use in this study. In addition, the 3-day, general-type storm from December 21 to 24, 1955, was analyzed in order to evaluate the extent of flooding at Lakes Chabot and Dalwigk, and at the mouth of each stream in the area of detailed study.

The hydrologic analyses for Miller Ditch (formerly named Austin Creek), Lake Dalwigk, Lemon Street Canal, North Fork Ridler Creek, Rindler Creek, South Fork Rindler Creek, and Blue Rock Springs Creek were revised for this Physical Map Revision (Reference 67). The January 2012 BakerAECOM study determined the 10-,4-, 2-, 1-, and 0.2-percent annual chance peak discharges using the EPA-SWMM Version 5.0 stormwater management model. Several

portions of the studied streams are contained within the underground stormwater sewer system which. Rating curves were developed for detention ponds such as Lake Chabot and Lake Dalwigk to determine tailwater conditions for contributing streams. Open channel streams and canals were also analyzed within EPA-SWMM and sizing, slope, and roughness values were determined based on survey data obtained in March 2011.

Solano County (Unincorporated Areas)

For Dickson Creek, Marina Creek, Marina Creek Tributary, and Industrial Creek, rainfall amounts for computation of cloudburst floods other than the Standard Project Flood were computed from a precipitation-frequency analysis of the Sacramento City Weather Service Office precipitation station (period of record, 128 years). For Ulatis, Alamo, and Laguna Creeks; Lagoon Drain; Encinosa, Old Alamo, Gibson Canyon, South Branch Gibson Canyon, Horse, Middle Branch Horse, and Middle Swale to South Branch Horse Creeks; Unnamed Tributary to Ulatis Creek; and Suisun, Green Valley, Dan Wilson, Wild Horse, McCoy, Pennsylvania Avenue, Ledgewood, Gordon Valley, Clayton, Laurel, and Union Avenue Creeks, rainfall amounts were computed from a precipitation-frequency analysis of the Fairfield 3 NNE precipitation station (period of record, 5 years).

Ratios (of the computed Standard Project Flood) developed from peak flow-frequency curves for regional streams were used to compute the 10-, 2-, 1-, and 0.2-percent annual chance general rain floods. Ratios for the drainage basins of Green Valley, Suisun, Dan Wilson, and Ledgewood Creeks were based on the frequency curve for San Ramon Creek near San Ramon (near the City of Walnut Creek, Contra Costa County). Ratios for other drainage basins were based on the frequency curve for Dry Creek, near Roseville (Placer County).

The hydrologic analyses for the Sweeney Creek model were conducted using the USACE HEC-1 hydrologic computer model.

The NRCS made slope-area measurements of floodflows in January 1967 and January 1973 on streams in the Ulatis Creek basin. Flows developed for this study were comparable to the measured flows except for Gibson Canyon Creek. This discrepancy may be due to the lack of adequate rainfall information for the Gibson Canyon Creek basin.

Peak tide stage-frequency data for Sacramento River and Yolo Bypass were taken from an analytical study of higher-high stage-frequency relationship for 24 locations in the Delta region (Reference 10). That study was based on the period 1945 to 1974 because it was considered a representative sample and covered the maximum length of record for the majority of existing gages. Further, the hydraulic regimen of the Delta did not change significantly during that period of time. Originally, the stage data were statistically

analyzed using the Pearson Type III distribution method included in U.S. Water Resources Council guidelines (Reference 11). The resultant curves did not reflect either levee overtopping or levee breaks resulting in extensive areal inundation. Therefore, the shape of the curves was graphically developed to include those conditions. The stage-frequency relationship for each gage was compared with the stage-frequency relationships developed for adjacent gages and, if necessary, adjusted to obtain consistency. Stage data from the study by the USACE reflected a static water condition that included wind set and any other hydrologic action that tended to build up stage levels, but not wave action (Reference 10). Tidal stages for the Suisun City area were estimated from a stage-frequency relationship developed for the tidal gage on Peytonia Slough at the Union Pacific Railroad. The record at Peytonia Slough was extended by correlation with the tidal gage on Suisun Bay at Benicia Arsenal. No significant peak stage was recorded at the tidal gage on Peytonia Slough during the period of record 1976-1977. Stage data developed for this study specifically exclude wave action. Tidal gage data for Solano County is shown on Table 7, "Tidal Gages."

Table 7 – Tidal Gages

Station Name	Period of Record	Maximum Recorded Feet (NGVD)	Peak Stage Date
SACRAMENTO RIVER			
At Collinsville	1908-1909 (Partial); 1929 to Present	6.1	January 1909
At Rio Vista	1925 to Present	8.8	February 1986
At Walnut Grove	[1]	12.4	1956
At Snodgrass Slough	[1]	18.0	1951
At Sacramento (I Street Bridge)	[1]	30.2	1951
YOLO BYPASS			
At Lisbon	[1]	21.70	December 25,1964
		24.53	February 20, 1986
SUISUN BAY			
At Benicia Arsenal	1929 to Present	5.7	April 1958

[1]*Data not available*

Higher-high stage-frequency profiles were developed for defined channel reaches by connecting a line between the higher-high stage data for each pertinent gage. It should be noted that a stage shown on the stage-frequency curve for one gage is valid only for that particular gage being analyzed. Synthetic higher-high stage profiles for the 2- and 1-percent annual chance flood events were developed for the Sacramento River and the Yolo Bypass.

The 2- and 1-percent annual chance higher-high stage profiles were based on historical flood profiles and the higher-high stage-frequency curves.

Flood elevations on Sutter Slough, Streamboat Slough, Miner Slough and Cache Slough were determined using the Delta Tidal Hydrodynamic Computer Model (Reference 17). Based on a network of nodes and a grid of channels connecting the nodes, the model solves two basic equations of one-dimensional dynamic fluid flow. The first is the equation of continuity; the second is the equation of motion. Through numerical integration of these equations using the modified Runge-Hutta or modified Euler methods, the model computes water-surface elevations.

The Sacramento-San Joaquin Delta to the Golden Gate is represented on two grid systems. The coarse grid contains some 250 nodes connected by 325 channels; the fine grid contains 1,200 nodes and 1,800 channels. In addition to physical parameters of the individual channels, the model uses inflow, overflow, evaporation losses, tidal elevations, and wind velocity to solve for water-surface elevations. It must be noted that wave action may increase the 1-percent annual chance flood stage by 1.5 to 2.0 feet on many streams, and up to 3.0 feet in certain areas in Suisun Bay.

For the restudy, as part of the Gonsalves-Lockie development just downstream of Peabody Road, a 50 acre-foot detention basin was constructed to mitigate the impact of the development on the 1-percent annual chance peak discharge in Union Creek (References 18-19). The embankment of this detention basin is certified by the City of Vacaville and will be maintained by a maintenance assessment district established by the City of Vacaville, California (Reference 20).

A second detention basin for the Gonsalves-Lockie development was incomplete and not included in the hydrologic analysis.

The Union Creek channel approximately 3,800 feet downstream of Vanden Road diverts flows from the original natural channel. However, the analysis conducted during this study indicates that the capacity of the Union Creek Channel downstream of the abandoned railroad embankment at Cordero Junction is insufficient to carry the 1-percent annual chance flood discharge without the attenuation effects of the impoundment area behind the embankment.

The 1-percent annual chance flood discharge in Union Creek was computed using the USACE computer program HEC-1 (Reference 9). The watershed was modeled as nine separate subbasins in order to account for varying topographic features and to evaluate storage at three locations. The discharges decrease in the downstream direction between Cordero Junction and Forbes Street in the City of Fairfield as a result of flow spilling out of the

channel on the right bank as sheetflow away from the channel to the southeast.

The hydrologic analyses for the second restudy were conducted using the USACE HEC-1 hydrologic computer model. Storms having duration of 24 hours were developed using regional depth-duration-frequency information related to mean annual precipitation. The precipitation depths were distributed based on the 24-hour NRCS Type 1A distribution, according to the NRCS National Engineering Handbook. The Snyder unit hydrograph method was selected to simulate the rainfall-runoff process. Because the 1-percent annual chance discharges exceed the capacity of the channel, an iterative approach to the hydrology was used to account for the overflow.

The hydrologic analyses for the third restudy were carried out to establish peak discharge-frequency relationships for streams studies in detail. The USACE HEC-1 computer program (Reference 12) was used to establish peak discharges having recurrence intervals of 10, 50, 100, and 500 years. No stream gages were available for the streams being restudied.

Precipitation was estimated using a synthetic storm distribution with 240-hour duration. Synthetic precipitation depths were obtained from a report entitled "Solano and Yolo county Design Rainfall" (Reference 13). The precipitation depths were distributed based on the NRCS (NRCS) 24-hour, Type 1A distribution according to the NRCS "National Engineering Handbook" (Reference 14). Adjustments to precipitation depths were made in accordance with the NOAA "Precipitation-Frequency Atlas of the Western United States" (Reference 15). The initial uniform loss rate methods were used to reflect precipitation loss according to the Sacramento City and County Drainage Manual.

The Snyder unit hydrograph method was used for the rainfall runoff in the HEC-1 modeling. Lag parameters were based on the methods shown in the U.S. Bureau of Reclamation "Flood Hydrology Manual." Hydrograph routing was performed with the Muskingum and Muskingum-Cunge methods, depending on the availability of stream information.

The computational methods and techniques used are acceptable procedures for hydrologic analyses and produced results considered reasonable for Solano County. Unexpected finds were not encountered in carrying out the hydrologic analyses for this Flood Insurance Study.

Peak discharge-drainage area relationships for Solano County are shown in Table 8, "Summary of Discharges."

Table 8 – Summary of Discharges

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
ALAMO CREEK[1]					
Pleasant Valley Road	[2]	2,000	2,700	2,900	3,600
Interstate Highway 80	[2]	2,700	3,200	3,400	3,500
Alamo Drive	[2]	4,400	5,700	6,200	6,700
Leisure Town Road	25.1	3,500	3,700	3,700	3,900
BLUE ROCK SPRINGS CREEK					
At Confluence with Rindler Creek	2.36	806	987	1,049	1,135
Just Downstream of Interstate 80	2.32	791	978	1,040	1,126
Just Upstream of Interstate 80	2.28	776	968	1,030	1,117
BUCKTOWN CREEK					
At Confluence with Ulatis Creek	1.0	310	390	400	420
CLAYTON CREEK					
At Clayton Road	2.3	250	580	760	1,390
DAN WILSON CREEK [3, 4]					
At Cordelia Road	4.8	125	1,220	1,995	3,100
At Interstate Highway 80	4.6	125	1,220	1,995	3,100
At Rockville Road	3.7	75	795	1,535	2,500
DICKSON CREEK [6]					
At Union Pacific Railroad	2.0	6	31	33	36
At North 1st Street	1.8[5]	6	129	319	689
At North Almond Street	1.1	5	47	88	201
At Interstate Highway 80	0.8	11	60	77	111
ENCINOSA CREEK					
At Confluence with Alamo Creek	3.0	760	1,070	1,080	1,160

[1]*Decrease in 2-, 1-, and 0.2-percent annual chance floodflows in downstream direction due to overbank losses*

[2]*Data not available*

[3]*Flows from Green Valley and Dan Wilson Creeks commingle between Interstate Highway 80 and Cordelia Road*

[4]*Flows for 2-, 1, and 0.2-percent annual chance floods include overland flow from Suisun Creek*

[5]*Fluctuation in floodflows due to ponding and (for North First Street and Union Pacific Railroad index stations) overland flow from Dudley Creek*

[6]*Includes Dudley Creek*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
GIBSON CANYON CREEK					
At Browns Valley Road	1.16	390	530	580	710
Upstream of Putah South Canal	1.93	620	850	940	1,200
Downstream of Putah South Canal	1.93	440[1]	480[1]	490[1]	520
Approximately 675 feet downstream of Eubanks Road	2.10	470	520	530	570
At Interstate Highway 505	2.78	620	730	770	850
Upstream of Confluence of South Branch Gibson Canyon Creek	2.81	630	740	780	860
At Leisure Town Road	4.19	510[2]	520[2]	520[2]	530[2]
At Sewage Treatment Plant	4.63	600[3]	730[3]	810[3]	790[3]
Upstream of Interstate Highway 80	7.36	1,800	2,300	2,400	2,900
Downstream of Interstate Highway 80	7.62	1,800	2,300	2,500	3,000
At Byrnes Road	8.03	1,900	2,500	2,700	3,100
GORDON VALLEY CREEK					
At Gordon Valley Road	3.8	365	900	1,210	2,210
GREEN VALLEY CREEK [4, 5]					
At Cordelia Road	18.0	1,225	2,400	2,950	4,350
At Interstate Highway 80	17.8	1,225	2,350	3,300	5,100
At Green Valley Road (Lower Crossing)	16.3	1,130	2,200	3,350	6,600
At Mason Road	10.6	990	1,800	2,150	2,700
At Rockville Road	8.2	770	1,550	1,750	2,350
At Wild Horse Creek	6.8	710	1,550	2,500	4,800
At Green Valley Road (Upper Crossing)	3.2	350	790	1,260	2,520

[1] *Increase in area with reduction in discharge due to ponding behind South Putah Canal*

[2] *Increase in area with reduction in discharge due to split flow*

[3] *Value reflects reduction in total discharge due to split flow*

[4] *Fluctuation in 1- and 0.2-percent annual chance floodflows due to tributary inflow and overbank gains and losses*

[5] *Flows from Green Valley and Dan Wilson Creeks commingle between Interstate Highway 80 and Cordelia Road*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
HORSE CREEK					
Upstream of Putah South Canal	1.10	370	500	560	680
Downstream of Putah South Canal	1.10	370	420[1]	425[1]	430[1]
Upstream of Confluence with South Branch Horse Creek	1.18	400	460	460	480
At Interstate Highway 505	2.38	800	890	910	970
Upstream of Confluence with Pine Tree Creek	2.42	810	900	920	990
At Interstate Highway 80 (Westbound)	3.88	1,200	1,300	1,400	1,500
At Orange Drive	5.19	1,600	1,900	1,900	2,000[2]
At Leisure Town Road	7.84	2,200	2,700	2,700	3,300
At Willow Avenue	8.24	2,300	2,800	2,900	3,500
INDUSTRIAL CREEK					
At St. Francis Way	1.4	135	325	455	940
LAGUNA CREEK					
At Confluence with Alamo Creek	8.8	1,700	2,400	2,700	3,300
LAGOON DRAIN					
At Interstate Highway 80	3.5	370	650	850	1,400
LAUREL CREEK					
At Union Pacific Railroad	7.2	800	1,615	2,190	4,100
At Air Base Parkway	5.9	680	1,400	1,930	3,620
At Putah South Canal	4.6	550	1,260	1,740	3,130
LEMON STREET CANAL					
At Lemon Street	1.95	989[3]	1,275[3]	1,397[3]	1,649[3]
At Fahey Court	1.78	884[3]	1,143[3]	1,234[3]	1,446[3]
At Confluence with Magazine Street Canal	1.29	667[3]	711[3]	734[3]	783[3]
At the Upstream Limit of Study	0.91	390	403	417	444

[1]*ncrease in area with reduction in discharge due to ponding behind South Putah Canal*

[2]*Value reflects reduction in total discharge due to split flow*

[3]*Information based on combined hydrograph data*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
LEDGEWOOD CREEK [1]					
At Interstate Highway 80	16.8	1,180	2,280	4,480	12,750
At Abernathy Road	13.6	1,020	2,120	4,100	12,010
At Mankas Corner Road	3.9	330	770	1,070	2,000
MAGAZINE STREET CANAL					
At the Upstream Limit of Study	0.38	263	284	287	298
MARINA CREEK					
At Second Street	1.8	200	510	730	1,500
Above Marina Creek Tributary	1.6	175	450	645	1,330
MARINA CREEK TRIBUTARY					
Above Mouth	0.2	25	60	85	170
MCCOY CREEK					
At State Highway 12	8.4	450	800	1,040	1,810
At Air Base Parkway	6.0	250	300	350	500
MIDDLE BRANCH HORSE CREEK [2]					
At Mouth	1.0	70	100	120	570
At Interstate Highway 505	0.58	210	280	310	380
At Confluence with Horse Creek	0.87	340	400	420	430
MIDDLE SWALE TO SOUTH BRANCH HORSE CREEK					
At Confluence with South Branch Horse Creek	0.30	130	170	180	220
At Putah South Canal	0.3	70	150	190	340
At Browns Valley Road	0.1	70	150	190	340
MILLER DITCH					
At Vervais Avenue	1.77	1,274	1,475	1,647	2,027
1,500 Feet Upstream of Carolina Street	1.68	1,072	1,432	1,612	1,990
At Thelma Avenue	1.43	896	1,303	1,490	1,859
At Oakwood Avenue	1.28	819	1,195	1,368	1,708
At Heartwood Drive	0.36	232	334	339	521

[1]*Flows for 1, and 0.2-percent annual chance floods at Abernathy Road and Interstate Highway 80 include overland flow from Suisun Creek*

[2]*Decrease in 2- and 1-percent annual chance floodflows in a downstream direction due to overbank losses*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
NORTH FORK RINDLER CREEK					
Upstream of Lake Chabot	0.70	455	455	461	579
At Fairgrounds Drive	0.64	362	389	448	580
At Sage Street	0.41	151	231	265	337
At Highway 37	0.23	147	209	234	300
OLD ALAMO CREEK [1]					
At Lewis Road	1.3	65	75	75	80
At Union Pacific Railroad	1.1	65	100	105	140
At Leisure Town Road	0.8	45	80	100	215
PENNSYLVANIA AVENUE CREEK [2]					
At Cordelia Road	3.7	360	650	900	1,000
At Crowley Lane	3.2	360	650	900	1,400
At Interstate Highway 80	2.3	105	160	340	415
PINE TREE CREEK [3]					
Upstream of Union Pacific Railroad	0.20	75	100	110	140
Upstream of Putah South Canal	0.84	340	450	500	750
Downstream of Putah South Canal	1.11	280[4]	300[4]	320[4]	370[4]
At Interstate Highway 505	1.46	390	440	460	520
At Interstate Highway 80	1.4	225	500	650	825
At Nut Tree Airport	0.9	225	425	525	1,250
At Putah South Canal	0.8	225	425	800	2,000
At Browns Valley Road	0.6	240	425	950	2,200

[1]*Fluctuation in 10-percent annual chance floodflow due to tributary inflow above Interstate Highway 80 and to channel routing losses; fluctuation in 2-, 1-, and 0.2-percent annual chance floodflows due to overbank losses and tributary inflow*

[2]*Decrease in 2-, 1-, and 0.2-percent annual chance floodflows in a downstream direction due to overbank losses*

[3]*Decrease in 10-percent annual chance floodflow in a downstream direction due to channel routing losses; fluctuation in 1- and 0.2-percent annual chance floodflows due to overbank losses and large inflow from Ulatis Creek via overflow channelway*

[4]*Increase in area with reduction in discharge due to ponding behind South Putah Canal*

[5]*Value reflects reduction in total discharge due to split flow*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
RINDLER CREEK					
At Confluence with Blue Rock Springs Creek	5.13	1,543	2,492	2,798	3,484
At Confluence with South Fork Rindler Creek	2.67	816	1,575	1,861	2,461
At Solano County Fairgrounds	[1]	798	1,326	1,553	1,944
Approximately 250 Feet Downstream of Interstate 80	[1]	742	905	1,072	1,171
Approximately 700 Feet Upstream of Interstate 80	2.10	799	1,333	1,568	1,980
Approximately 1,500 Feet Upstream of Interstate 80	1.80	647	1,110	1,342	1,690
Approximately 1,700 Feet Upstream of Interstate 80	1.28	458	762	915	1,147
SOUTH BRANCH GIBSON CANYON CREEK					
Upstream of Browns Valley Road	0.40	150	180[3]	190[3]	210[3]
Upstream of Putah South Canal	0.72	260	350	390	480
Downstream of Putah South Canal	0.72	200[2]	210[2]	210[2]	220[2]
At Interstate Highway 505	1.14	350	400	420	470
Upstream of Confluence with Gibson Canyon Creek	1.17	360	420	440	490

[1]*Data not available*

[2]*Increase in area with reduction in discharge due to ponding behind South Putah Canal*

[3]*Value reflects reduction in total discharge due to split flow*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
SOUTH BRANCH HORSE CREEK [1]					
Upstream of Confluence of Middle Swale to South Branch Horse Creek	0.72	280	380	420	510
Downstream of Putah South Canal	1.01	350	370	380	410
Upstream of Confluence with Horse Creek	1.06	370	380	390	420
At Mouth	1.0	180	400	450	650
At Putah South Canal	0.7	120	270	300	680
At Browns Valley Road	0.4	140	300	375	680
SOUTH FORK RINDLER CREEK					
At Turner Parkway	0.57	249	334	386	533
SUISUN CREEK [2]					
At Cordelia Road	49.5	2,550	3,300	3,300	3,300
At Interstate Highway 80	48.8	2,550	3,610	3,610	3,610
At Rockville Road	48.3	2,500	4,200	4,200	4,310
At Suisun Valley Road	47.3	2,550	4,900	5,850	6,400
At Wooden Valley Road	44.0	2,450	5,000	6,900	10,270
At Napa County-Solano County Limits	40.7	2,200	4,800	6,500	12,400
SULPHUR SPRINGS CREEK					
Downstream of I-680	18.3	2,060	3,160	4,020	10,950
Downstream of East 2nd Street	17.9	1,987	3,068	3,900	10,549
Downstream of Lake Herman	15.7	1,391	2,217	2,856	7,961
SWEENEY CREEK [2]					
Upstream of Conf. with McCune Creek	15.5	[3]	[3]	2,660	[3]
At Putah South Canal Bridge	10.1	[3]	[3]	3,780	[3]
At Peaceful Valley Road Bridge	7.65	[3]	[3]	3,830	[3]

[1]*Fluctuation in 10-percent annual chance floodflow due to channel routing losses and tributary inflow above South Putah Canal; fluctuation in 2-, 1-, and 0.2-percent annual chance floodflows due to overbank losses and tributary inflow*

[2]*Decrease in 2-, 1-, and 0.2-percent annual chance floodflows in a downstream direction due to overbank losses*

[3]*Data not available*

Table 8 – Summary of Discharges, continued

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges (cfs) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
ULATIS CREEK (ABOVE LEISURE TOWN ROAD) [1]					
Leisure Town Road	16.6	2,700	2,800	2,800	2,800
At Interstate Highway 80	[2]	3,300	4,700	5,200	6,100
Farrell Road	[2]	3,000	4,200	4,700	5,800
Putah South Canal	[2]	3,300	4,400	4,500	4,700
UNION AVENUE CREEK [3]					
At Marina Boulevard	3.8	160	160	160	160
At Union Pacific Railroad	3.5	385	515	690	740
At Washington Street	3.1	330	520	555	630
At Travis Boulevard	2.8	310	480	495	530
At Western Pacific Railroad	2.5	255	535	545	555
At Air Base Parkway	2.3	195	430	450	450
At Putah South Canal	1.5	105	275	470	730
At Intestate Highway 80 (Downstream)	1.3	100	270	480	850
At Intestate Highway 80 (Upstream)	1.3	195	495	670	1,180
UNION CREEK					
At Airbase Parkway	5.6	[4]	[4]	560	[4]
At Cordero Junction	4.9	[4]	[4]	2,500	[4]
At Union Pacific Railroad	3.5	[4]	[4]	1,930	[4]
WILD HORSE CREEK [5]					
At Mouth	3.1	320	625	850	1,350
At Upstream Limit of Study	3.0	320	750	1,270	2,425

[1]*Decrease in 2-, 1-, and 0.2-percent annual chance floodflows in a downstream direction due to overbank losses*

[2]*Data not available*

[3]*Fluctuation in floodflows due to overbank gains and losses*

[4]*Data not available*

[5]*Decrease in 2-, 1-, and 0.2-percent annual chance floodflows in a downstream direction due to overbank losses*

Elevations for floods of the selected recurrence intervals on the San Francisco Bay are shown in Table 9, "Summary of Stillwater Elevations."

Table 9 – Summary of Stillwater Elevations

Flooding Source and Location	Elevation (feet – NAVD88) [1] 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
CARQUINEZ STRAIT				
At Interstate Highway 80 Bridge	7.8	[2]	8.3	8.5
LAKE CHABOT	81.44	82.56	82.90	83.53
LAKE DALWIGK	6.37	9.05	10.04	10.89
MARE ISLAND STRAIT				
At Mouth	8.6	[2]	9.1	9.5
NAPA RIVER				
At Sears Point Road	7.9	[2]	8.4	8.7
SACRAMENTO RIVER				
At Collinsville Tide Gage	8.3	8.9	9.1	9.4
At Rio Vista Tide Gage	9.0	9.6	9.8	10.6
At Walnut Grove Tide Gage	14.7	15.6	15.8	16.2
At Snodgrass Slough Tide Gage	19.7	20.8	21.1	21.6
At Sacramento (Near I Street Bridge)	31.5	32.9	33.3	34.1
SUISUN SLOUGH				
At Suisun City	8.3	8.9	9.1	9.4

[1] *Reflects a static water condition that includes wind set and any other hydrologic action that tends to build up stage levels, but not wave action, which will increase 1-percent annual chance flood stage by 1.5 to 2.0 feet.*

[2] *Data not available*

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (Reference 21) and modified by manual calculations where appropriate.

For each community within Solano County that had a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below.

City of Benicia

Cross sections for the backwater analyses of Sulphur Springs Creek were obtained from topographic maps prepared fro this study at a scale of 1":4,800', with a contour interval of five feet and intermediate spot elevations (Reference 22). All bridges and culverts were measured to determine channel geometries at flow restrictions.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas. The roughness values used for the main channels of Sulphur Springs Creek were 0.015 to 0.040. The roughness value for overbank flow was 0.060.

Starting water surface elevations were established by using a mean higher high water elevation of 3.1 in the Carquinez Strait.

Flood profiles were drawn showing computer water-surface elevations for floods of the selected recurrence intervals.

City of Dixon

Cross sections for backwater analysis were located at close intervals upstream and downstream from bridges, culverts, and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans. All bridges, dams, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings, and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.035 to 0.075 for channels and from 0.050 to 0.060 for overbank areas.

Starting water-surface elevations for Dickson Creek were developed by the slope-area method.

Above the Union Pacific Railroad, flooding on Dickson Creek was determined to be shallow ponding. Below the railroad, all frequency floods considered in this study were found to be contained within the channel. Due to the nature of flooding along Dickson Creek, no flood profiles are presented.

For Dudley Creek, studied by approximate methods, the elevation of the 1-percent annual chance flood was established by professional engineering judgment, giving consideration to available data and field observation.

City of Fairfield

Cross sections for backwater analyses were located at close intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans. USGS topographic maps were used to supplement available data. All bridges, dams, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.015 to 0.075 for channels and from 0.035 to 0.060 for overbank areas.

Starting water-surface elevations were developed by the slope-area method, taken from the main stem for tributary streams, or estimated from expected high-water stage for streamways flowing into tidal areas.

From the Western Pacific Railroad crossing to approximately 300 feet upstream of the Violet Avenue crossing, Union Avenue Creek produces only shallow flooding. Therefore, no profiles are presented for this stream segment.

Areas of sheetflow and shallow ponding occur along Green Valley and Ledgewood Creeks; Laurel Creek; along the northern edge of Kentucky Street from Pennsylvania Avenue Creek flooding; and on Dahlia Street from Union Avenue Creek flooding.

Flood profiles were not prepared for Suisun Slough because flood stages reflect tidal effect only and are not influence by stream hydraulics.

Only a 1-percent annual chance flood profile is given for Laurel Creek upstream of Nightingale Drive.

Ledgewood Creek has been channelized from Interstate Highway 80 downstream to the Union Pacific Railroad spur. Channel flows in this area have been reduced from the values shown in Table 7, "Summary of Discharges," due to breakouts along the channel upstream of Interstate Highway 80. These flows are contained within the channel down to station 1.75. Additionally, flows were modified in a section of this channel due to flow into a parallel low-flow channel along the right bank. Based upon a starting water-surface elevation at the downstream confluence of these two channels, different flows were assumed for the low-flow and overflow channels until computed elevations balanced at the upstream diversion.

Along Pennsylvania Avenue Creek, a continuous culvert extends approximately from station 3.18 downstream to station 1.82. The 0.2-percent annual chance flood is contained in the culvert from stations 3.18 to 3.11; from stations 2.6 to 1.82 the 1-percent annual chance flood is contained; and between these two sections the 2-percent annual chance flood is contained. When the capacity of the culvert is reduced in this middle section, the excessive flow escapes through storm drains along Travis Boulevard where the flow is contained in the street until it reenters the culvert near the Western Pacific Railroad or flows overland and floods areas east of Pennsylvania Avenue.

Hydraulic analysis for the restudy was conducted using the USACE HEC-2 step-backwater computer program (Reference 21) to provide estimates of the elevations of the 1-percent annual chance flood of the selected recurrence intervals along Union Creek. The starting water-surface elevation was determined by the slope-area method.

Cross section data for the backwater analysis were obtained from topographic maps at a scale of 1":2,400', which were compiled from aerial photographs (Reference 23). Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were based on field observations of the stream and floodplain areas, Open-Channel Hydraulics by Ven Te Chow (Reference 24), and engineering judgment. The channel "n" values range from 0.015 to 0.10 and the overbank "n" values range from 0.035 to 0.04. The floodplain boundaries were based on elevations determined during the hydrologic and hydraulic analyses and delineated using the USGS quadrangle map of Elmira, California (Reference 23), and an aerial topographic map at a scale of 1"2,400', with a contour interval of 2 feet (Reference 25).

Hydraulic analyses for the third restudy were performed to determine the effects of channel modifications and the construction of a levee along the west bank of Dan Wilson Creek from just upstream to approximately 1,650 feet upstream of Interstate Highway 80. The newly constructed levee ties into an existing levee at its upstream and downstream limits. The existing levee at the downstream limit (just upstream of Interstate Highway 80) extends southwesterly along the northern side of, and parallel to, Interstate Highway 80 for approximately 600 feet, and west from that point across (perpendicular to) the floodplain of Dan Wilson Creek. These levees are intended to protect the Fairfield Corporate Commons development form flooding from Dan Wilson Creek. In addition, two detention ponds were constructed on the landward side of the levee, within the Fairfield Corporate Commons development.

The 1-percent annual chance floodplain and floodway area base flood elevations (BFE) were reduced along the revised reach of Dan Wilson Creek. The only exception is that the 1-percent annual chance floodplain area increased in the eastern overbank of Dan Wilson Creek from just upstream to approximately 1,050 feet upstream of Interstate Highway 80. This increase in floodplain area was a

result of updated topographic information and not a result of the channel modifications or levee construction.

City of Rio Vista

Cross sections for backwater analysis were located at close intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans.

All bridges, dam, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings, and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.030 to 0.080 for channels and 0.030 to 0.100 for overbank areas.

Starting water-surface elevations for Marina Creek and Industrial Creek were taken to be the corresponding elevations along Sacramento River at their respective confluences. Starting water-surface elevations for Marina Creek Tributary were taken to be the corresponding elevations along Marina Creek at their confluence. These starting elevations are the result of determining that peak flows occur coincidentally.

Results of the hydraulic analysis showed that flooding along Marina Creek Tributary, within the study area and along Industrial Creek above St. Francis Way, take the form of sheetflow. In sheetflow areas, depths of flooding area determined and no profiles are drawn.

City of Suisun City

Cross sections for backwater analyses were located at close intervals upstream and downstream from bridges, culverts, and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans. All bridges, dams, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings, and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.035 to 0.075 for channels and from 0.050 to 0.060 for overbank areas.

Starting water-surface elevations were developed by the slope-area method, taken from the main stem for tributary stream, or estimated from expected high-water stage for streamways flowing into tidal areas.

Areas of shallow flooding occur along Sunset Avenue and State Highway 12 due to sheetflow and ponding from Laurel Creek, between State Highway 12 and the Union Pacific Railroad from Laurel Creek, and at Cordelia road due to ponding from Pennsylvania Avenue Creek flooding.

Flooding along Pennsylvania Avenue Creek, within Suisun City, is caused by backwater fro Suisun Slough, therefore, no flood profiles have been shown.

City of Vacaville

Cross sections for backwater analysis were located at close intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans. USGS topographic maps were used to supplement available data.

All bridges, dam, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings, and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.020 to 0.080 for channels and from 0.030 to 0.100 for overbank areas.

Starting water-surface elevations were developed by the slope-area method, or taken from the main stem for tributary streams, or estimated from expected high-water stage for streamways flowing into tidal areas.

The hydraulic analyses for the revised study were performed using the USACE HEC-2 step-backwater hydraulic computer model. Channel cross sections for the detailed analyses were obtained by aerial and field surveys. Roughness coefficients (Manning's "n") used for the hydraulic computations were based upon field inspection. The data to define the hydraulic structures were obtained from field surveys and as-built construction plates.

The starting water surface elevations for Alamo Creek and Ulatis Creek were developed by the slope-area method. The starting water surface elevations for Encinosa Creek, Laguna Creek, and Ulatis tributary were determine ed from the main stream at the time of the peak for each individual creek.

HEC-2 hydraulic analyses were performed along the overflow areas to determine the depth of flooding. Since the depth of flow along the overflow path and along the main channel bank at the overflow point is less than one foot, the overflow areas have been designated as Zone X.

Levees exist along both banks of Alamo Creek at the downstream end of the studied reach. Because they do not meet the requirements established in the National Flood Insurance Program Regulations, they cannot be recognized as

providing protection from the 1-percent annual chance flood. Therefore, analyses were performed to determine the flooding effects with and without the levees in place.

Water-surface elevations for floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 computer program (Reference 21). Cross sections for this restudy were compiled photogrammetrically and by field survey in areas of dense vegetation. Hydraulic structure dimensions were determined using as-built construction plans, field measurements, and the HEC-2 models used in previous Flood Insurance Studies for the City of Vacaville and Solano County, California (References 26-28). The starting water-surface elevations were established for Gibson Canyon and House Creeks using slope-area and for South Branch Gibson Canyon; Middle, North, and South Branches Horse; Pine Tree; and Middle Swale to South Branch Horse Creeks and Pine Tree Creek Split using coincident peak. The Manning's "n" roughness coefficients were revised for the channels and overbanks using photographs obtained from field visits and the methodology described in USGS Water Supply Paper 2339, "Guide for Selected Manning's Roughness Coefficients for Natural Channels and Flood Plains" (Reference 29), and are shown in Table 10, "Manning's "n" Values."

The 1- and 0.2-percent annual chance floods shown on the FIRMs (Published Separately) have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic mapping at a scale of 1":400', with a contour interval of 4 feet (Reference 30).

City of Vallejo

Cross sections for the backwater analyses were checked by field survey and located at close intervals above and below bridges in order to compute the significant backwater effects of these structures.

Channel roughness factors (Manning's "n") for these computations were assigned on the basis of field inspection of floodplain areas.

A study was made of the hydraulic capacity of Chabot Creek with all man-made structures removed. The computed water-surface profile for this condition indicated that the Chabot Creek Channel has an unobstructed inbank capacity of 1-percent annual chance flood frequency. However, existing inbank capacity is only approximately a 10- to 15-year flood frequency.

This Physical Map Revision revised the hydraulic analyses for Miller Ditch (formerly known as Austin Creek), Lake Dalwigk, Lemon Street Canal, North Fork Rindler Creek, Rindler Creek, South Fork Rindler Creek, and Blue Rock Springs (Reference 68). The study utilized the USACE HEC-RAS Version 4.1 hydraulic model to determine water surface elevations. The stillwater elevations

for Lake Chabot and Lake Dalwigk were developed and were used as starting water surface elevations for Rindler Creek and Lemon Street Canal respectively. The hydraulic model revealed open channel capacity issues on Miller Ditch downstream of Caroline Street. The center median (K-Rail) of Interstate 80 acts as a barrier to overflow from Miller Ditch and ponding elevations at this location were developed in the EPA-SWMM stormwater management model. The hydraulic model revealed open channel capacity issues on Lemon Street Canal downstream of Interstate 80 as well. Overflow into the adjacent trailer park residential area closely matched that of previous studies. North Fork Rindler Creek was determined, using the EPA-SWMM stormwater management model, to be entirely contained within the underground stormwater sewer system. The hydraulic model revealed culvert capacity issues on Rindler Creek upstream of Interstate 80. The excess flooding above the culvert is routed adjacent to Interstate 80 in a separate grass lined channel. This channel also lacks sufficient capacity and spills back to Rindler Creek over Interstate 80. A lateral weir calculation within HEC-RAS was used to determine the flow returning to Rindler Creek. South Fork Rindler Creek downstream water surface elevation was determined from the calculated water surface elevation of Rindler Creek which inundates most of the channelized portion of the stream. The hydraulic model revealed open channel capacity issues on Blue Rock Springs Creek downstream of Interstate 80. The overflow inundates the adjacent trailer park residential area which closely matches that of previous studies. The starting water surface elevation for Blue Rock Springs Creek was determined from the calculated water surface elevation of Rindler Creek which inundates the downstream area of the stream.

Composite Manning's 'n' roughness values for channel and overbank were evaluated using aerial imagery and site photographs using guidelines established by Ven Te Chow, 1959. The channel 'n' value range was 0.015 to 0.045 and the overbank 'n' value range was 0.015 to 0.1.

Solano County (Unincorporated Areas)

Cross sections for the backwater analysis were located at close intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Cross sections were either field surveyed or taken from available construction plans. USGS (USGS) topographic maps were used to supplement available data. All bridges, dams, weirs, drop structures, and culverts were field checked to obtain elevation and size of openings, and other structural data.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of floodplain areas. The factors ranged from 0.035 to 0.075 for channel and 0.050 to 0.060 for overbank areas.

Starting water-surface elevations were developed by the slope-area method, taken from the main stem for tributary streams, or estimated from expected high water stage for streamways flowing into tidal areas.

Floodwaters are diverted at the American River confluence with the Sacramento River and are conveyed to the Yolo Bypass by means of the Sacramento Weir through Sacramento Bypass. In such circumstances the Sacramento River appears to flow upstream, caused by diversion of floodwaters at the Sacramento Weir in Yolo County.

The Yolo Bypass conveys these diverted flows from the Sacramento River at Sacramento south into Solano County and eventually back onto the Sacramento River. Flood profiles were determined for the Yolo Bypass by using the synthetic 1-percent annual chance higher-high stage profiles mentioned previously, interpolating between elevations at tide gaging stations.

Shallow flooding occurs along portions of Ulatis Creek, Alamo Creek, Encinosa Creek, Unnamed Tributary to Ulatis Creek, Green Valley Creek, Wild Horse Creek, Ledgewood Creek, Gordon Valley Creek, Laurel Creek, Marina Creek, Marina Creek Tributary, Sweeney Creek, and Industrial Creek.

Hydraulic analyses of the shoreline characteristics of the flooding sources studied by detailed methods were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Flood profiles were not prepared for Suisun Slough because flood stages at those locations reflect tidal effect and are not influence by stream hydraulics.

Flood profiles area not presented for Lagoon Drain because the only flooding affecting Solano County is a small overbank area as a constant elevation of 215.4 feet.

Flooding on the Sacramento River Deep Water Ship Channel is controlled by backwater effects from the Sacramento River through its tributaries, Sutter Slough and Miner Slough.

Reaches of the Suisun Bay coastline which are susceptible to wave action were determined by examining several factors. These factors included, but were not limited to, wind setup, average depth, and available fetch length. The areas, which would be affected by wind setup, were determined by examining historical records and other sources for the Suisun Bay area (References 8 & 31). Once these reaches of the Bay were identified, the available fetch for each reach was determined. Next, the average depth for each fetch length affecting these reaches was determined. These data were analyzed using the shallow water wave forecasting curves in the USACE Shore Protection Manual (SPM) (Reference 32). Using these curves, the reaches of the coastline which would be affected by significant wave action (waves greater than 3 feet high) were determined. Within these reaches, areas, which were protected by local features such as headlands,

breakwaters, levees, and dikes, were eliminated from consideration. The base flood elevations (BFEs) for these areas are based on the Stillwater flood level (SWFL) since no detailed wave height analysis was done landward of the Suisun Bay shoreline.

Cross section for the restudied backwater analyses were obtained from topographic maps compiled from aerial photographs (Reference 33). Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment, based on field observations of the stream and the floodplain areas (Reference 24). The channel "n" values range from 0.015 to 0.10 and the overbank "n" values range from 0.035 to 0.04.

Water-surface elevations of floods of the 1-percent annual chance flood recurrence interval for reaches studied in detail were computed using the USACE HEC-2 step-backwater computer program (Reference 34). The water surface of the ponded area upstream of Cordero Junction was computed as part of the hydrologic storage routing using the USACE HEC-1 computer program (Reference 9). This water-surface elevation served as the starting water-surface elevation for the upstream reach. The starting water-surface elevation at the downstream end of the detailed study reach was determined by the slope-area method.

Water-surface elevations of floods of the 1-percent annual chance flood recurrence interval for the Sweeney Creek were computed using the USACE HEC-RAS 4.0 program (Reference 63).

The reach upstream of Vanden Road was modeled with DEC-2 using cross sections taken from the USGS quadrangle for Elmira, California (Reference 35) and adjusted based on field inspections. The starting water-surface elevation at Vanden Road was determined from the HEC-1 storage routing discussed earlier.

The Zone A flood limits extending downstream from Cordero Junction west of Union Creek were determined by approximate methods. The discharge was determined as that which would spill over the right bank of Union Creek assuming that uncertified upstream embankments would not hold during a significant flood event. The flood limits were based on limited topography from the Elmira, California, USGS quadrangle (Reference 35) and are shown sufficiently broad to accommodate uncertainties in the ground description.

The 1-percent annual chance floodplain and the 1-percent annual chance floodway boundaries were delineated on topographic maps at a scale of 1":2,400', with a contour interval of 2 feet and on the USGS quadrangle entitled Elmira, California (References 33 & 35). All elevations along controlling physical features, such as railroad and other embankments, were surveyed. A floodway was shown only for the upstream reach of the detailed study because the downstream reach is an area of floodwater storage. Reduction of this storage would increase the amount of water, which spills over the watershed divide and is

diverted down the original Union Creek channel. If all flow is prevented from spilling down the original Union Creek channel, the ponded water surface would increase by approximately 1 foot without any encroachment on the 1-percent annual chance floodplain.

A floodway was not shown downstream of Cordero Junction because the discharge cannot be confined to the channel without causing a greater-than-1-foot rise in the 1-percent annual chance flood water-surface elevation.

The upper portion of the watershed has recently been studied by MacKay & Somps as part of their work on the Gonsalves-Lockie development. Their hydrology is documented in Gonsalves-Locke Union Creek Drainage Report (Reference 18) and Foxboro Village Unit No. 2, Hydrology Study (Reference 19). Their hydrology did not extend downstream of Vanden Road; however, at Vanden Road the discharge agreed with the discharge developed for this study.

The consulting firm of Creegan and D'Angelo conducted a study (Reference 36) to improve the channel of Union Creek between Hanger Avenue and Air Base Parkway. The adopted hydrology for this Flood Insurance Study exceeds the discharges used by Creegan and D'Angelo primarily for three reasons: 1) their study used lower 24-hour precipitation than is supported by the NOAA maps (Reference 37) or the two precipitation gages in the vicinity; 2) their study considered the impact of existing upstream storage which is disregarded in this study due to a lack of freeboards and certification; and 3) their study considered the upstream diversion facility that has been removed.

The hydraulic analyses for the second revised study were performed using the USACE HEC-2 step-backwater hydraulic computer model. Channel cross sections for the detailed analyses were obtained by aerial and field surveys. Roughness coefficients (Manning's "n") used for the hydraulic computations were based upon field inspection. The data to define the hydraulic structures were obtained from field surveys and as-built construction plates.

The starting water-surface elevations for Alamo Creek and Ulatis Creek were developed by the slop-area method. The starting water-surface elevations for Encinosa Creek, Laguna Creek, and Ulatis Tributary were determined from the main stream at the time of the peak for each individual creek.

HEC-2 hydraulic analyses were performed along the overflow areas to determine the depth of flooding. Since the depth of flow along the overflow path and along the main channel bank at the overflow point is less than 1 foot, the overflow areas have been designated as Zone X.

Levees exist along both banks of Alamo Creek at the downstream end of the studied reach. Because they do not meet the requirements established in the National Flood Insurance Program Regulations, they cannot be recognized as providing protection from the 1-percent annual chance flood. Therefore, analyses

were performed to determine the flooding effects with and without the levees in place.

Water-surface elevations for floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 computer program (Reference 21). Cross sections for this restudy were compiled photogrammetrically and by field survey in areas of dense vegetation. Hydraulic structure dimensions were determined using as-built construction plans, field measurements, and the HEC-2 models used in previous Flood Insurance Studies for the City of Vacaville and Solano County, California (References 26-28). The starting water-surface elevations were established for Gibson Canyon and House Creeks using slope-area and for South Branch Gibson Canyon; Middle, North, and South Branches Horse; Pine Tree; and Middle Swale to South Branch Horse Creeks and Pine Tree Creek Split using coincident peak. The Manning's "n" roughness coefficients were revised for the channels and overbanks using photographs obtained from field visits and the methodology described in USGS Water Supply Paper 2339, "Guide for Selected Manning's Roughness Coefficients for Natural Channels and Flood Plains" (Reference 29), and are shown in Table 1, "Manning's "n" Values."

The 1- and 0.2-percent annual chance floods shown on the FIRMs (Published Separately) have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic mapping at a scale of 1":400', with a contour interval of 4 feet (Reference 30).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 10, "Manning's "n" Values".

Table 10 – Manning's "n" Values

Stream Name / Community Name	Roughness Values Channel	Roughness Values Overbank
Blue Rock Springs Creek	0.015 – 0.045	0.015 – 0.100
Gibson Canyon Creek	0.030 – 0.035	0.050 – 0.060
Horse Creek	0.030 – 0.040	0.050 – 0.060
Lake Dalwigk	0.015 – 0.045	0.015 – 0.100
Lemon Street Canal	0.015 – 0.045	0.015 – 0.100
Middle Branch Horse Creek	0.030	0.050
Middle Swale to South Branch Horse Creek	0.035	0.050
Miller Ditch	0.015 – 0.045	0.015 – 0.100
North Branch Horse Creek	0.030	0.050
North Fork Rindler Creek	0.015 – 0.045	0.015 – 0.100
Pine Tree Creek	0.030 – 0.050	0.050 – 0.060
Rindler Creek	0.015 – 0.045	0.015 – 0.100
Rindler Creek – Parking Overflow	0.015 – 0.045	0.015 – 0.100
South Branch Gibson Canyon Creek	0.030 – 0.035	0.050 – 0.060
South Branch Horse Creek	0.030 – 0.040	0.050
South Fork Rindler Creek	0.015 – 0.045	0.015 – 0.100
Sulphur Springs Creek	0.015 – 0.040	0.060
Sweeney Creek	0.030-0.090	0.030-0.090

The hydraulic analysis for this revision was based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Published Separately).

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD88). Elevation reference marks (ERMs) used in this study, and their descriptions, are shown on the FIRM. ERMs shown on the FIRM represent those used during the preparation of this and previous FISs. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and floodplain boundaries shown on the FIRM. Users should be aware that these ERM elevations might have changed since the publication of this FIS. To obtain up-to-date

elevation information on National Geodetic Survey (NGS) ERMs shown on this map, please contact the NGS at:

NGS Information Services

NOAA, N/NGS12

SSMC-3, #9202

1315 East-West Highway

Silver Spring, Maryland 20910-3282

(301) 713-3242

www.ngs.noaa.gov

Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the

Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

Levee Hazard Analysis

Some flood hazard information presented in prior FIRMs and in prior FIS reports for Santa Clara County and its incorporated communities was based on flood protection provided by levees. Based on the information available and the mapping standards of the National Flood Insurance Program at the time that the prior FISs and FIRMs were prepared, FEMA accredited the levees as providing protection from the flood that has a 1-percent-chance of being equaled or exceeded in any given year. For FEMA to continue to accredit the identified levees with providing protection from the base flood, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

On August 22, 2005, FEMA issued Procedure Memorandum No. 34 - Interim Guidance for Studies Including Levees. The purpose of the memorandum was to help clarify the responsibility of community officials or other parties seeking recognition of a levee by providing information identified during a study/mapping project. Often, documentation regarding levee design, accreditation, and the impacts on flood hazard mapping is outdated or missing altogether. To remedy this, Procedure Memorandum No. 34 provides interim guidance on procedures to minimize delays in near-term studies/mapping projects, to help our mapping partners properly assess how to handle levee-mapping issues.

While 44 CFR Section 65.10 documentation is being compiled, the release of more up-to-date FIRM panels for other parts of a community or county may be delayed. To minimize the impact of the levee recognition and certification process, FEMA issued Procedure Memorandum No. 43 - Guidelines for Identifying Provisionally Accredited Levees on March 16, 2007. These guidelines will allow issuance of preliminary and effective versions of FIRMs while the levee owners or communities are compiling the full documentation required to show compliance with 44 CFR Section 65.10. The guidelines also explain that preliminary FIRMs can be issued while providing the communities and levee owners with a specified timeframe to correct any maintenance deficiencies associated with a levee and to show compliance with 44 CFR Section 65.10.

FEMA contacted the communities within Solano County to obtain data required under 44 CFR 65.10 to continue to show the levees as providing protection from

the flood that has a 1-percent-chance of being equaled or exceeded in any given year.

FEMA understood that it may take time to acquire and/or assemble the documentation necessary to fully comply with 44 CFR 65.10. Therefore, FEMA put forth a process to provide the communities with additional time to submit all the necessary documentation. For a community to avail itself of the additional time, it had to sign an agreement with FEMA. Levees for which such agreements were signed are shown on the final effective FIRM as providing protection from the flood that has a 1-percent-chance of being equaled or exceeded in any given year and labeled as a Provisionally Accredited Levee (PAL). Communities have two years from the date of FEMA's initial coordination to submit to FEMA final accreditation data for all PALs. Following receipt of final accreditation data, FEMA will revise the FIS and FIRM as warranted.

FEMA coordinated with the U.S. Army Corps of Engineers, the local communities, and other organizations to compile a list of levees that exist within Solano County. Table 11, "List of Structures Requiring Flood Hazard Revisions" lists all levees shown on the FIRM, to include PALs, for which corresponding flood hazard revisions were made.

Approximate analyses of "behind levee" flooding were conducted for all the levees in Table 11 to indicate the extent of the "behind levee" floodplains. The methodology used in these analyses is discussed below.

The approximate levee analysis was conducted using information from existing hydraulic models (where applicable) and USGS topographic maps.

The extent of the 1-percent-annual-chance flood in the event of levee failure was determined. Normal-depth calculations were used to estimate the base flood elevation if detailed topographic or representative cross section information was available. The remaining base flood elevations were estimated from effective FIRM maps. The 1-percent-annual-chance floodplain boundary was traced along the contour line representing the estimated base flood elevation. Topographic features such as highways, railroads, and high ground were used to refine approximate floodplain boundary limits. The 1-pecent annual chance peak flow and floodplain widths and depth (assumed at 1 foot) were used to ensure the floodplain boundary was not overly conservative.

Table 11 – List of Structures Requiring Flood Hazard Revisions

Community	Flood Source	Levee Inventory ID (Lat./Long. Coordinates. ; FIRM panel)	USACE Levee
City of Rio Vista	Channel	P540 (-121.703, 38.182; -121.698, 38.192 06095C0530E / 06095C0537E)	No
City of Vacaville	Alamo Channel	P513 (-121.945, 38.335; -121.945, 38.333 06095C0279E)	No
City of Vacaville	Alamo Channel	P577 (-121.950, 38.335; -121.945, 38.344 06095C0277E)	No
City of Vallejo	Austin Creek	P477 (-122.261, 38.122; -122.259, 38.120 06095C0610E)	No
Solano County (Unincorporated areas)	Horseshoe Bend	P16 (-121.724, 38.084; -121.716, 38.093 06095C0730E)	No
Solano County (Unincorporated areas)	Sacramento River	P521 (-121.721, 38.095; -121.716, 38.099 06095C0730E)	No
Solano County (Unincorporated areas)	Miner Slough	P116 (-121.673, 38.229; -121.605, 38.285 06095C0345E / 06095C0365E / 06095C0535E)	Yes
Solano County (Unincorporated areas)	Steamboat Slough	P19 (-121.601, 38.254; -121.658, 38.183 06095C0365E / 06095C0541E / 06095C0545E / 06095C0555E)	Yes
Solano County (Unincorporated areas)	Sutter Slough	P597 (-121.606, 38.285; -121.601, 38.255 06095C0365E)	Yes
Solano County (Unincorporated areas)	Cache Slough	P598 (-121.673, 38.229; -121.658, 38.183 06095C0535E / 06095C0541E)	Yes

Table 11 – List of Structures Requiring Flood Hazard Revisions, continued

Community	Flood Source	Levee Inventory ID (Lat./Long. Coordinates. ; FIRM panel)	USACE Levee
Solano County (Unincorporated areas)	Cache Slough	P579 (-121.759, 38.308; -121.726, 38.291 06095C0320E / 06095C0340E)	Yes
Solano County (Unincorporated areas)	Cache Slough	P580 (-121.758, 38.325; -121.759, 38.308 06095C0320E / 06095C0325E)	Yes
Solano County (Unincorporated areas)	Cache Slough	P581 (-121.758, 38.325; -121.726, 38.292 06095C0325E / 06095C0330E / 06095C0340E)	Yes
Solano County (Unincorporated areas)	Alamo Channel	P269 (-121.945, 38.330; -121.878, 38.330 06095C0279E / 06095C0283E / 06095C0284E)	No
Solano County (Unincorporated areas)	South Fork Putah Creek	P512 (-121.782, 38.522; -121.695, 38.512 06095C0075E / 06095C0100E)	Yes
Solano County (Unincorporated areas)	South Fork Putah Creek	P576 (-121.784, 38.524; -121.803, 38.520 06095C0075E / 06095C0100E)	Yes
Solano County (Unincorporated areas)	Ulatis Channel	P10 (-121.803, 38.312; -121.818, 38.336 06095C0325E)	No
Solano County (Unincorporated areas)	Ulatis Channel	P582 (-121.795, 38.307; -121.819, 38.336 06095C0320E / 06095C0325E)	No
Solano County (Unincorporated areas)	Ulatis Channel	P584 (-121.795, 38.308; -121.805, 38.313 06095C0320E)	No
Solano County (Unincorporated areas)	Lindsey Slough	P518 (-121.796, 38.276; -121.696, 38.247 06095C0320E / 06095C0340E / 06095C0530E)	Yes

Table 11 – List of Structures Requiring Flood Hazard Revisions, continued

Community	Flood Source	Levee Inventory ID (Lat./Long. Coordinates. ; FIRM panel)	USACE Levee
Solano County (Unincorporated areas)	Hastings Cut	P22 (-121.771, 38.263; -121.741, 38.292 06095C0320E / 06095C0340E)	No
Solano County (Unincorporated areas)	Hastings Cut	P12 (-121.772, 38.263; -121.742, 38.293 06095C0320E / 06095C0340E)	No
Solano County (Unincorporated areas)	Lindsey Slough	P593 (-121.696, 38.247; -121.694, 38.257 06095C0340E / 06095C0530E)	Yes
Solano County (Unincorporated areas)	Lindsey Slough	P9 (-121.749, 38.297; -121.694, 38.257 06095C0340E)	No
Solano County (Unincorporated areas)	Lindsey Slough	P11 (-121.796, 38.276; -121.749, 38.297 06095C0320E)	Yes
Solano County (Unincorporated areas)	Undetermined	P599 (-121.682, 38.180; -121.674, 38.174 06095C0541E)	Yes
Solano County (Unincorporated areas)	Undetermined	P607 (-121.682, 38.184; -121.682, 38.180 06095C0541E)	No
Solano County (Unincorporated areas)	Lindsey Slough	P590 (missing)	Yes
Solano County (Unincorporated areas)	Miner Slough	P335 (-121.656, 38.288; -121.656, 38.287 06095C0345E)	No
Solano County (Unincorporated areas)	Miner Slough	P595 (-121.656, 38.287; -121.652, 38.262 06095C0345E)	No

Several levees within Solano County and its incorporated communities meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems." Table 12, "List of Accredited Levees" lists all levees shown on the FIRM that meet the requirements of 44 CFR 65.10 and have been determined to provide protection from the flood that has a 1-percent-chance of being equaled or exceeded in any given year.

Table 12 – List of Accredited Levees

Community	Flood Source	Levee Inventory ID (Lat./Long. Coordinates. ; FIRM panel)	USACE Levee
City of Fairfield	Dan Wilson Creek	P27 (-122.125, 38.226; -122.123, 38.231 06095C0451E)	No
City of Fairfield	Green Valley Creek	P24 (-122.141, 38.219; -122.138, 38.218 06095C0432E / 06095C0434E)	No
City of Fairfield	Green Valley Creek	P604 (-122.155, 38.225; -122.152, 38.226 06095C0432E)	No

3.3 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in base flood elevations across the corporate limits between the communities.

The conversion factor from NGVD29 to NAVD88 was 2.56 for all streams in Solano County.

As noted above, the elevations shown in the FIS report and on the FIRM for Solano County are referenced to NAVD88. Ground, structure, and flood

elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor.

The Base Flood Elevations shown on the FIRM represent whole-foot rounded values. For example, a Base Flood Elevation of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the stated conversion factor(s) to elevations shown on the Flood Profiles and supporting data tables in the FIS report.

For more information on NAVD88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the, National Geodetic Survey Information Services, NOAA, N/NGS12, National Geodetic Survey, SSMC-3, #9202, 1315 East-West Highway, Silver Spring, Maryland 20910-3282 (Internet address http://www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent annual chance floodplain data, which may include a combination of the following: 10-percent, 2-percent, 1-percent, and 0.2-percent annual chance flood elevations; delineations of the 1-percent and 0.2-percent annual chance floodplains; and 1-percent annual chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the 1-percent and 0.2-percent annual chance floodplains have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale and a contour interval as shown on Table 13, “Topographic Map Information.”

The 1-percent and 0.2-percent annual chance floodplain boundaries are shown on the FIRM (Published Separately). On this map, the 1-percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1-percent and 0.2-percent annual chance floodplain boundaries

are close together, only the 1-percent annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM (Published Separately).

Flood boundaries for creeks studied by approximate methods were established according to the professional judgment of engineers familiar with the region taking into account flood elevations estimated from available data, existing hydrologic and hydraulic analyses, correlations with similar streams, and field observations.

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

City of Benicia

Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:600 and 1:4,800, with contour intervals of 5 feet (Reference 34).

City of Dixon

Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:600 and 1:24,000, with contour intervals of 5 feet (Reference 38).

City of Fairfield

Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:600 and 1:24,000, with contour intervals of 2 and 20 feet, respectively (References 39-43).

Topographic data were supplemented by preliminary and as-built drawings for channel improvement works, levee profiles, subdivision site grading plans, the USACE surveys, Solano County surveys, and aerial photographs. Other information useful in making flooded area determinations was obtained from a floodplain information report (Reference 44) and project design documents (References 45-46)

Some areas in Solano County are subject to broad, shallow, overland flooding generally less than 3 feet deep and characterized by unpredictable flow paths (sheetflow). The water-surface elevations of flooding in these areas are essentially independent of those along the adjacent streamway and are affected principally by natural and manmade barriers to flow in the flooded area. Minor levee systems affect flood boundaries at several locations in the community. Where pertinent, these levees are shown FIRM (Published Separately). Also,

railroad embankments, irrigation structures, and many roadfills crossing floodplain areas alter the natural patterns of floodflows. These varying flood patterns can be seen on the FIRM in the form of confinement to streamways, ponding behind obstructions, and lateral distribution of floodflows.

Flood boundaries for Suisun Slough were delineated on the basis of flood elevations established from stage-frequency curves. Flood boundaries for these areas reflect the effects of wind set but not wave action.

City of Rio Vista

Flood boundaries for the Sacramento River were delineated on the basis of flood elevations established from stage-frequency curves using aerial photomaps (Reference 47) and topographic maps at a scale of 1:1,200 with a contour interval 2 feet (Reference 48). Flood boundaries for these areas reflect the effects of wind setup, but not wave action. Wave action is specifically excluded from data developed for this study.

Areas of shallow flooding were delineated using the topographic maps at a scale of 1:24,000, with a contour interval at 10 feet (Reference 49).

City of Suisun City

Topographic data were supplemented by preliminary and as-built drawings for channel improvement works, levee profiles, subdivision site grading plans, the USACE surveys, Solano County surveys, and aerial photographs.

Flood boundaries for Suisun Slough were delineated on the basis of flood elevations established from stage-frequency curves. Flood boundaries for these areas reflect the effects of wind set but not wave action. Wave action, which is specifically excluded from data developed for this study, will increase the 1-percent annual chance flood stage at Suisun City by 1.5 to 2.0 feet.

Some areas in Solano County are subject to broad, shallow, overland flooding generally less than 3 feet deep and characterized by unpredictable flow paths (sheetflow). The water-surface elevations of flooding in these areas are essentially independent of those along the adjacent streamway and are affected principally by natural and manmade barriers to flow in the flooded area. Minor levee systems affect flood boundaries at several locations in the community. Where pertinent, these levees are shown FIRM (Published Separately). Also, railroad embankments, irrigation structures, and many roadfills crossing floodplain areas alter the natural patterns of floodflows. These varying flood patterns can be seen on the FIRM in the form of confinement to streamways, ponding behind obstructions, and lateral distribution of floodflows.

City of Vacaville

Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:600 and 1:2,400, with contour intervals of 5 feet (Reference 50).

City of Vallejo

Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:600 and 1:24,000, with contour intervals of 20 feet (Reference 51).

Solano County (Unincorporated Areas)

Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:12,000, with contour intervals of 5, 10, and 20 feet (References 52-54).; at a scale of 1:24,000, with contour intervals of 5 and 10 feet (References 52-53); at a scale of 1:600, with contour intervals of 2 feet (References 40-41, 55-57, 66).; at a scale of 1:2,400, with contour intervals of 5 feet (References 50 & 58, 65).; and at a scale of 1:3,600, with contour intervals of 5 feet (Reference 59).

Flood boundaries for Sacramento River, Yolo Bypass, Suisun Slough, and the other sloughs were delineated on the basis of flood elevations established from stage-frequency curves using topographic maps at a scale of 1:24,000 with contour intervals of 5 feet (Reference 53). Flood boundaries for these areas reflect the effects of wind setup but not wave action.

Topographic data were supplemented by preliminary and as-built drawings for channel improvement works, levee profiles, subdivision site grading plans, the USACE surveys, Solano County surveys, and aerial photographs. Other information useful in making flooded area determinations was obtained from Flood Plain Information reports (References 44 & 60) and project design documents (References 45-46).

Some areas in Solano County are subject to broad, shallow, overland flooding generally less than 3 feet deep and characterized by unpredictable flow paths (sheetflow). The water-surface elevations of flooding in these areas are essentially independent of those along the adjacent streamway and are affected principally by natural and manmade barriers to flow in the flooded area. Minor levee systems affect flood boundaries at several locations in the community. Where pertinent, these levees are shown FIRM (Published Separately). Also, railroad embankments, irrigation structures, and many roadfills crossing floodplain areas alter the natural patterns of floodflows. These varying flood patterns can be seen on the FIRM in the form of confinement to streamways, ponding behind obstructions, and lateral distribution of floodflows.

Table 13 – Topographic Map Information

Community	Scale	Contour Interval	Reference
City of Benicia	1 : 600	5	34
	1 : 4,800	5	22
City of Dixon	1 : 600	5	38
	1 : 24,000	5	38
City of Fairfield	1 : 600 (original)	2	39-43
	1 : 24,000 (original)	20	39-43
	1 : 2,400 (restudy)	10	23
	1 : 2,400 (restudy)	2	25
City of Rio Vista	1 : 1,200	2	48
	1 : 24,000	10	49
City of Suisun City	N/A	N/A	N/A
City of Vacaville	1 : 600	5	50
	1 : 2,400	5	50
	1 : 400 (restudy)	4	30
City of Vallejo	1 : 600	20	51
	1 : 24,000	20	51
	1 : 400 (restudy)	68	68
Solano County	1 : 12,000	5, 10, 20	52-54
(Unincorporated areas)	1 : 24,000	5, 10	52-53
	1: 9,600	2	66
	1 : 600	2	40-41, 55-57
	1 : 2,400	5	50, 58, 65
	1 : 3,600	5	59
	1 : 2,400 (restudy)	2	33 & 35
	1 : 400 (restudy)	4	30

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections. The computed floodways are shown on the revised FIRM (Published Separately). In cases where the floodway and 1-percent annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

As shown on the FIRM (Published Separately), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 1-percent annual chance flood boundaries are close together, only the floodway boundary has been shown.

<u>City of Benicia</u>

No floodway information is available.

<u>City of Dixon</u>

The nature of flooding from Dickson Creek is shallow ponding and sheetflow; therefore, no floodway was determined.

<u>City of Fairfield</u>

Floodways are not established for streams studied by approximate methods; tidal flood, sheetflow, or ponding areas; where floodflows are contained in culverts; or where natural overflow losses from one stream basin to another occur and containing the loss would result in exceeding allowable floodway criteria.

No floodway was determined for Suisun, Green Valley, and McCoy Creeks and the lower part of Pennsylvania Avenue Creek due to excessive losses of flow under natural conditions. Because of tidal influence, no floodway was determined for areas flooded by Suisun Slough, including the lower part of Dan Wilson Creek. Also, floodways were not determined for those reaches of Pennsylvania Avenue and Union Avenue Creeks where flows are contained in culverts.

City of Rio Vista

No floodway information is available.

City of Suisun City

The following stream reaches were not designated floodways because of these tabulations:

Laurel Creek: Excessive natural overflow losses, sheetflow, and ponding areas

McCoy Creek: Excessive natural overflow losses

Pennsylvania Avenue Creek: Ponding area and sheetflow

Union Avenue Creek: Excessive natural overflow losses

Suisun Slough: Tidal flood areas

City of Vacaville

Floodways are not established where excessive natural overflow losses from one stream basin to another occur. Containing the loss would result in exceeding allowable floodway criteria. For this reason, floodways were not designated on Ulatis and Alamo Creeks downstream of the excessive overflow losses. No floodway was designated on the upstream end of Old Alamo Creek because of ponding in the area.

City of Vallejo

No floodway information is available.

Solano County (Unincorporated Areas)

The following stream reaches were not designated floodways because of these tabulations:

Alamo Creek (XS A thru G): Excessive natural overflow losses

Cache Slough: Tidal flood area

Clayton Creek: Sheetflow area

Dickson Creek: Sheetflow area

Encinosa Creek: Shallow flooding

Gordon Valley Creek: Sheetflow area

Green Valley Creek (XS A thru I): Excessive natural overflow losses

Industrial Creek: Shallow flooding

Lagoon Drain: Floodway within City of Vacaville corporate limits

Laurel Creek: Excessive natural overflow losses, sheetflow, and ponding areas

Ledgewood Creek: Sheetflow area

McCoy Creek: Excessive natural overflow losses

Miner Slough: Tidal flood area

Pennsylvania Avenue Creek: Ponding area

Sacramento River: Tidal flood area

Steamboat Slough: Tidal flood area

Suisun Creek (XS A thru AB): Excessive natural overflow losses

Suisun Slough: Tidal flood areas

Sutter Slough: Tidal flood area

Sweeney Creek: Excessive natural overflow losses

Ulatis Creek (XS A thru T): Excessive natural overflow losses

Yolo Bypass: Tidal flood area

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent annual chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1, “Floodway Schematic.”

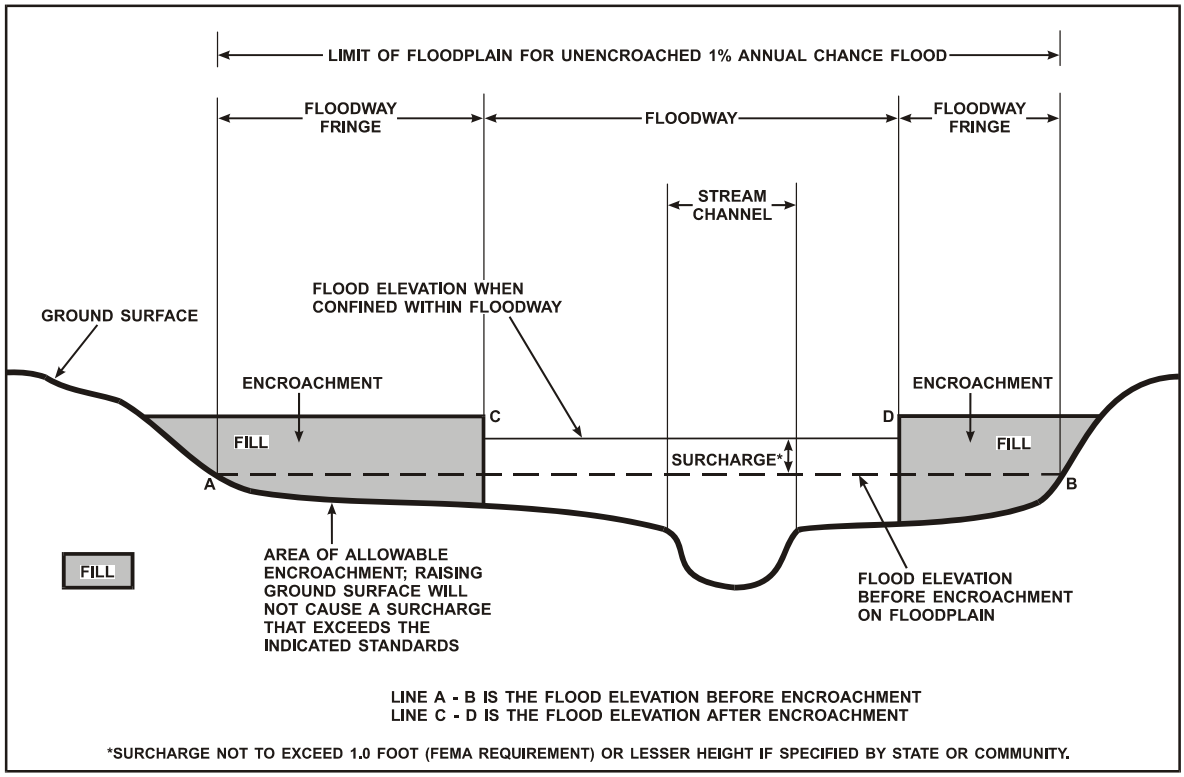

Figure 1 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bucktown Creek								
A	1,426	120	1,205	0.4	241.1	241.1	242.1	1.0
B	1,848	11	535	0.8	241.2	241.2	242.2	1.0
C	2,270	40	179	2.5	241.3	241.3	242.3	1.0
D	3,221	38	113	3.9	248.1	248.1	248.1	0.0
E	3,854	10	82	5.4	256.9	256.9	256.9	0.0
F	3,907	38	170	2.6	260.9	260.9	261.1	0.2
G	4,277	32	57	7.7	263.7	263.7	263.9	0.2
H	4,858	29	27	5.5	289.6	289.6	289.6	0.0
I	5,016	100	147	1.0	303.0	303.0	303.0	0.0
J	5,387	40	39	3.9	317.1	317.1	317.1	0.0

[1]Feet above confluence with Ulatis Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

BUCKTOWN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Dan Wilson Creek								
A[2]								
B	950	145	4,051	0.9	11.2	11.2	11.2	0.0
C	2,534	85	342	5.8	13.3	13.3	13.3	0.0
D	3,854	146	155	4.7	17.3	17.3	17.9	0.6
E	5,491	80	192	5.4	23.4	23.4	24.1	0.7
F	6,864	145	590	3.3	29.3	29.3	29.6	0.3
G	8,131	60	279	6.2	31.2	31.2	31.6	0.4
H	9,874	463	970	1.7	39.0	39.0	39.8	0.8
I	10,982	73	271	5.8	43.3	43.3	43.3	0.0
J	11,616	47	225	7.0	46.2	46.2	47.2	1.0
K	12,725	323	568	2.7	50.6	50.6	50.9	0.3
L	13,464	142	421	3.7	53.2	53.2	54.1	0.9

[1]Feet above confluence with Green Valley Creek

[2]No floodway determined

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

DAN WILSON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Gibson Canyon Creek								
A	-1,768	54	450	6.0	72.4	72.4	73.2	0.8
B	-1,206	49	389	6.9	73.2	73.2	73.8	0.6
C	-646	50	388	7.0	75.0	75.0	75.5	0.5
D	704	59	421	6.4	77.3	77.3	77.8	0.5
E	1,312	49	467	5.8	78.1	78.1	78.6	0.5
F	1,903	52	433	6.2	78.6	78.6	79.1	0.5
G	2,424	51	366	7.4	79.3	79.3	79.7	0.4
H	4,285	68	416	5.2	84.7	84.7	85.1	0.4
I	4,754	48	325	6.7	85.3	85.3	85.3	0.0
J	5,136	48	324	6.7	85.2	85.2	86.2	1.0
K	5,983	170	867	1.0	88.8	88.8	89.8	1.0
L	7,435	100	348	1.3	89.0	89.0	90.0	1.0
M	8,210	75	143	3.0	90.2	90.2	90.9	0.7
N	9,419	48	134	4.1	92.9	92.9	93.0	0.1
O	10,809	48	181	6.1	95.2	95.2	95.4	0.2
P	11,361	54	249	4.6	96.6	96.6	96.7	0.1
Q	12,242	45	197	4.0	98.2	98.2	98.2	0.0
R	19,526	49	336	2.8	121.0	121.0	121.0	0.0
S	20,067	47	304	2.3	123.1	123.1	123.1	0.0
T	20,790	51	448	1.5	128.9	128.9	128.9	0.0
U	21,180	47	338	2.0	128.9	128.9	128.9	0.0
V	21,720	62	566	1.3	136.1	136.1	136.1	0.0

[1]Feet above Byrnes Road

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

GIBSON CANYON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Green Valley Creek								
A	19,853	106	569	5.9	62.4	62.4	63.1	0.7
B	20,962	150	760	4.4	69.0	69.0	69.8	0.8
C	22,123	212	726	4.6	74.4	74.4	75.2	0.8
D	23,760	227	89	3.0	86.7	86.7	87.6	0.9
E	25,344	136	525	5.1	94.9	94.9	95.5	0.6
F	26,611	113	572	4.1	108.0	108.0	109.0	1.0
G	27,826	299	1,269	2.6	119.7	119.7	120.7	1.0
H	28,248	106	526	5.3	123.5	123.5	124.5	1.0
I	29,938	132	571	4.9	144.0	144.0	145.0	1.0
J	31,046	86	284	5.4	171.7	171.7	171.7	0.0
K	32,472	68	236	5.7	206.3	206.3	206.9	0.6
L	33,211	96	471	2.8	222.7	222.7	223.7	1.0

[1]Feet above confluence with Cordelia Slough

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN VALLEY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Horse Creek								
A	19,360 [1]	69	584	5.0	80.8	80.8	81.5	0.7
B	22,023 [1]	75	620	3.1	88.7	88.7	88.7	0.0
C	31,925 [1]	40	160	2.9	114.5	114.5	114.7	0.2
D	32,526 [1]	31	128	3.6	115.0	115.0	115.1	0.1
E	33,079 [1]	43	130	3.3	115.6	115.6	115.7	0.1
F	33,875 [1]	85	537	1.0	127.0	127.0	127.1	0.1
G	34,476 [1]	71	296	1.9	127.1	127.1	127.2	0.1
Industrial Creek								
A	400 [2]	27	102	4.5	11.5	11.5	12.0	0.5
B	660 [2]	27	63	7.2	11.9	11.9	12.3	0.4
C	1,160 [2]	55	150	5.0	13.4	13.4	14.2	0.8
D	1,860 [2]	100	102	4.5	15.8	15.8	15.8	0.0
Lagoon Drain								
A	53 [3]	12	116	7.2	208.2	208.2	209.0	0.8
B	211 [3]	109	551	1.8	208.5	208.5	209.0	0.5
C	1,162 [3]	264	441	1.9	217.3	217.3	217.3	0.0
D	2,323 [3]	441	2,862	0.3	218.0	218.0	218.0	0.0

[1]Feet above confluence with Ulatis Creek
[2]Feet above confluence with Sacramento River
[3]Feet above confluence with Laguna Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

HORSE CREEK - INDUSTRIAL CREEK - LAGOON DRAIN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Laguna Creek								
A	5,808 [1]	40	194	2.2	224.7	224.7	225.7	1.0
B	6,811 [1]	100	293	2.0	229.9	229.9	230.6	0.7
C	7,286 [1]	22	145	4.0	233.6	233.6	234.0	0.4
D	7,814 [1]	64	241	2.4	237.3	237.3	237.8	0.5
E	8,870 [1]	48	246	3.2	243.2	243.2	244.1	0.9
Marina Creek								
A	1,305 [2]	85	111	6.6	11.2	11.2	11.5	0.3
B	1,355 [2]	66	282	2.6	11.7	11.7	12.2	0.5
C	1,695 [2]	215	1,573	0.5	11.9	11.9	12.3	0.4
D	2,615 [2]	156	644	1.0	12.0	12.0	12.3	0.3
E	2,965 [2]	136	374	1.7	12.0	12.0	12.3	0.3
Marina Creek Tributary								
A	450 [3]	91	598	0.1	11.9	11.9	12.9	1.0
B	900 [3]	86	390	0.2	11.9	11.9	12.9	1.0
C	1,083 [3]	69	175	0.5	11.9	11.9	12.9	1.0

[1]Feet above confluence with Alamo Creek
[2]Feet above confluence with Sacramento River
[3]Feet above confluence with Marina Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

LAGUNA CREEK - MARINA CREEK - MARINA CREEK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Middle Branch Horse Creek								
A	368 [1]	52	356	1.2	90.9	90.9	91.9	1.0
B	1,414 [1]	34	215	2.0	91.0	91.0	92.0	1.0
C	2,579 [1]	36	144	3.0	91.6	91.6	92.3	0.7
D	3,192 [1]	36	144	3.0	92.2	92.2	92.7	0.5
E	3,816 [1]	87	21	2.0	92.9	92.9	93.2	0.3
F	6,191 [1]	440	827	0.2	103.9	103.9	103.9	0.0
Middle Swale to South Branch Horse Creek								
A	1,461 [2]	121	76	2.4	125.6	125.6	125.6	0.0
B	2,025 [2]	86	89	2.0	127.5	127.5	127.5	0.0
C	2,587 [2]	57	60	3.0	129.1	129.1	129.1	0.0
North Branch Horse Creek								
A	980 [1]	50	235	3.5	88.1	88.1	88.9	0.8

[1]Feet above confluence with Horse Creek

[2]Feet above confluence with South Branch Horse Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE BRANCH HORSE CREEK - MIDDLE SWALE TO SOUTH BRANCH HORSE CREEK - NORTH BRANCH HORSE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Old Alamo Creek								
A - B[2]								
C	16,579 [1]	21	42	1.9	66.0	66.0	66.1	0.1
D[3]								
E	20,275 [1]	107	458	0.4	77.9	77.9	78.9	1.0
F	20,962 [1]	9	59	3.5	78.0	78.0	79.0	1.0
G	27,878 [1]	42	146	1.4	89.6	89.6	89.6	0.0
H	28,987 [1]	22	60	1.7	90.7	90.7	90.7	0.0
I	30,043 [1]	48	146	0.7	92.4	92.4	92.4	0.0
J	30,994 [1]	22	58	1.7	94.6	94.6	94.6	0.0
K	31,944 [1]	26	55	1.8	96.8	96.8	96.8	0.0
Pennsylvania Avenue Creek								
A	7,973 [4]	21	101	8.9	11.4	11.4	12.4	1.0
B	8,448 [4]	40	222	4.1	13.0	13.0	13.7	0.7
C	9,451 [4]	26	165	5.4	17.8	17.8	18.5	0.7

[1]Feet above confluence with Alamo Creek
[2]Data not available
[3]No floodway determined
[4]Feet above confluence with Ledgewood Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

OLD ALAMO CREEK - PENNSYLVANIA AVENUE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Pine Tree Creek								
A	4,111 [1]	72	129	3.6	108.7	108.7	108.7	0.0
B	4,318 [1]	32	94	4.9	109.1	109.1	109.1	0.0
C	5,045 [1]	25	68	6.7	110.3	110.3	110.3	0.0
D	5,876 [1]	11	87	3.7	114.3	114.3	114.4	0.1
E	6,703 [1]	40	82	6.1	123.5	123.5	124.5	1.0
F	7,346 [1]	38	121	4.1	129.7	129.7	129.9	0.2
G	8,178 [1]	72	441	1.1	132.9	132.9	133.1	0.2
South Branch Gibson Canyon Creek								
A	1,089 [2]	29	99	4.4	99.2	99.2	99.6	0.4
B	1,930 [2]	26	87	5.1	101.2	101.2	101.3	0.1
C	2,319 [2]	31	97	4.6	102.2	102.2	102.3	0.1
D	2,802 [2]	39	208	2.0	104.8	104.8	104.8	0.0
E	7,014 [2]	50	365	1.2	121.4	121.4	121.4	0.0
F	7,329 [2]	49	331	1.3	121.4	121.4	121.4	0.0
G	8,225 [2]	39	269	1.4	126.3	126.3	126.3	0.0
H	8,883 [2]	75	353	1.1	126.4	126.4	126.4	0.0
I	9,495 [2]	25	49	8.0	126.5	126.5	126.5	0.0
J	10,081 [2]	25	76	5.1	131.1	131.1	131.2	0.1

[1]Feet above confluence with Horse Creek

[2]Feet above confluence with Gibson Canyon Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

PINE TREE CREEK - SOUTH BRANCH GIBSON CANYON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
South Branch Horse Creek								
A	2,216 [1]	53	227	1.9	125.0	125.0	125.0	0.0
Suisun Creek								
A - AA [3]								
AB	50,794 [2]	216	1,668	4.0	165.9	165.9	165.9	0.0
AC	51,533 [2]	128	1,183	5.7	167.7	167.7	167.7	0.0
AD	52,166 [2]	102	1,060	6.3	170.1	170.1	170.4	0.3
AE	53,011 [2]	89	984	6.7	173.5	173.5	173.9	0.4
AF	54,226 [2]	184	1,310	5.0	180.5	180.5	180.6	0.1
AG	55,334 [2]	80	779	8.3	189.1	189.1	189.4	0.3

[1]Feet above confluence with Horse Creek
[2]Feet above mouth
[3]Floodway not applicable due to excessive overbank losses

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH BRANCH HORSE CREEK - SUISUN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Sulphur Springs Creek								
A	2,980	88	752	2.1	11.8	11.8	12.8	1.0
B	4,500	95	866	5.7	14.1	14.1	14.8	0.7
C	5,950	592	1,198	3.6	17.6	17.6	18.2	0.6
D	6,950	456	1,502	2.8	19.9	19.9	20.6	0.7
E	8,450	120	660	6.5	22.8	22.8	23.2	0.4
F	9,530	85	565	8.9	25.3	25.3	25.8	0.5
G	10,360	140	599	6.9	31.4	31.4	31.9	0.5
H	11,220	110	669	6.1	36.5	36.5	37.5	1.0
I	11,810	113	809	5.1	40.7	40.7	41.5	0.8
J	13,220	120	655	6.3	50.7	50.7	51.3	0.6
Sulphur Springs Creek Overflow								
A	2,660	299	2,170	1.8	11.7	11.7	12.7	1.0

[1]Feet above confluence with Carquinez Strait

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

SULPHUR SPRINGS CREEK - SULPHUR SPRINGS CREEK OVERFLOW

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Ulatis Creek								
A - B [2]								
C - E [3]								
F	99,317	51	479	6.8	235.3	235.3	235.3	0.0
G	100,320	157	1,103	3.0	237.8	237.8	237.8	0.0
H	101,218	60	611	5.4	241.6	241.6	241.6	0.0
I	102,221	41	318	9.7	244.1	244.1	244.1	0.0
J	102,485	70	677	4.6	247.4	247.4	247.4	0.0
K	103,382	87	513	6.1	251.4	251.4	251.4	0.0
L	104,386	166	1,064	3.0	256.7	256.7	256.7	0.0
M	105,125	80	673	4.8	264.2	264.2	264.2	0.0
N	106,022	157	865	3.8	267.0	267.0	267.0	0.0
O	106,286	82	598	5.5	268.3	268.3	268.3	0.0
P	107,184	80	715	4.7	274.8	274.8	274.8	0.0
Q	108,134	73	549	6.1	279.6	279.6	279.6	0.0
R	108,821	57	323	8.8	282.2	282.2	282.2	0.0

[1]Feet above confluence with Cache Slough
[2]No floodway determined
[3]Data not available

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

ULATIS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Union Avenue Creek								
A - E [2]								
F	6,125	24	157	3.5	17.4	17.4	18.4	1.0
G	6,758	22	106	5.3	18.9	18.9	19.9	1.0
H	7,339	18	61	8.1	21.4	21.4	21.4	0.0
I	8,290	17	51	9.8	26.1	26.1	26.1	0.0
J	8,923	26	123	5.2	28.9	28.9	29.9	1.0
K	9,874	22	81	7.9	32.4	32.4	32.4	0.0
L	10,824	22	84	6.5	36.0	36.0	36.0	0.0
M	11,299	26	80	6.8	38.9	38.9	38.9	0.0
N	19,747	24	142	3.4	94.8	94.8	94.8	0.0
O	20,328	14	47	10.3	97.0	97.0	97.0	0.0
P	21,120	17	55	8.7	105.6	105.6	105.6	0.0
Q	21,384	19	127	3.8	114.4	114.4	114.4	0.0
R	22,440	20	52	9.2	125.2	125.2	125.2	0.0
S	23,179	21	38	7.6	144.0	144.0	144.0	0.0
T	24,394	21	38	7.6	164.1	164.1	164.1	0.0

[1]Feet above confluence with Marina Channel

[2]No floodway determined

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

UNION AVENUE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Union Creek								
A - D [1]								
E	21,405 [2]	907	4,573	0.4	83.6	83.6	84.6	1.0
F	21,915 [2]	723	2,844	0.7	83.6	83.6	84.6	1.0
G	22,525 [2]	135	363	5.3	84.6	85.0	85.6	0.6
H	22,925 [2]	80	297	6.5	86.8	86.8	86.8	0.0
I	23,460 [2]	320	1,061	1.8	89.4	89.4	90.2	0.8
J	23,925 [2]	380	1,171	1.6	89.6	89.6	90.5	0.9
Wild Horse Creek								
A	264 [3]	82	173	7.4	151.7	151.7	152.2	0.5
B	528 [3]	26	109	11.7	160.6	160.6	161.3	0.7
C	1,056 [3]	97	398	3.2	166.4	166.4	167.4	1.0
D	2,059 [3]	32	204	6.2	190.3	190.3	191.3	1.0
E	2,745 [3]	56	207	6.1	219.4	219.4	220.4	1.0

[1]No floodway determined
[2]Feet above mouth
[3]Feet above confluence with Green Valley Creek

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

SOLANO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

UNION CREEK - WILD HORSE CREEK