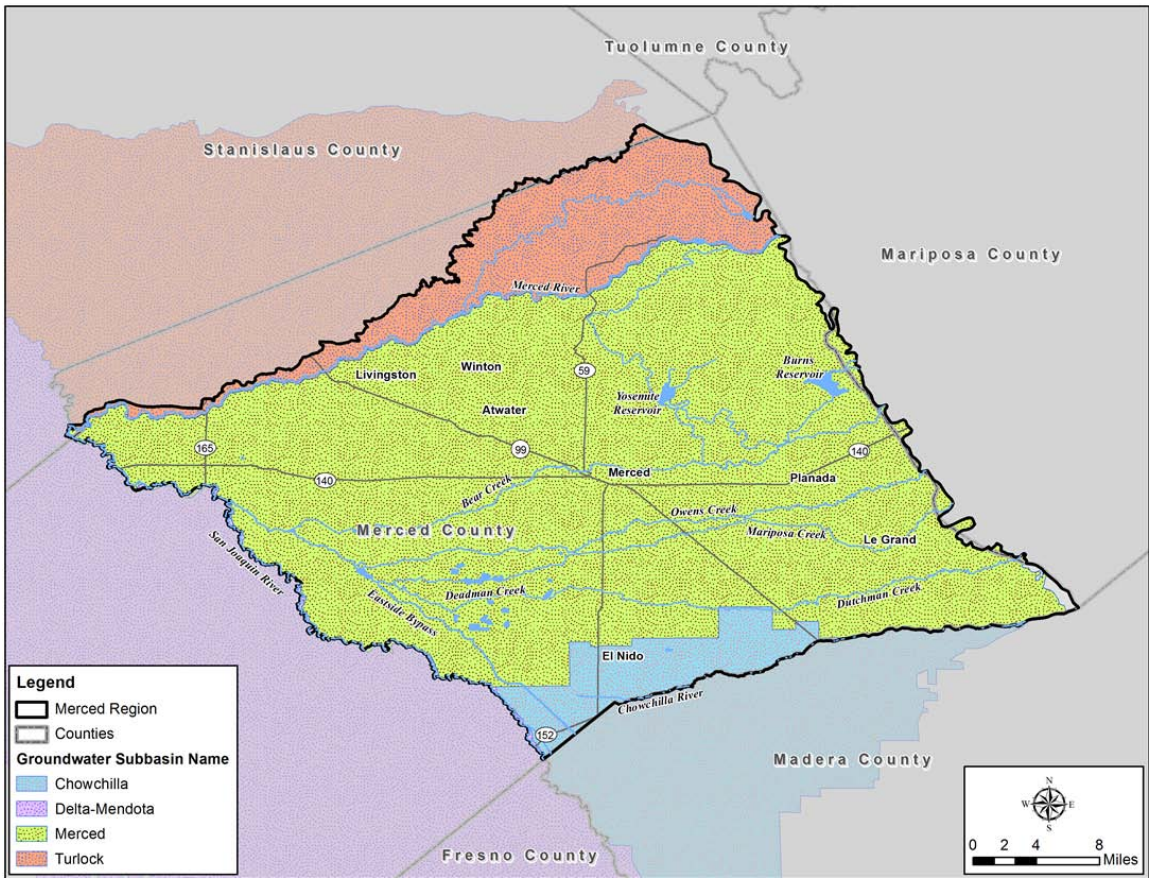
Merced Integrated Regional Water Management Plan



FLOOD MANAGEMENT SUMMARY

AUGUST 2013

PREPARED FOR:

PREPARED BY:

PETERSON . BRUSTAD . INC
ENGINEERING . CONSULTING

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MERCED IRWMP
INTEGRATED REGIONAL WATER MANAGEMENT PLAN

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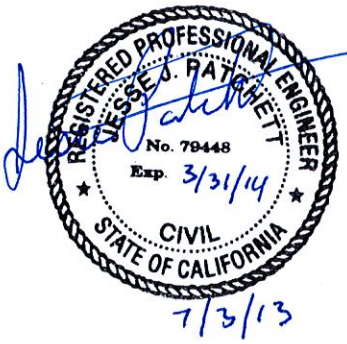
Flood Management Summary

Prepared by:



PETERSON . BRUSTAD . INC
ENGINEERING . CONSULTING

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INTRODUCTION

The City of Merced, County of Merced, and Merced Irrigation District are currently leading the preparation of an Integrated Regional Water Management Plan (IRWMP). Part of this effort is to summarize flood management issues and identify opportunities to integrate flood management into the overall water system management for the IRWMP Planning Area (Planning Area).

The purpose of this technical memorandum (TM) is to summarize findings from studies previously prepared in the Planning Area, as well as laws, standards, and regulations which impact this area. Known system vulnerabilities and identified gaps in available information are also summarized. Finally, potential projects consistent with objectives and performance measures identified by the IRWMP Regional Advisory Committee (RAC) have also been included. This information is intended to inform the flood management portion of the IRWMP being prepared by RMC.

BACKGROUND

The Planning Area generally consists of Merced County north/east of the San Joaquin River and is part of the Upper San Joaquin Region, as defined by the California Department of Water Resources (DWR).

Flood management and planning has significantly shaped history in the Planning Area. Flooding in the San Joaquin River basin is typically characterized by infrequent severe winter storms, combined with snowmelt runoff from the foothills east of Merced County. Runoff from these storm events traverses the Planning Area via numerous creeks and rivers, ultimately draining to the San Joaquin River. The relatively flat topography of the Planning Area causes floodwaters to exceed the banks of these rivers and streams to spread out over large areas. Figures 1 and 2 on the following page indicate the soils upstream of Merced are primarily Hydrologic Soils Group D and C, which have a high runoff potential. These soils groups, combined with the steep slopes in these areas contribute to the flashy nature of flooding in the Merced area. Finally, subsidence along the San Joaquin River near the Eastside Bypass has effectively reduced the capacity of these leveed systems, which will continue to increase the risk of flooding along the San Joaquin River. Figure 3 on page 4 illustrates some of the many streams and rivers which traverse the Planning Area.

The Merced County Stream Group (MSG) project, originally authorized by the Flood Control Act of 1944, aimed to provide flood protection as part of the comprehensive flood management plans for the Sacramento and San Joaquin Basins. Numerous subsequent projects have also been undertaken to address the problem of regional flooding. To date, the MSG is mostly complete, but a key feature intended to protect downtown Merced has not been built.

Unfortunately, a significant portion of the Planning Area is still subject to flooding. According to FEMA, approximately 380,000 acres in Merced County are located within a 100-year (1% Annual Chance Exceedance) (ACE) floodplain. A significant component of the flooding in Merced appears to be caused by breakout flow over the south bank of Bear Creek upstream of Merced. This floodplain then becomes comingled with overbank flooding from Miles Creek. Downstream of Merced, flooding is typically caused by flows leaving the banks of Bear Creek, Burns Creek, Mariposa Creek, and Deadman Creek. Figure 4 of page 4 illustrates the FEMA flood zones in and around the Planning Area.

FIGURE 1 –Hydrologic Soil Groups

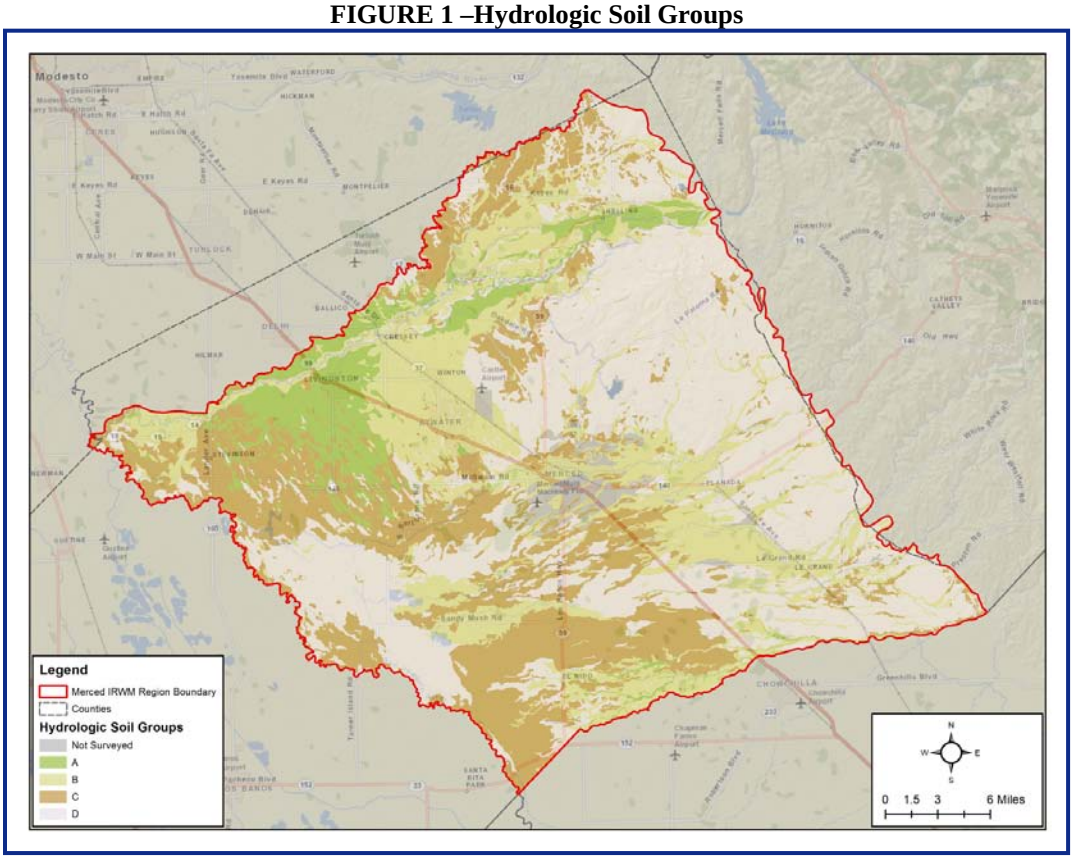


FIGURE 2 – Ranked Hydrologic Soil Groups

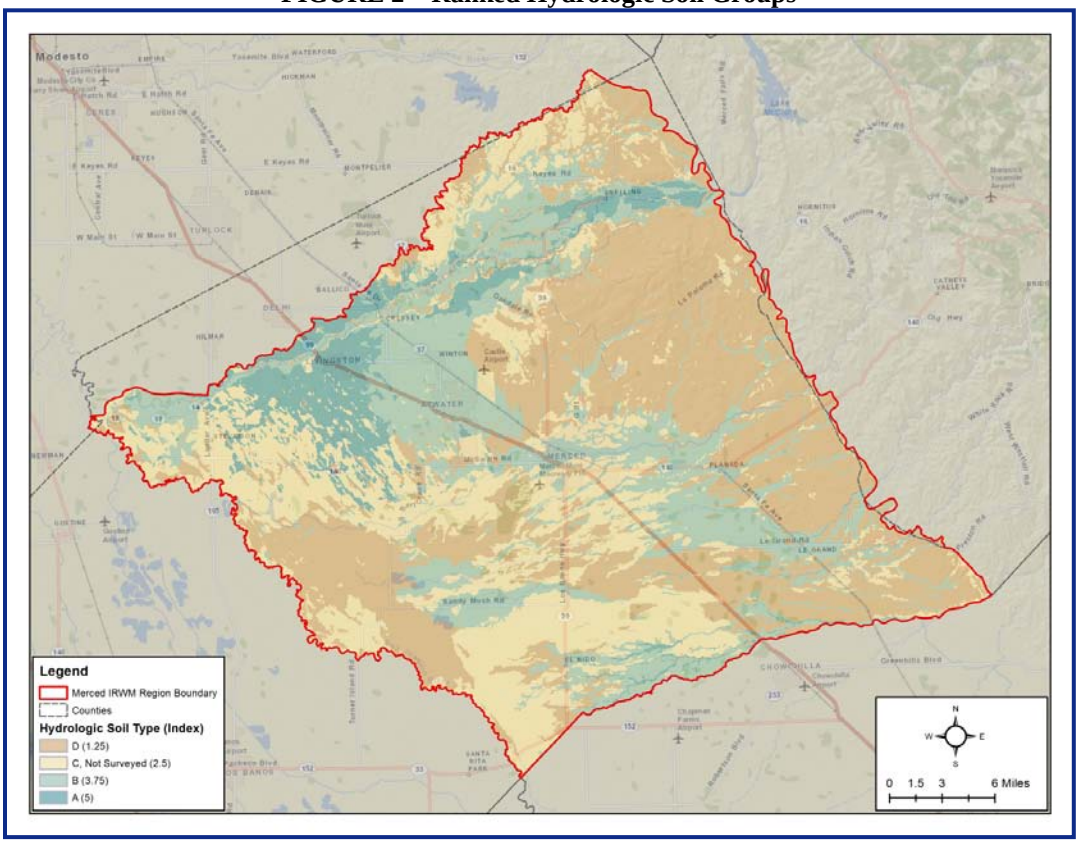


FIGURE 3 –Streams Traversing the Planning Area

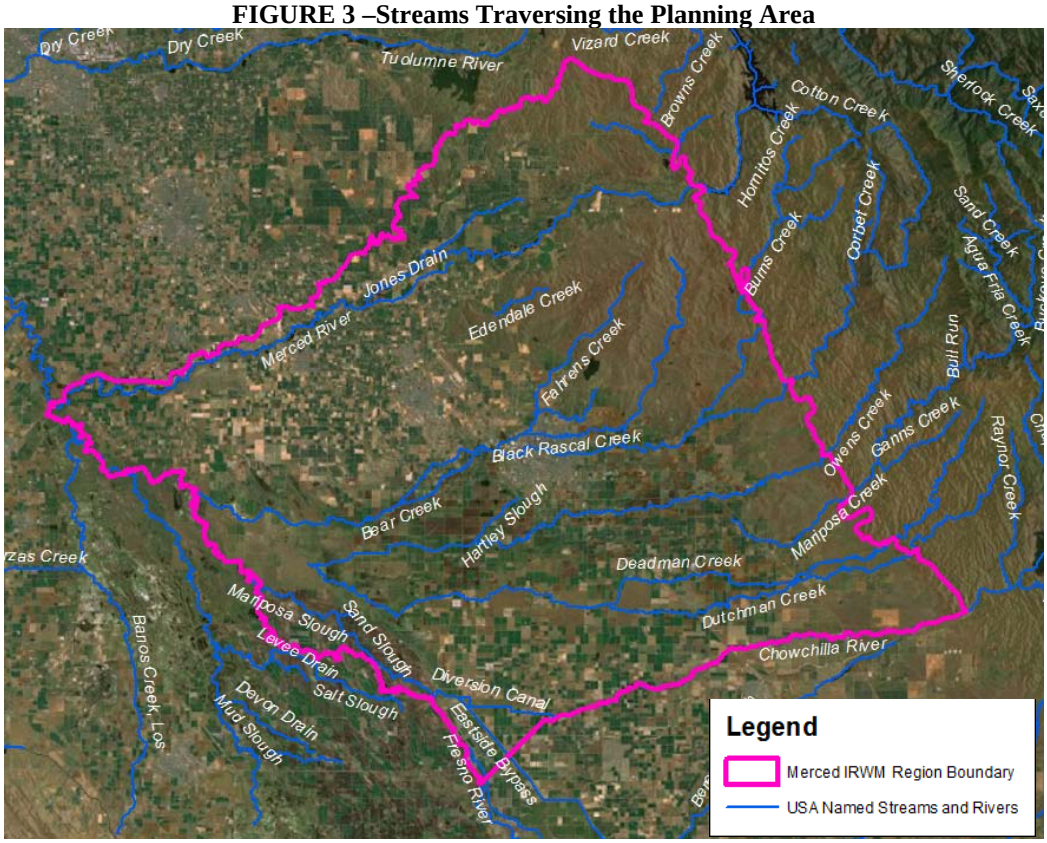
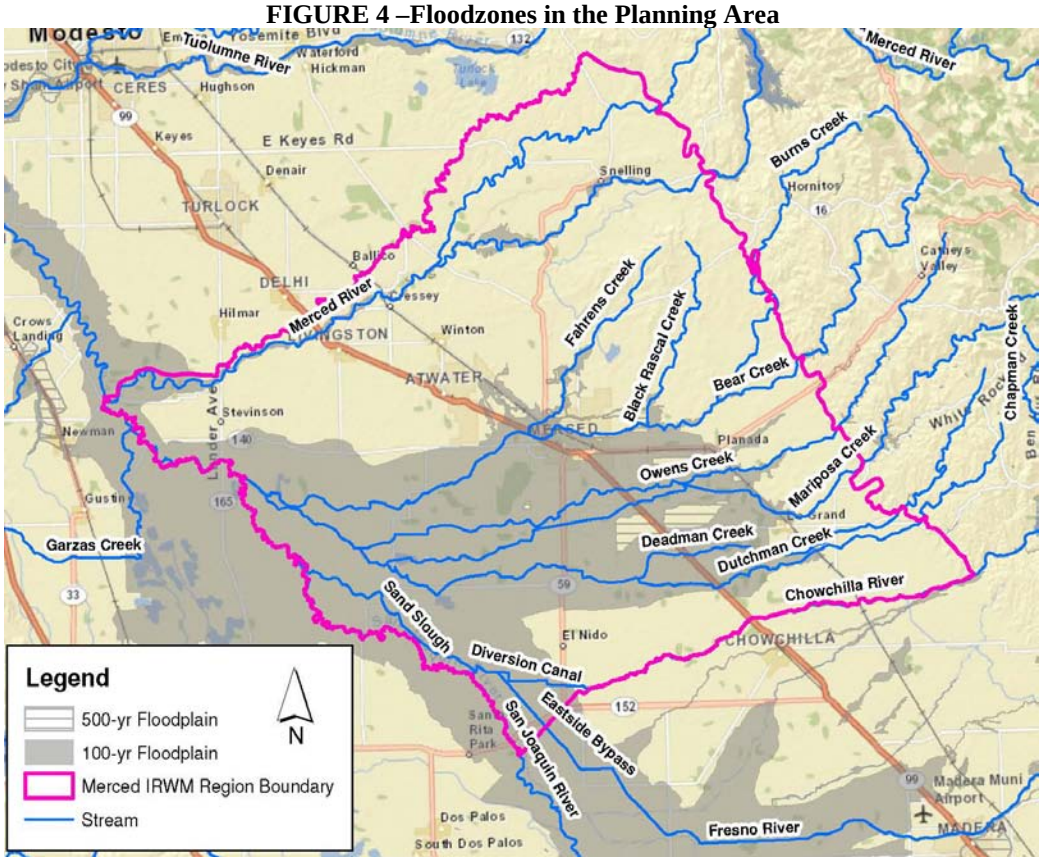


FIGURE 4 –Floodzones in the Planning Area

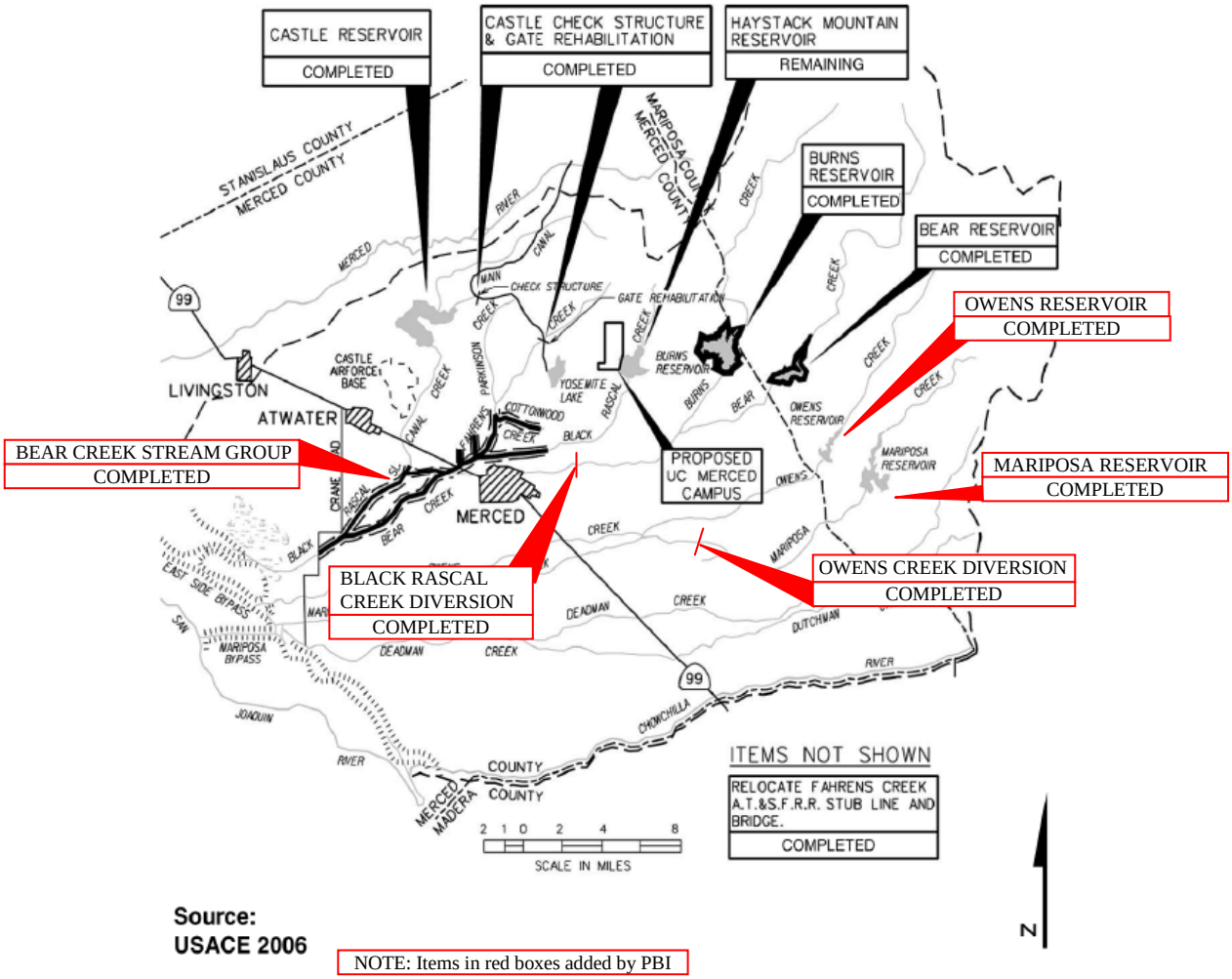


Recent flood events occurred in the Planning Area in 1997, 1998, 2000, 2001, 2002, 2005, 2006, and 2007. The frequency of flooding events illustrates the fact that many areas in the Planning Area are prone to flooding from storm events less severe than a 100-year event. These floods prompted numerous lawsuits over residential structural damage due, in part, to alleged lack of flood control improvements.

REGIONAL FLOOD CONTROL PROJECTS

As previously noted, flood control projects in the Planning Area date back to 1944 with the Merced County Streams Group (MSG) project. In 1970, the original project proposed by the United States Army Corps of Engineers (USACE) was updated to include a dam on Black Rascal Creek, known as Haystack Dam. However, the USACE later determined that environmental concerns may pose a significant challenge to implementing the Haystack Dam. The MSG effort continues to this day as the USACE is studying feasible alternatives for a flood control structure on Black Rascal Creek. Figure 5 summarizes the USACE progress implementing the MSG projects.

FIGURE 5 – Merced County Streams Group Project Status



Source:
USACE 2006

NOTE: Items in red boxes added by PBI

In addition to the reservoir projects shown in Figure 5, improvements along Black Rascal Creek, Bear Creek, Burns Creek, Miles Creek, Owens Creek, and Mariposa Creek were completed as part of the MSG. Although channels were improved, very few levees were constructed, and the incised channels are subject to periodic overflows, causing widespread but relatively shallow

flooding. Merced County is responsible for maintenance of channels and levees on Black Rascal Creek, Black Rascal Creek Diversion, Burns Creek, Mariposa Creek, Miles Creek, sections of Owens Creek, Owens Creek Diversion, sections of Bear Creek, and Canal Creek. The Merced Irrigation District performs maintenance of Castle Dam.

The MSG is only one of several USACE flood control projects in the Planning Area. Figure 6 below illustrates USACE project levees in the Planning Area. Figure 7 on the following page outlines State Plan of Flood Control (SPFC) levees in the Planning Area.

FIGURE 6 – USACE Project Levees in the Planning Area

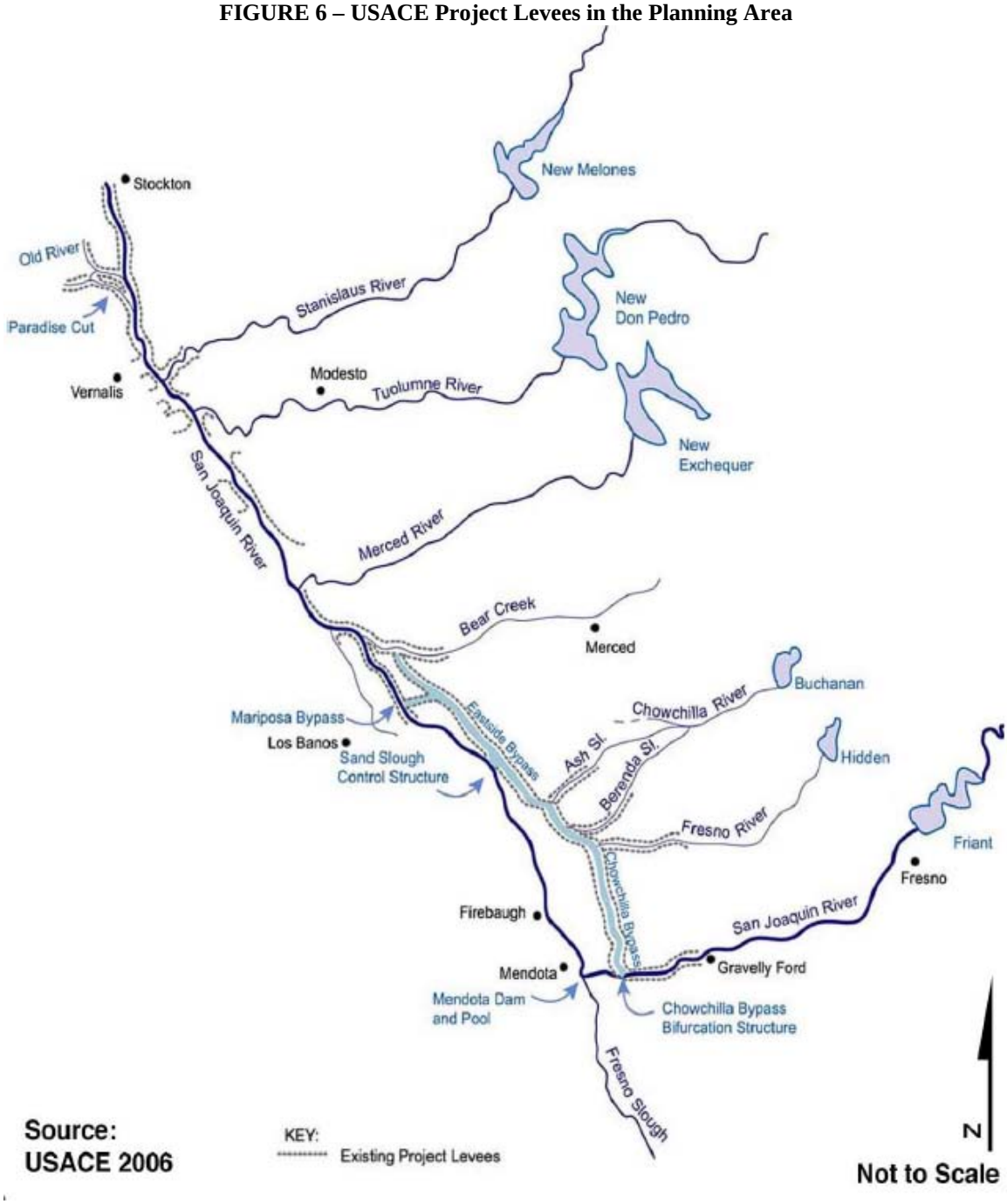
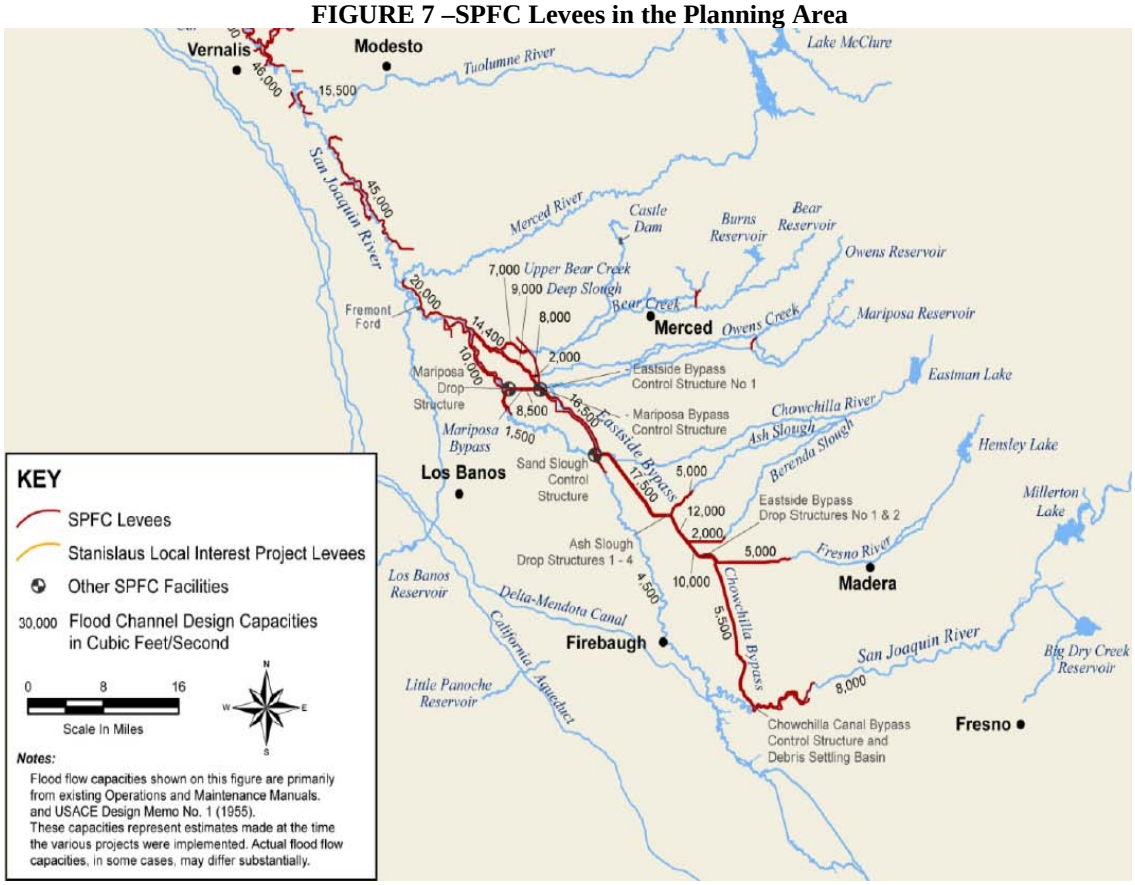


FIGURE 7 –SPFC Levees in the Planning Area



REGULATIONS

Structural flood control projects are only one method of managing flood risk. Development restrictions and land use policies also play an important role in helping Merced County manage flooding impacts to businesses and residents. Various Federal, State, and local development restrictions are summarized below.

FEMA

FEMA oversees floodplains and manages the National Flood Insurance Program (NFIP). FEMA incentivizes cities and counties, through reduced NFIP insurance rates, to restrict development in the floodplain. Merced County and the incorporated cities within Merced County participate in the NFIP and therefore must meet FEMA standards for floodplain protection facilities and floodplain management.

STATE REGULATIONS

In 2006, DWR started the "FloodSAFE" initiative. This program is a collaborative statewide effort designed to accomplish five broad goals:

1. Reduce the chance of flooding
2. Reduce the consequences of flooding
3. Sustain economic growth
4. Protect and enhance ecosystems
5. Promote sustainability

DWR proposes to achieve these goals by helping local agencies improve flood management systems, O&M programs, and emergency response.

Following DWR's initiative, Senate Bill 5 (SB5) was passed in 2007 which restricts land development within California's Central Valley. Under SB5, the State (DWR and CVFPB) was obligated to develop and adopt a comprehensive Central Valley Flood Protection Plan (CVFPP) for regional flood control by 2012 (Cal. Water Code § 9614.). This plan was approved by the CVFPB in June 2012. According to SB5, all cities and counties in the Central Valley must incorporate the CVFPP into their general plans within 24 months and into their zoning ordinances within 36 months (July 2014 and 2015, respectively) (Cal. Gov't Code §§ 65302.9, 65860.1.).

Under SB5, development in a moderate or high flood hazard zone would only be allowed if the permitting agency can find, based on substantial evidence in the record, that urban or urbanizing areas will be protected to a 200-year-flood level. This applies to all developed areas with population of at least 10,000 (or with plans to reach 10,000 within 10 years), overlain by FEMA Zones A, B, or shaded X. Therefore, as of mid-2015, Merced - along with other Central Valley cities and counties - will be prevented from entering into development agreements, approving discretionary permits that would result in construction of a residence, and approving subdivision maps in urban or urbanizing areas without a finding of 200-year- flood-level protection. This is more restrictive than FEMA regulations.

SB5 was amended in September 2012 by Senate Bill 1278 (SB1278) and Assembly Bill 1965 (AB 1965). SB1278 and AB 1965 extended the requirement for communities to incorporate the CVFPP into their general plans and zoning ordinances by 12 months (July 2015 and 2016, respectively). SB1278 also removed local drainage and "shallow" flooding from Urban Level of Flood Protection (ULOP) requirements, thus easing SB5 requirements on Merced. Future DWR guidance on legislation aims to define "shallow" and modify other concerns with SB5.

ULDC/ULOP

The Urban Levee Design Criteria (ULDC) was developed by DWR in May of 2012 to provide criteria and guidance for design, evaluation, operation, and maintenance of levees and floodwalls in urban and urbanizing areas. The ULDC was developed pursuant to SB5, and provides the standards levees need to meet in order to justify a "finding" of 200-yr flood protection.

The Urban Level of Flood Protection Criteria (ULOP) is currently under development by DWR, and provides the process by which land use authorities make a "finding" of an urban level of protection. A draft ULOP exists, which is slated to be revised in 2013. This draft presents a rather involved process which must be repeated every 20 years, with O&M reports every 5 years.

LOCAL RESTRICTIONS

According to the Merced County General Plan, Merced County is responsible for implementing and enforcing FEMA floodplain management regulations in the Planning Area. The Merced County Code contains specific requirements limiting and conditioning development in various flood zones. Specifically, the Merced County Code States:

a) Residential construction, new or substantial improvement, shall have the lowest floor, including basement:
    i. In an AO zone, elevated above the highest adjacent grade to a height equal to or exceeding the depth number specified in feet on the FIRM, or elevated at least two feet above the highest adjacent grade if no depth number is specified.
    ii. In an A zone, elevated to or above the base flood elevation

The County also requires construction of individual storm water detention basins for new development to limit peak flows to pre-project conditions.

Merced County also has a significant amount of vernal pool habitat, which can directly impact new development and flood control projects. The USFWS designated approximately 148,000

acres in Merced County as critical habitat for listed vernal pool crustaceans and vernal pool plants in 2005. These listed species have become a major consideration of the MSG project, and will likely impact flood control projects contemplated in hilly terrain in the future.

PREVIOUS STUDIES

MERCED COUNTY STREAMS GROUP

The original Merced County Stream Group (MSG) project was authorized by the Flood Control Act of 1944 as part of the comprehensive plan for flood control for the Sacramento and San Joaquin River Basins. The project consisted of flood control reservoirs on Burns, Bear, Owens, and Mariposa creeks and was completed in 1957.

A 1970 authorization provided for enlargement of the four original reservoirs, construction of three additional reservoirs (Castle, Haystack, and Marguerite), and channel improvements on Bear and Mariposa creek systems. These channel improvements included two diversions: Black Rascal Creek to Bear Creek (3,000 cfs capacity) and Owens Creek to Mariposa Creek (400 cfs). The Marguerite reservoir was subsequently removed from the MSG, and has not been constructed.

The Haystack reservoir is the only component of the MSG not completed at this time. Changes in population, downstream development, and new environmental compliance issues have prompted a new analysis, which is being completed by the USACE as the Merced County Streams Group Feasibility Study. This study is intended to evaluate options to increase flood protection along Black Rascal Creek and Bear Creek to increase the current level of flood protection beyond a 50-year level of protection, but this study has not started due to lack of Federal funding.

BLACK RASCAL CREEK FEASIBILITY STUDY

Flooding along Bear Creek and Black Rascal Creek near the City of Merced has historically been problematic. In 2008, Merced County completed a local feasibility study evaluating several alternatives for a proposed detention basin upstream of the Black Rascal Creek Diversion. The goal of this study was to identify a preferred alternative which would reduce the flows in the diversion to less than 3,000 cfs, which the County believes may significantly reduce flooding within the city of Merced. This study was updated in 2009 to evaluate 200-yr flood protection.

Two primary challenges were identified in this study. The first is that each of the proposed detention basins would be larger than the minimum size dam subject to California Division of Safety of Dams (DSOD) permitting authority. According to DSOD requirements, dams greater than 25’ tall, or dams which store more than 50 acre feet of water are subject to DSOD jurisdiction. The other major challenge is sensitive biological resources (i.e. vernal pools) which would be impacted by all the alternatives. The apparent recommendation from this study was to further evaluate environmental permitting challenges associated with three of the four alternatives.

CENTRAL VALLEY FLOOD PROTECTION PLAN (CVFPP)

In 2012 the DWR authored and the CVFPB adopted the CVFPP which is intended to be a sustainable, integrated flood management plan that describes and addresses flood risk in the Sacramento and San Joaquin River watersheds. The authorization for CVFPP originates in SB5, known as the Central Valley Flood Protection Act of 2008. The CVFPP guides implementation activities by local, State, and federal agencies for subsequent feasibility studies, environmental compliance, design, and construction activities.

The CVFPP's primary goal is to improve flood risk management. Its supporting goals include improving O&M, promoting ecosystem functions, improving institutional support, and promoting multi-benefit projects. The CVFPP desires to improve the existing flood management system within its existing footprint, to protect high flood risk communities, and enhance flood system capacity. As previously illustrated on Figure 7, SPFC projects are primarily located along the San Joaquin River and do not extend along many of the creeks traversing east to west through the Planning Area. The CVFPP describes the current physical condition of SPFC facilities at a system-wide level as determined by the Flood Control System Status Report (FCSSR). The findings from the FCSSR are presented in the following section.

Between now and 2017, the CVFPB will work with each of nine regions within the Central Valley to create Regional Flood Management Plans, which will help inform two Basin-Wide Feasibility Studies prepared by DWR. The Planning Area is part of the Upper San Joaquin Region and will be contained within DWR's San Joaquin Basin Feasibility Study.

KNOWN SYSTEM DEFICIENCES

Flood control system deficiencies within the Planning Area can be divided into two categories: local, or non-SPFC system deficiencies, and SPFC system deficiencies. As noted previously, SPFC deficiencies were noted in the FCSSR and incorporated in the 2012 CVFPP.

SPFC SYSTEM DEFICIENCIES

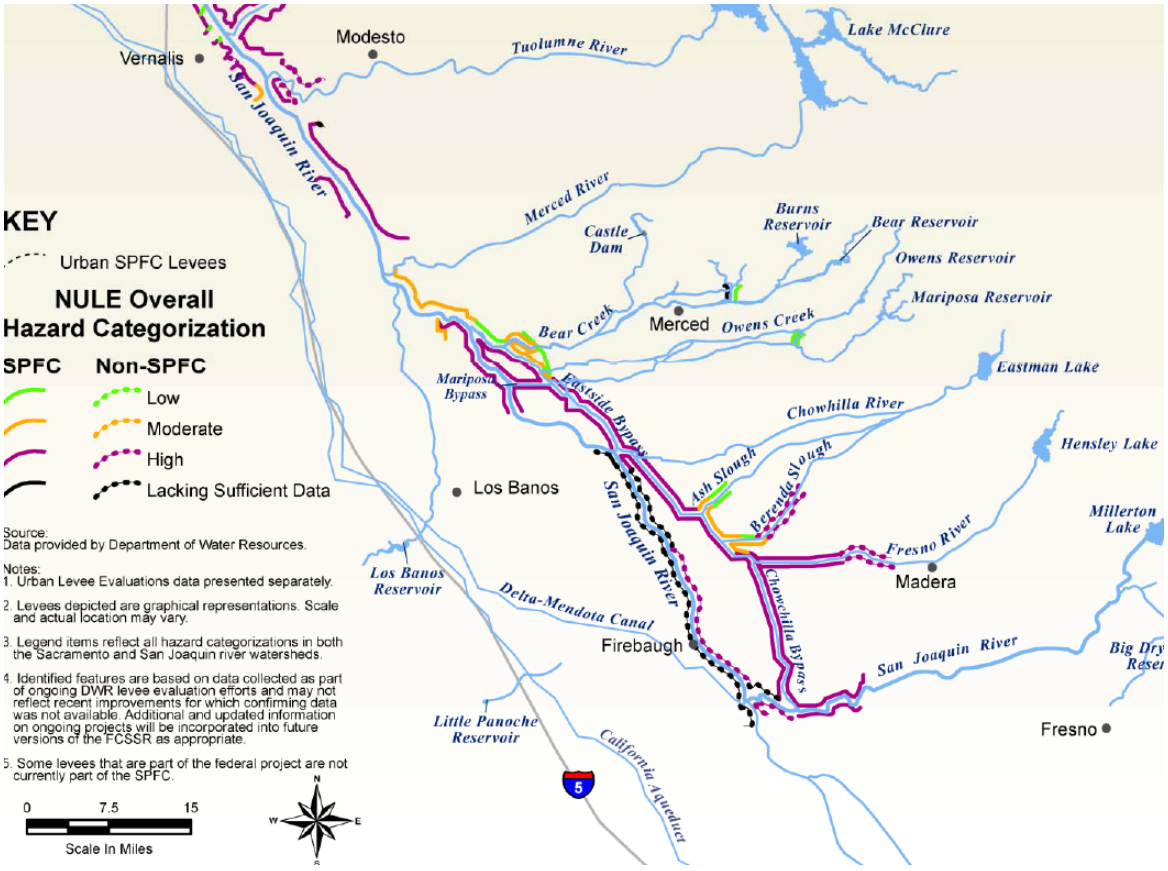
Many SPFC flood control structures were designed and constructed between 1940 and 1970 (or earlier) and have not been upgraded to meet current design criteria. Many of the structures are near (or beyond) the end of their expected service lives and some structures show significant visible age-related damage and other problems.

The FCSSR provides the physical condition of levees, hydraulic structures, and channels at a system wide level in order to identify weaknesses within current SPFC facilities. The following components are considered in the FCSSR evaluation.

- Levee geometry, seepage, structural instability, erosion, settlement, penetrations, levee vegetation, rodent damage, and encroachments
- Channel conveyance, vegetation, and sedimentation
- Structural deficiencies
- Overall system condition

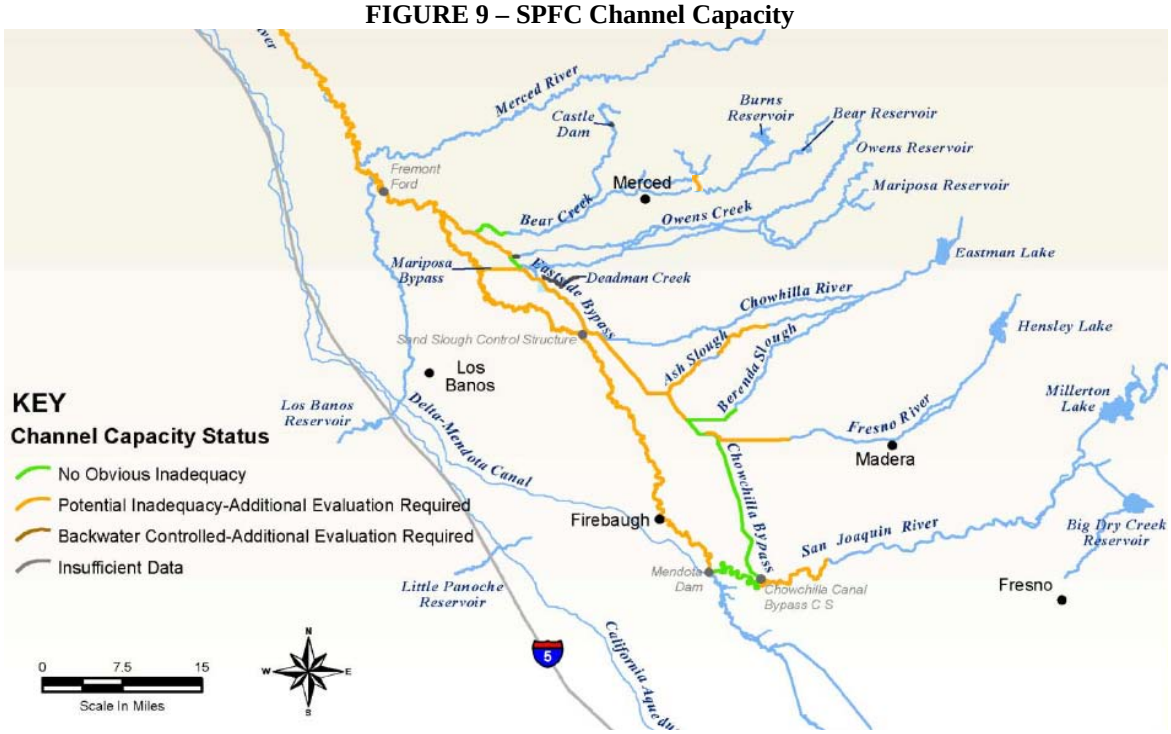
According to the FCSSR, a significant portion of the Planning Area has levees which represent moderate and high hazards. The purpose of this information is to help guide future inspection, evaluation, reconstruction, and improvement of SPFC facilities. Figure 8 below summarizes the overall findings of the FCSSR.

FIGURE 8 –Levee Conditions



SPFC channel conveyance capacity has been estimated based on the ability of a channel to pass original design flood flows. There are potential inadequate channel conveyance capacities along the San Joaquin River, Mariposa Bypass, Eastside Bypass, Black Rascal Creek Diversion, Ash Slough and the Fresno River as shown in the figure below.

FIGURE 9 – SPFC Channel Capacity



In addition to levee and channel deficiencies, deficiencies to SPFC flood control structures are listed in the FCSSR in the categories of hydraulic structures, pumping plants, and bridges.

SPFC hydraulic structures include weirs, drop structures, control structures, drainage structures, and outfall structures. The Black Rascal Creek drop structure, Bear Creek diversion structure, San Joaquin River structure and Sand Slough structure, San Joaquin River and Chowchilla Canal Bypass control structure, and Fresno River drainage structure are rated minimally acceptable for structural integrity according to the FCSSR. The Owens Creek overflow structure is rated unacceptable for structural integrity.

The Owens Creek siphon structure, San Joaquin River structure and Sand Slough structure, Ash Slough drop structure #4, and Fresno River diversion structure are rated minimally acceptable for vegetation and obstruction conditions.

The Owens Creek siphon structure and Ash Slough drop structure #4 are rated minimally acceptable for encroachment conditions. Finally, the Owens Creek siphon structure is rated minimally acceptable for erosion, bank caving, shoaling, and sedimentation.

NON-SPFC SYSTEM DEFICIENCIES

The flood management system of the San Joaquin River also relies on many non-SPFC flood control structures to convey floodwaters. The primary non-SPFC deficiency is the capacity of Bear Creek although severe flooding has occurred along Fahrens Creek and along the San Joaquin River. FEMA freeboard requirements are not met by the channel banks on Bear Creek and the east levee of the Black Rascal Diversion Channel. Solutions to these deficiencies have been studied over the past few decades and continue to face environmental challenges.

The canal system is vulnerable to failure, more so during excessive storm events due to a lack of significant flood control improvements. Deadman Slough, Duck Slough (Mariposa Creek), Miles Creek, and Owens Creek lack adequate capacity to convey 100-year flows according to the Merced County General Plan.

FUNDING OPPORTUNITIES

The DWR has made several programs available to assist communities with flood management planning and projects. These programs are supported by funds from by Propositions 1E and 84 (2009).

Currently available Proposition 1E funds are aimed at Storm Water Flood Management projects which are not part of the SPFC and require a 50% local match of funds. $92M is available under this program, with a maximum grant of $30M allowed per project. In order to qualify for Prop. 1E funds, the project must be consistent with the IRWMP for the Planning Area, be consistent with the Regional Water Quality Control Plan for the Basin, must reduce stormwater runoff & damage, and yield multiple benefits.

Currently available proposition 84 funds are intended for implementation of projects identified in the IRWMP, must include multiple benefits, and require a 25% match of local funds. The San Joaquin Region has $8.3M available, but only one application for this area will be accepted. Funding under these programs will give preference to projects which address regional water management issues, resolve conflicts between regions, and address water needs of disadvantaged communities.

Finally, DWR has recently announced funding for Regional Flood Management Plans as part of the next phase of the CVFPP. DWR has authorized $5 million for the program to be divided among nine Regions. Merced County is part of the Upper San Joaquin Region.

INTEGRATED FLOOD MANAGEMENT OPPORTUNITIES

This study has focused on flood management challenges within the Planning Area. However, another water challenge faced by the Planning Area is groundwater basin overdraft.

The Planning Area has expressed interest in focusing the IRWMP on alternatives for addressing the historical flooding on Bear Creek and Black Rascal Creek and coordinating these solutions with storage and groundwater recharge, or direct beneficial use. This is consistent with DWR's goal of implementing multi-benefit projects for flood control, water supply, and ecosystem restoration. Furthermore, the California Roundtable on Food and Water Supply published *From Storage to Retention: Expanding California's Options for Meeting Its Water Needs* in November 2012. A key focus of this publication was on methods to "hold on to water for as long as possible in the landscape for later use, while maintaining healthy ecosystems". The suggested approach in this report was to use agricultural lands to retain water for later use. According to the Roundtable, this approach could meet flood management, water supply, and ecosystem restoration goals.

Finally, flooding due to breakout flows from Bear Creek, Mariposa Creek, Deadman Creek, and Burns Creek downstream of Merced may be beneficial flooding from a groundwater recharge and environmental perspective. This is important in making the case for interceptor projects and other projects related to Merced Streams where diverted flows upstream of Merced may reduce the risk of flooding in populated areas, while maintaining beneficial flooding and recharge opportunities in agricultural areas.

The Planning Area has established an IRWMP objective to manage flood flows for public safety, water supply, recharge, and natural resource management. Performance measures for this objective include: occurrence of flooding at the Bear Creek, Black Rascal Creek diversion, Deadman Creek, Dry Creek, Fahrens Creek, Lake Yosemite, Mariposa Creek, Merced River, and San Joaquin River; volume of flood water stored and/or recharged; and flood-related damages (extent and frequency).

The following section presents an overview of the potential projects to address IRWMP objectives, and also summarizes the ranking determined by the RAC.

POTENTIAL PROJECTS TO ADDRESS IRWMP OBJECTIVES

This section presents a preliminary list of potential projects and policies for improving flood risk management in the Merced Region. The RAC reviewed these projects against other criteria including: economic feasibility, readiness, and consistency with the various IRWMP objectives.

To reduce flood-related damages, the Merced Region has three primary options:

1. Reduce the flow
2. Contain the flow
3. Get out of the way of the flow

The following is a summary of the potential projects and policies that may mitigate flood risk in the Planning Area. The planning level cost estimates prepared for each project are preliminary and were prepared using the best available information.

These projects were presented to the RAC for review and consideration on which projects represent the interests of the Planning Area. It is noted that a combination of any or all of these is possible.

Options to Reduce the Flow Entering Merced

- Black Rascal Creek Dam (Haystack Reservoir)
- Black Rascal Creek Detention Basin
- Bear, Burns, Owens, and/or Mariposa Reservoir Enlargements
- Route Flood Flows to Agricultural Lands South of Merced
- Ecosystem Restoration Along Waterways
- Bear Creek Detention Basin/Groundwater Recharge Facility
- Bear Creek Diversion Channel
- Le Grand/Planada Flood Control/Conjunctive Use Expansion Study
- Bear Creek Siphon and Diversion Structure (BCSDS) Expansion

Options to Contain the Flow Through Merced

- Levees along Channels
- Channel Dredging and/or Vegetation Removal
- Various local drainage improvements

Options to get out of the way of the flow

- Modify Land Use and Building Restrictions
- Develop Emergency Response Plans
- Ring Levees around Flood-Prone Areas or Critical Facilities
- Increase Public Awareness of Flooding
- Establish a Regional Flood Control District

In addition to the projects on the following pages, studies that evaluate the comprehensive flood management system should be considered. These could include:

- Analyzing the adequacy of Lake Yosemite for a 200-yr flood event with Fahrens Creek Headgates closed
- Analyzing the impact of flood flows and backwater effects at the confluence of the San Joaquin River and the Merced Streams and Merced River, and how upstream projects could reduce these effects
- Assess options to increase the capacity of Bear Creek to reduce the risk of flooding in the Franklin-Beachwood area

- Assess the impact of the Montgomery Reservoir on Merced River, San Joaquin River and the delta levees
- Evaluating New Exchequer Spillway Modifications to reduce flooding risks
- Evaluating how modification or removal of the Crocker Dam may reduce the risk of flooding

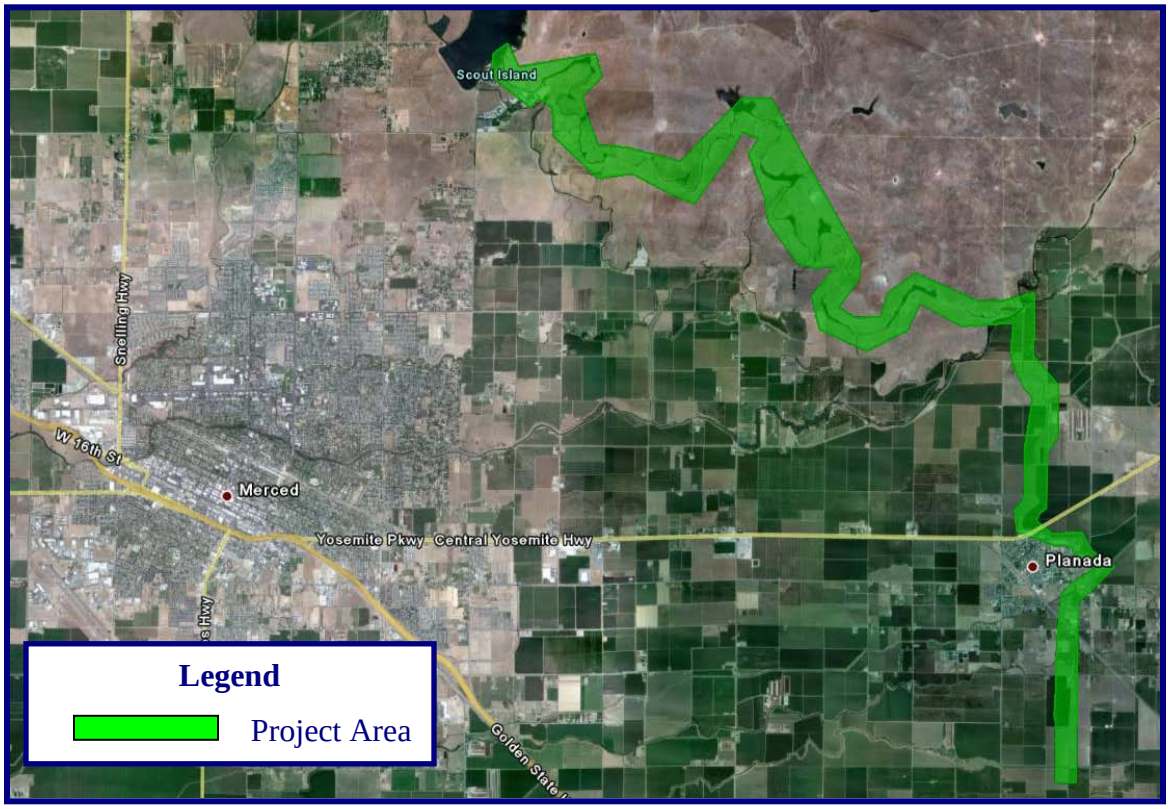
These recommended studies were not reviewed and prioritized by the RAC, but are suggested in this TM as potential studies Merced County should consider if future funds are available.

Furthermore, as previously noted in this TM, DWR has authorized funding for the Upper San Joaquin River Regional Flood Management Plan (RFMP). It is recommended Merced County and the Merced Irrigation District work closely with the DWR to ensure these project considerations are included in the RFMP to increase the possibility of having these studies be eligible for future State grant solicitations.

The following pages of this section summarize the pertinent flood management project details, as determined by the RAC.

Tier 1 Projects (Highest Priority)

PROJECT:
LE GRAND/PLANADA FLOOD CONTROL/CONJUNCTIVE USE EXPANSION STUDY



RESPONSIBLE AGENCY:
Merced Irrigation District

PROJECT DESCRIPTION:
The Le Grand canal was originally constructed to convey irrigation flows from Lake Yosemite (LY) south to the Planada and Le Grand area. The canal crosses multiple ravines and waterways along its course, including Black Rascal Creek (BRC) and Bear Creek (BC). The canal is the official spillway for Lake Yosemite. During flood season, MID breaches its southerly bank to discharge conveyed flows from the lake to BRC and prevent the canal from overtopping downstream due to limited channel capacity downstream. This multi-purpose project study is to redirect and route the flood waters from LY, BRC, BC and the watershed between them safely downstream through various conveyance systems for beneficial uses in the southern Merced region where groundwater is the main supply. A series of checks and diversion structures would be constructed along the canal to control and manage flood flows. Various reaches of Le Grand and Planada Canals must be enlarged as well to accommodate for higher flow.

The project is needed to provide protection against the overtopping of Lake Yosemite, especially in the case of storms occurring within the irrigation season. The project would allow MID to move from an irrigation season mode to flood protection mode and vice versa with minimal impact to the system, UC Merced, the City of Merced, and Merced County. Additionally, the project is needed to prevent the Le Grand and Planada Canals from breaching during high flood flows. The controlled flood waters may be re-routed to provide additional water supply downstream for various uses such as environmental, recharge, and counter subsidence measures.

This multi-phased and multi-purpose project allows the Merced Streams Group to direct flood water away from the City of Merced, Franklin Beachwood, Stevinson, and Planada areas as needed. Flood waters would then be directed to other areas downstream for flood protection, natural resources management, water supply, land subsidence mitigation, and providing in-lieu recharge. This project also provides for Lake Yosemite's volume to increase by 4,000 AF for irrigation purposes and allows for draining of 4,000 AF from Lake Yosemite in less than half the current time in preparation for major storms.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Meet demands for all uses, including agriculture, urban, and environmental resource needs. • Correct groundwater overdraft conditions. • Maximize water use efficiency. • Address water-related needs of disadvantaged communities (DACs). • Effectively address climate change adaptation and/or mitigation in water resource management.	• Improve coordination of land use and water resources planning. • Protect and improve water quality for all beneficial uses, consistent with the Basin Plan. • Protect, restore, and improve natural resources. • Protect and enhance water-associated recreation opportunities. • Establish and maintain effective communication among water resource stakeholders in the Region.	• Reduce Water Demand • Improve Operational Efficiency and Transfers • Increase Water Supply • Improve Water Quality • Improve Flood Management • Practice Resources Stewardship • Rainfed Agriculture

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

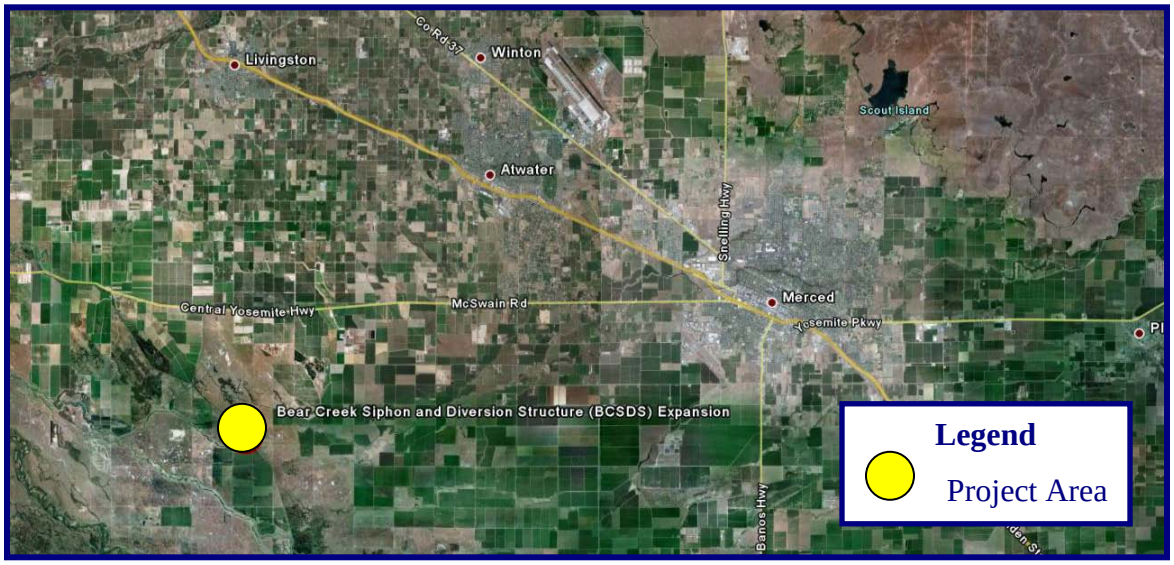
Conceptual	***Planning***	***Permitting/Design***	***Ready for Implementation***	***O&M***

Note: Overall Project is in the Conceptual Phase; the Study is Ready for Implementation

ESTIMATED COST FOR STUDY:
$240,000

Tier 1 Projects (Highest Priority)

PROJECT:
BEAR CREEK SIPHON AND DIVERSION STRUCTURE (BCSDS) EXPANSION STUDY



RESPONSIBLE AGENCY:
Stevinson Water District and the Community of Stevinson

PROJECT DESCRIPTION:
In 1963, the state Department of Water Resources (DWR) constructed the BCSDS at the intersection of Bear Creek and the East Side Canal. The facility was intended to channel Bear Creek flows over the East Side Canal Siphon during the winter and to divert these flows into the East Side Canal during the irrigation season. The proposed project would enlarge the BCSDS by building additional bays to extend the structure to the south. These bays would be used at times of unusual storm runoff when properties, both agricultural and residential, are threatened by rising flood waters in Bear Creek.

The BCSDS project would enhance the conveyance capacity needed to pass flood waters of Bear Creek that stem from the upstream watershed located outside of the Stevinson Water District boundary. This project would relieve the bottleneck at the BCSDS and would reduce the degree to which backwater extends upstream. Backwater extending upstream of the structure causes flood water in Bear Creek to overtop the bank, which leads to flooding behind the East Side Canal embankment, forces closure of the Highway 165, and leads to failure of the canal embankment.

Reduced flooding from BCSDS project would also reduce the likelihood of non-point and managed single point discharges of contaminants. Permitted urban and agricultural lands (including dairies) would better contain on-site runoff and prevent it from entering potable groundwater aquifers, the San Joaquin River, and the California Delta.

Ultimately, the BCSDS reduces upstream flooding in Bear Creek. This minimizes flood damage to urban and agricultural lands, decreases the risk of contamination from nearby dairies, and reduces pollution of groundwater and surface water supplies.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve coordination of land use and water resources planning. • Establish and maintain effective communication among water resource stakeholders in the Region. • Effectively address climate change adaptation and/or mitigation in water resource management.	• Improve Operational Efficiency and Transfers • Improve Water Quality • Improve Flood Management • Practice Resources Stewardship • Increase Water Supply

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/Design***	***Ready for Implementation***	***O&M***

Note: Overall Project is in the Conceptual Phase; the Study is Ready for Implementation

ESTIMATED COST FOR STUDY:
$80,000

Tier 1 Projects (Highest Priority)

PROJECT:
MERCED REGION PROGRAMMATIC ENVIRONMENTAL IMPACT REPORT - STREAM BED AND VEGETATION CONTROL

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
Flood management continues to be increasingly important and difficult at the local level. Vegetation and stream bed/channel management is critical to decrease flood related impacts in Merced County. Recent interpretations and application of Fish and Game codes have nearly halted Stream Bed and Channel maintenance. CEQA analyses required for the Streambed Alteration permitting on each project is expensive and defers maintenance, creating complex unintended outcomes. The Merced IRWM region should explore the effectiveness and expense of preparing a local Programmatic Environmental Impact Report (PEIR) to potentially create low-cost and faster-teiring in subsequent CEQA reviews related to flood management.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Improve coordination of land use and water resources planning. • Address water-related needs of disadvantaged communities (DACs). • Protect and enhance water-associated recreation opportunities. • Establish and maintain effective communication among water resource stakeholders in the Region.	• Improve Operational Efficiency and Transfers • Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

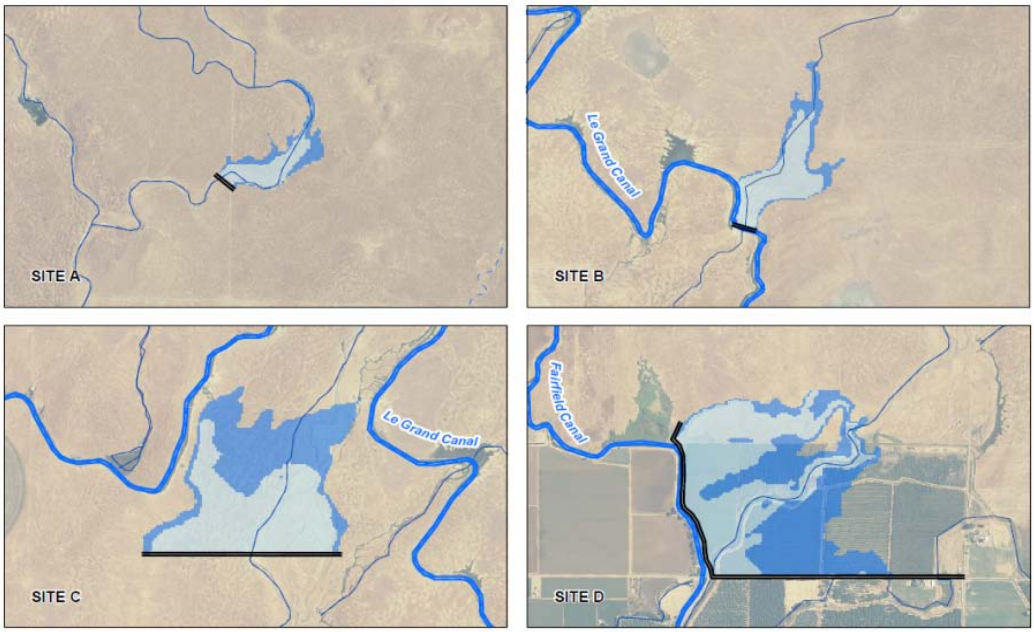
CURRENT STATUS OF PROJECT:

■				
Conceptual	***Planning***	***Permitting/Design***	***Ready for Implementation***	***O&M***

Note: Overall Project is in the Conceptual Phase; the Study is Ready for Implementation

ESTIMATED COST FOR ENVIRONMENTAL REPORT:
$300,000

PROJECT:
BLACK RASCAL CREEK FLOOD CONTROL PROJECT



Black Rascal Creek Detention Basin Alternatives
Source: Black Rascal Creek Flood Control Feasibility Study, URS Corporation, 2008

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
Local area flooding has been a chronic problem in Merced County going back as long as historical data has been documented on storm events. The Merced Streams Group (MSG) was established by Congress in the 1950's and is the flood control project for the eastern portion of Merced County. The MSG project impacts all downstream areas including the San Joaquin River and features five reservoirs, two bypass channels, and miles of channel improvements. The major project element to yet be completed is a flood control system on the Black Rascal Watershed. Flood flows are currently allowed to flow freely through the most populated areas of Merced County without any regulation controls in place. Flooding occurs on a routine basis causing major damage to residential structures, personal property, infrastructure (bridges and roads), sanitary systems, domestic water delivery systems, and valuable agricultural land/crops.

Based upon initial review of existing information, reducing flood flows in Black Rascal Creek at the Yosemite Ave. diversion to less than about 3,000 cfs by use of an upstream detention would substantially reduce the flooding in the City of Merced. The USACE Haystack Reservoir aimed at addressing this issue, but has been put on hold. Merced County retained URS Corporation to investigate the feasibility of alternative flood control improvements, including alternative operation procedures and infrastructure improvements to the Lake Yosemite facilities, to reduce the peak flows at the Black Rascal Creek diversion. The study identified four different sites along Black Rascal Creek for construction of a detention basin. The amount of new storage provided by the various detention basins ranged from 300 to 2,500 acre-feet.

The preferred project location for the detention basin is immediately north of Yosemite Avenue and Arboleda Drive, in northeast Merced. This is Site D in the graphic on the previous page. The

reservoir would maintain a minimum pool for wildlife purposes and, during the flood season, the reservoir would act primarily as a flood control retarding basin.

During the irrigation season, the reservoir would regulate irrigation flows. This increases Merced Irrigation District water system efficiency without impacting power generation schedules at New Exchequer Dam with the Independent System Operator (ISO).

Ultimately, the project could provide 200-year flood protection to portions of Merced.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management.	• Meet demands for all uses, including agriculture, urban, and environmental resource needs. • Correct groundwater overdraft conditions. • Protect and improve water quality for all beneficial uses, consistent with the Basin Plan. • Protect, restore, and improve natural resources. • Address water-related needs of disadvantaged communities (DACs). • Protect and enhance water-associated recreation opportunities. • Establish and maintain effective communication among water resource stakeholders in the Region. • Effectively address climate change adaptation and/or mitigation in water resource management. • Enhance public understanding of water management issues and needs.	• Improve Operational Efficiency and Transfers • Increase Water Supply • Improve Water Quality • Improve Flood Management • Practice Resources Stewardship • Irrigated Land Retirement

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	***Planning***	***Permitting/Design***	***Construction***	***O&M***

ESTIMATED COST TO COMPLETE PERMITTING/DESIGN AND CONSTRUCTION:
$84,000,000

Tier 1 Projects (Highest Priority)

PROJECT:
FRANKLIN COUNTY WATER DISTRICT (FCWD) DRAINAGE IMPROVEMENTS

RESPONSIBLE AGENCY:
Franklin County Water District (FCWD)

PROJECT DESCRIPTION:
In 1981, FCWD and the County of Merced jointly participated in a Housing and Urban Development (HUD) block grant project for drainage improvements in the Franklin-Beachwood area of Merced County. The project included curbs and gutters, street paving, storm drain inlets and piping, a storm basin and a storm pump station with a discharge into the Merced Irrigation District's El Capitan Canal. Funding for that project was only sufficient to provide improvements for about 70% of the proposed design area, so this application seeks to complete the remaining 30% of the original project area that did not receive improvements.

Five streets in the remaining project area currently have no effective form of drainage. Without curbs and gutters, the existing road shoulders and driveways frequently flood or have standing water due to insufficient slope and poorly maintained or non-existent driveway culvert pipes. During rainy weather, vehicles frequently park in dirt shoulder areas and front yards, creating muddy ruts. When runoff from these areas eventually reaches inlets, like at the intersection of Cabot and Meadowbrook, the runoff is full of muddy sediment which is ultimately pumped to the El Capitan Canal. New streets and curbs/gutters would be lowered with improved slopes and connected to storm drain facilities reducing localized flooding of driveways and front yards.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	• Improve Operational Efficiency and Transfers • Improve Water Quality • Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	*Planning*	*Permitting/Design*	*Construction*	*O&M*

ESTIMATED COST TO COMPLETE PERMITTING/DESIGN AND CONSTRUCTION:
$7,300,000

Tier 1 Projects (Highest Priority)

PROJECT:
MARY LANE DRAINAGE

RESPONSIBLE AGENCY:
City of Atwater

PROJECT DESCRIPTION:
The community of Atwater has a 193 acre drainage area in part of the community that generates peak flows that that are not handled by collection, storage and pumping facilities. This has resulted in flooding at Mary Lane and Terri Drive to such a depth that residents along these streets are also flooded. The City has completed a study of the drainage problem and determined a possible solution. This solution proposes additions to the drainage system that provide for additional storage and increased pumping capacity to handle peak storm volumes. The drainage project would reduce the continued flooding of residential areas during normal or above normal rainfall events.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objective	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	***Planning***	***Permitting/Design***	***Construction***	***O&M***

ESTIMATED COST TO COMPLETE PROJECT:
$1,800,000

Tier 1 Projects (Highest Priority)

PROJECT:
UPDATE STORMWATER DESIGN STANDARDS FOR THE CITY AND REGION

RESPONSIBLE AGENCY:
City of Merced

PROJECT DESCRIPTION:
This project would update the region's stormwater design standards.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Operational Efficiency and Transfers • Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

			■	
Conceptual	***Planning***	***Permitting/Design***	***Ready to Implement***	***O&M***

ESTIMATED COST TO IMPLEMENT:
$80,000

Tier 1 Projects (Highest Priority)

PROJECT:
4TH AVENUE & LANDER (HWY 165) DRAINAGE PROJECT

RESPONSIBLE AGENCY:
Merquin County Water District

PROJECT DESCRIPTION:
The intersection of 4th Avenue and Lander floods during normal and heavy rainfall events. This flooding impacts emergency personal operating out of the intersection's fire station. This project includes replacement of the existing storm drainage pump with a new duplex pump station and force main connecting to the Highline Lateral. The existing drainage pump is an undersized single pump incapable of addressing the current and future conditions of the intersection. With all of the intersection improvements implemented over the past several years, the 40 year old pump station simply cannot dewater the intersection in a timely manner. The new pump station would remove floodwaters from the intersection and Fire Station, and would improve public safety for the community.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	*Planning*	*Permitting/Design*	*Construction*	*O&M*

ESTIMATED COST TO COMPLETE PERMITTING/DESIGN AND CONSTRUCTION:
$340,000

Tier 2 Projects (High Priority)

PROJECT:
DEVELOP EMERGENCY RESPONSE PLANS

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
The objective of an emergency response plan is the prevent loss of life; reduce physical damage to public and private property (evacuation equipment, pre and post flood fight materials, etc.); plan for speedy recovery; and disaster management and communication. The development of emergency response plans are typically a low-cost/high benefit option for mitigating flood risk.

Developing coordinated flood-fight activities and emergency response plans can reduce loss of life and property damage during flood events.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Establish and maintain effective communication among water resource stakeholders in the Region. • Address water-related needs of disadvantaged communities (DACs). • Establish and maintain effective communication among water resource stakeholders in the Region.	• Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Implementation***	***O&M***

ESTIMATED COST TO DEVELOP EMERGENCY RESPONSE PLANS:
$100,000

Tier 2 Projects (High Priority)

PROJECT:
MCCULLOUGH ROAD DRAINAGE PROJECT

RESPONSIBLE AGENCY:
Merquin County Water District

PROJECT DESCRIPTION:
The project would install approximately 5,000 feet of pipeline to replace the use of existing on-farm ditches and roadside ditches to convey storm flood waters and drainage waters away from the intersection of 4th Avenue and McCullough Road. The make-shift operation of using private and public facilities over the years has left the area flooded in most wet year events.

This project would provide floodwater removal and protection for existing residential and agricultural properties west of the community of Stevinson. Additionally, the project would help prevent the cross contamination of flood waters with dairy waste within the agricultural lands of the benefit area. This improves water quality and public safety due to reductions in ponding water that breed mosquitoes. Overall, this project's main objective is to provide flood relief to an area of the community that experiences flooding during normal and wet rainfall years.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	• Improve Flood Management • Improve Operational Efficiency and Transfers • Improve Water Quality

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN/DESIGN/IMPLEMENT:
$1,950,000

Tier 2 Projects (High Priority)

PROJECT:
MERCED COUNTY FLOOD CONTROL DISTRICT

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
In the past decade, established flood control agencies have had great success in mitigating flood risk throughout California, due to their singular focus. Examples include the Sacramento Area Flood Control Agency (SAFCA), the Sutter Butte Flood Control Agency (SBFCA), the San Joaquin Area Flood Control Agency (SJAFCA), and the San Joaquin County Flood Control and Water Conservation District (SJCFC & WCD). This option would involve the creation of a flood control agency for the region, either as an adjunct of Merced County, or as a joint powers authority. The agency would be responsible for planning, coordinating, and managing flood control projects for the region. A central flood control agency could also perform O&M functions.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO FORM A REGIONAL FLOOD CONTROL DISTRICT:
$100,000

Tier 2 Projects (High Priority)

PROJECT:
FLOOD RISK MANAGEMENT PROJECT, CITY OF LIVINGSTON

RESPONSIBLE AGENCY:
City of Livingston

PROJECT DESCRIPTION:
A storm drain lift station on East Avenue in Livingston is located in the back yard of a private residence. Its location creates major delays for staff to access the lift station when needed. Further, the lift station has exceeded its useful life and is in need of replacement due to its imminent failure. The project would relocate the lift station nearby to an adjacent parcel owned by the City of Livingston. Additionally, flood management would be improved by replacing the corroded, deteriorated, and undersized storm lines on East Avenue to allow for higher level of flows to be delivered through the system.

The existing lift station was installed more than 30 years ago. It is located on an approximately six foot by 14 foot fenced area within a private residential property. The lift station serves an area where approximately 6,000 people reside. Each time the lift station requires attention, public works staff must coordinate and inform three different property owners in order to gain access to the back yard. Access is further complicated since the subject properties are rental units; thus, public works staff must contact the property owner to obtain contact information for the actual resident. Additionally, if major equipment is required at the lift station, public works staff must take down the property owner fences. The location of the lift station creates additional expense and time lost when confronting significant overflow and flooding issues.

The replacement of the lift station would manage flood flows in Livingston and reduce damage to residential properties.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Protect, restore, and improve natural resources. •	• Improve Operational Efficiency and Transfers • Improve Water Quality • Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN/DESIGN/IMPLEMENT:
$3,400,000

Tier 2 Projects (High Priority)

PROJECT:
ECOSYSTEM RESTORATION ALONG WATERWAYS

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
An alternative, similar to routing flood flows onto agricultural land, would be to acquire riparian areas of agricultural land and restore natural floodplains. This type of flood control project could be implemented as an ecosystem mitigation bank. A secondary benefit to this option would be the direct recharge of groundwater. This type of project may be feasible for reaches of Bear Creek located upstream and downstream of Merced. Costs would vary on the number of parcels acquired, willingness of landowner to sell all or part of their property, and environmental impacts.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Protect, restore, and improve natural resources. • Address water-related needs of disadvantaged communities (DACs).	• Correct groundwater overdraft conditions. • Improve coordination of land use and water resources planning.	• Improve Flood Management • Practice Resources Stewardship

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN THE PROJECT:
$400,000

Tier 2 Projects (High Priority)

PROJECT:
BEAR RESERVOIR ENLARGEMENT AND DOWNSTREAM LEVEE AND CHANNEL IMPROVEMENTS

RESPONSIBLE AGENCY:
Merced Streams Group (County of Merced, City of Merced, & Merced Irrigation District)

PROJECT DESCRIPTION:
Bear Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The enlargement of Bear Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Bear Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project could meet the requirements of the new flood control legislation and increase level of flood protection to an urbanized area of Merced County.

This project calls for design, environmental documents, and construction funding. Due to the length of time since project need was identified, a new feasibility study may need to be completed to deal with changes in legislation.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers • Increase Water Supply

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

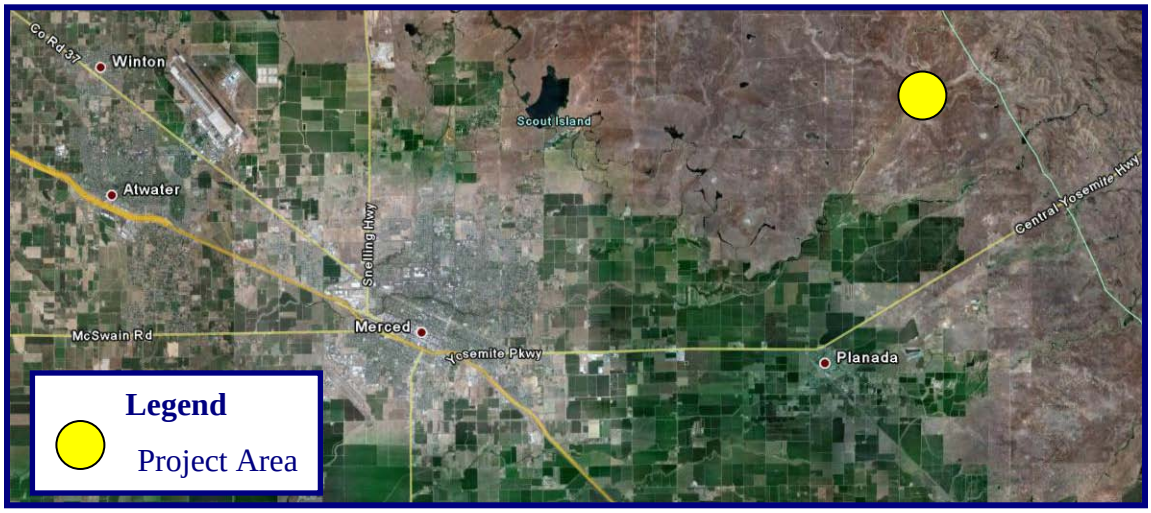
	■			
Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PERMIT/DESIGN/CONSTRUCT:
$55,000,000

Tier 2 Projects (High Priority)

PROJECT:

BURNS RESERVOIR ENLARGEMENT AND DOWNSTREAM LEVEE AND CHANNEL IMPROVEMENTS



RESPONSIBLE AGENCY:

Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)

PROJECT DESCRIPTION:

Burns Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The enlargement of Burns Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Burns Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project could help to meet the requirements of the new flood control legislation while also providing increased flood protection to the most urbanized areas of Merced County.

This project calls for design, environmental documents, and construction funding. Due to the length of time since the project was identified, a new feasibility study may need to be completed to deal with changes in legislation.

PRIMARY BENEFIT:

Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers • Increase Water Supply

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PERMIT/DESIGN/CONSTRUCT:
$41,400,000

Tier 2 Projects (High Priority)

PROJECT:
INCREASE PUBLIC AWARENESS OF FLOODING

Cover of DWR's First Annual Flood Risk Mailer (September 2010)

RESPONSIBLE AGENCY:
Merced County, City of Merced

PROJECT DESCRIPTION:
Increasing the public's knowledge about flood risk is another non-structural alternative for mitigating flood risk. In addition to improving safety during floods, the efforts can also enhance public support of flood control projects. Typical forms of outreach include press releases, individual mailer brochures, website development, posters, "flood awareness month", and social networking site involvement. Note that the public outreach efforts can often be completed in conjunction with other related projects in order to reduce costs.

Merced and other communities are prone to flooding from the creeks in the region. Increasing public awareness of flood season, precautionary measures, and their location with respect to the floodplain may be effective reducing flood damages.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Establish and maintain effective communication among water resource stakeholders in the Region. • Enhance public understanding of water management issues and needs. • Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO DEVELOP AN OUTREACH PROGRAM:
$50,000

Tier 2 Projects (High Priority)

PROJECT:
MODIFY LAND USE DESIGNATIONS

RESPONSIBLE AGENCY:
Merced County/City of Merced

PROJECT DESCRIPTION:
Merced County currently imposes development restrictions for Special Flood Hazard Areas (Chapter 18.34 of the County Code) in accordance with FEMA and the NFIP. Merced County's Floodplain Land Use Ordinance also provides formal primary and secondary floodplain zones along streams and describes limitations on land uses in these zones. In addition, City of Merced ordinances prohibit encroachment on land adjacent to Bear Creek. Modifications to the existing land use designations within the Merced Region could be used to direct growth outside of the floodplain and/or outside of stream corridors. Additional options include: imposing elevation requirements for new development within the 200-yr or 500-year floodplain, limiting or restricting new development within the 200-yr or 500-year floodplain in accordance with SB-5 requirements, or designating permanent agricultural zones. While this option may inhibit economic growth in floodplains, it may reduce flood risk and ultimately cost less than flood control system capital improvements.

Flood related damages occur in Merced due in part to development within the FEMA 100-yr floodplain. Land use modifications to direct growth outside the floodplain could reduce flood related damage risks and coordinate flood-prone areas into land-use planning.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Improve coordination of land use and water resources planning. • Address water-related needs of disadvantaged communities (DACs).	• Enhance public understanding of water management issues and needs.	• Improve Flood Management • Practice Resources Stewardship

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO MODIFY LAND USE DESIGNATIONS:
This can be implemented using current land use processes with minimal financial impact.

Tier 2 Projects (High Priority)

PROJECT:
HIGHLINE LATERAL DRAINAGE PROJECT

RESPONSIBLE AGENCY:
Merquin county Water District

PROJECT DESCRIPTION:
This would consist of installation of approximately 5,000 feet of pipeline from the existing end of the highline lateral to the San Joaquin River. The beginning would be near the intersection of HWY 140 and Lander Avenue and would continue south parallel with Lander Avenue to the San Joaquin River.

Flood flows in a portion of the Stevinson community are directed into the highline lateral, which does not have a direct connection to an outfall facility. Extending the highline lateral to the San Joaquin River would provide a relief point for flood flows from the community. This prevents the flooding of existing residential homes, agricultural property, and County roadways. This project would manage flood waters affecting the community during both normal and wet years.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN/DESIGN/CONSTRUCT:
$2,000,000

Tier 2 Projects (High Priority)

PROJECT:
DIVERT FLOOD FLOWS TO AGRICULTURAL LANDS

RESPONSIBLE AGENCY:
Merced County

PROJECT DESCRIPTION:
Diverting flood flows out of Bear Creek, east of Merced onto nearby agricultural land could decrease peak flows within the channel. Historically, flood flows in excess of the Bear Creek channel capacity spill over the south bank of Bear Creek about 6 miles east of Merced. These flows do not return to the channel and much of the water ends up making its way into the City. This action may be induced more often by reducing the capacity of Bear Creek upstream of Merced.

Depending on the topography, the types of crops, and the willingness of the landowners, agricultural land could be utilized as shallow floodplains, where excess flood flows would be temporarily stored until water percolates back into the ground or drains back to creeks more slowly. Agricultural lands would be temporarily flooded and the waters would be routed back into the channel after the high flows recede. Berms, ditches, and weirs could be constructed to optimize the process and to delineate the extents of agricultural flooding.

This project could reduce peak flows through the urban areas of Merced by allowing peak flows to exit the south bank of Bear Creek, upstream of Merced. This occurs in the existing condition, but could be enhanced to provide additional groundwater recharge opportunities by creating structures to contain flows on agricultural lands until water percolates.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Secondary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Correct groundwater overdraft conditions.	• Improve Flood Management • Practice Resources Stewardship

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO BEGIN PLANNING PHASE:
$400,000

Tier 2 Projects (High Priority)

PROJECT:
CHANNEL DREDGING AND/OR VEGETATION REMOVAL

RESPONSIBLE AGENCY:
Merced County/MID/City of Merced

PROJECT DESCRIPTION:
Streams, creeks, and rivers within the Merced Region are periodically choked with vegetation and/or sedimentation, causing channel capacities to be exceeded during major floods. Vegetation removal and/or dredging the channel would increase channel carrying capacities and decrease flood risk for select areas. This option may benefit reaches of Bear Creek, Black Rascal Creek, and Black Rascal Slough where current channel capacities are well below the 100-year level. This option may be implemented as a capital improvement project, or implemented via current Operations and Maintenance activities.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO IMPLEMENT (ONCE PEIR IS COMPLETE):
$2,200,000

Tier 2 Projects (High Priority)

PROJECT:
CONSTRUCT LEVEES ALONG CHANNELS/WIDEN EXISTING CHANNELS

RESPONSIBLE AGENCY:
Merced County/MID/City of Merced

PROJECT DESCRIPTION:
Based on a review of the available information, Bear Creek, Black Rascal Creek/Slough/Diversion, Deadman Creek, Dry Creek, Fahrens Creek, and Mariposa Creek are subject to flooding. Stream capacities and estimated 100-yr storm flow rates were found for Bear Creek, Black Rascal Creek/Slough, and Miles Creek. For the other streams, either the capacity or peak flows were not available in the referenced information.

Specific levee heights needed to contain the 100-yr storm flows were estimated for segments of Bear Creek and Black Rascal Creek/Slough. For areas where preliminary calculations yielded unrealistic freeboard deficiencies (i.e. needed levee heights >9 feet), a combination of channel widening and decreased levee heights were explored.

Levees and/ or channel widening projects may be suitable for select reaches adjacent to and upstream of urbanized development. For agricultural areas, the RAC may limit these expenditures. For example, Miles Creek currently cannot convey the 100-yr storm flows within its banks. However, the estimated $170M to fully contain this creek may not be as economically feasible as improvements elsewhere in the Region. Figure 10 on page 50 illustrates possible locations of channel improvements. The proposed levee and/or channel widening projects would not reduce flood flows, but would serve to manage flood flows by containing them within existing channels.

Table 1 – Summary of Channel Capacity Deficiencies and Estimated Levee Construction Costs

Stream	Current Estimated Channel Capacity (cfs)	Est. 100-Yr Flow in Creek (cfs)	Estimated Capacity Deficiency (cfs)	Estimated Increased Levee Height Needed to Contain 100-yr Flow (ft)	Est. Cost to Construct Levees to Contain 100-yr Flow[8]
Bear Creek					
Bear Creek (U/S of Diversion)	4,000[1]	10,000[6]	6,000	7	$30M
Bear Creek (U/S HWY 99)	7,000[1]	14,000[2]	7,000	12	$150M
Bear Creek (D/S HWY 99)	3,100[1]	6,150[2]	3,050	15	$150M
Black Rascal Creek/Slough					
Black Rascal Creek (U/S of Diversion)	3,500[4]	3,500[3]	N/A	N/A	N/A
Black Rascal Diversion	3,000[1]	3,500[5]	500	6	$10M
Black Rascal Creek (D/S of Diversion)	Not Available	Local Flow Only	N/A	N/A	N/A
Black Rascal Creek (U/S of Bear Creek)	Not Available	5,720[2]	Not Available	7 (Estimated)	$20M
Black Rascal Slough	3,900[1]	7,100[2]	3,200	14	$150M
Other Creeks					
Fahrens Creek	Not Available	5,400[2]	Not Available	7 (Estimated)	$20M
Mariposa Creek	1,250[1]	Not Available	Not Available	Not Available	N/A
Miles Creek	1,000[1]	3,400[2]	2,400	15	$410M

1. Information obtained from the Merced County Stream Group Study.
2. Information obtained from FEMA FIS.
3. Information obtained from the Merced County Feasibility Study for the Black Rascal Creek Flood Control Project.
4. Information estimated from inspection of FIS profiles.
5. Information estimated since FEMA FIS indicates only local drainage exists in Black Rascal Creek D/S of Diversion.
6. 100-Yr flow estimated based on FIS flows in other reaches of Bear Creek.
7. According to FEMA FIS, only local drainage is in Black Rascal Creek between the Diversion and the confluence with Fahrens Creek.
8. Cost Includes Design, Construction, and "Average" Environmental Costs. Does not include right-of-way or real estate costs.

Table 2 – Summary of Channel Capacity Deficiencies and Estimated Widening and Levee Construction Costs

Stream	Current Estimated Channel Capacity (cfs)	Est. 100-Yr Flow in Creek (cfs)	Estimated Capacity Deficiency (cfs)	Channel Widening & Short Levee Alternatives		
				Estimated Possible Channel Widening Width (ft)	Estimated Levee Height ft)	Est. Cost to Widen the Channel and Construct Smaller Levees[8]
Bear Creek						
Bear Creek (U/S of Diversion)	4,000[1]	10,000[6]	6,000	-	-	-
Bear Creek (U/S HWY 99)	7,000[1]	14,000[2]	7,000	20	8	$100M
Bear Creek (D/S HWY 99)	3,100[1]	6,150[2]	3,050	10	9	$80M
Black Rascal Creek/Slough						
Black Rascal Creek (U/S of Diversion)	3,500[4]	3,500[3]	N/A	-	-	-
Black Rascal Diversion	3,000[1]	3,500[5]	500	-	-	-
Black Rascal Creek (D/S of Diversion)	Not Available	Local Flow Only	N/A	-	-	-
Black Rascal Creek (U/S of Bear Creek)	Not Available	5,720[2]	Not Available	-	-	-
Black Rascal Slough	3,900[1]	7,100[2]	3,200	10	8	$80M
Other Creeks						
Fahrens Creek	Not Available	5,400[2]	Not Available	-	-	-
Mariposa Creek	1,250[1]	Not Available	Not Available	-	-	-
Miles Creek	1,000[1]	3,400[2]	2,400	20	7	$170M

1. Information obtained from the Merced County Stream Group Study.
2. Information obtained from FEMA FIS.
3. Information obtained from the Merced County Feasibility Study for the Black Rascal Creek Flood Control Project.
4. Information estimated from inspection of FIS profiles.
5. Information estimated since FEMA FIS indicates only local drainage exists in Black Rascal Creek D/S of Diversion.
6. 100-Yr flow estimated based on FIS flows in other reaches of Bear Creek.
7. According to FEMA FIS, only local drainage is in Black Rascal Creek between the Diversion and the confluence with Fahrens Creek.
8. Cost Includes Design, Construction, and "Average" Environmental Costs. Does not include right-of-way or real estate costs.

FIGURE 10 – Location of Possible Levee and/or Channel Widening Projects

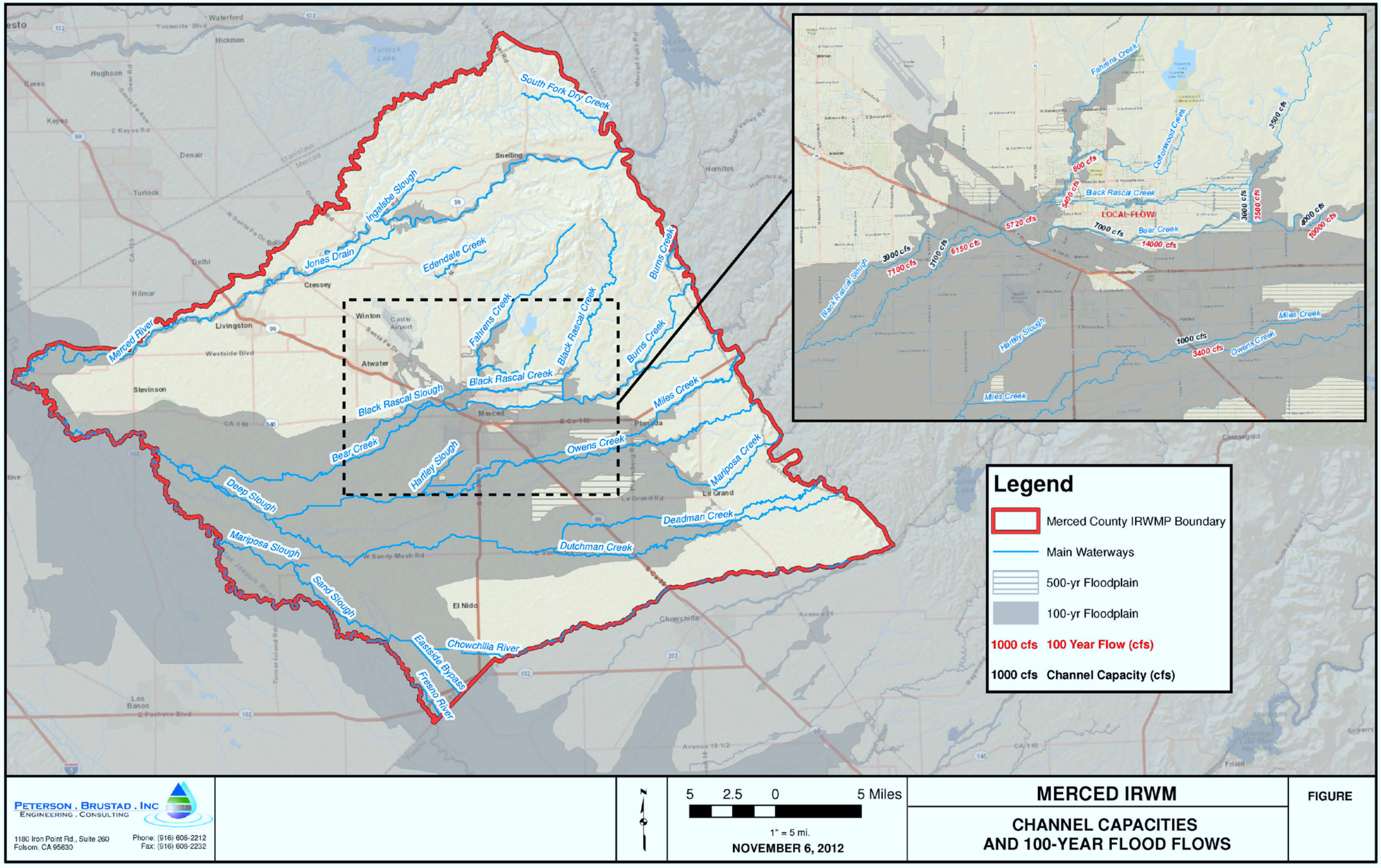
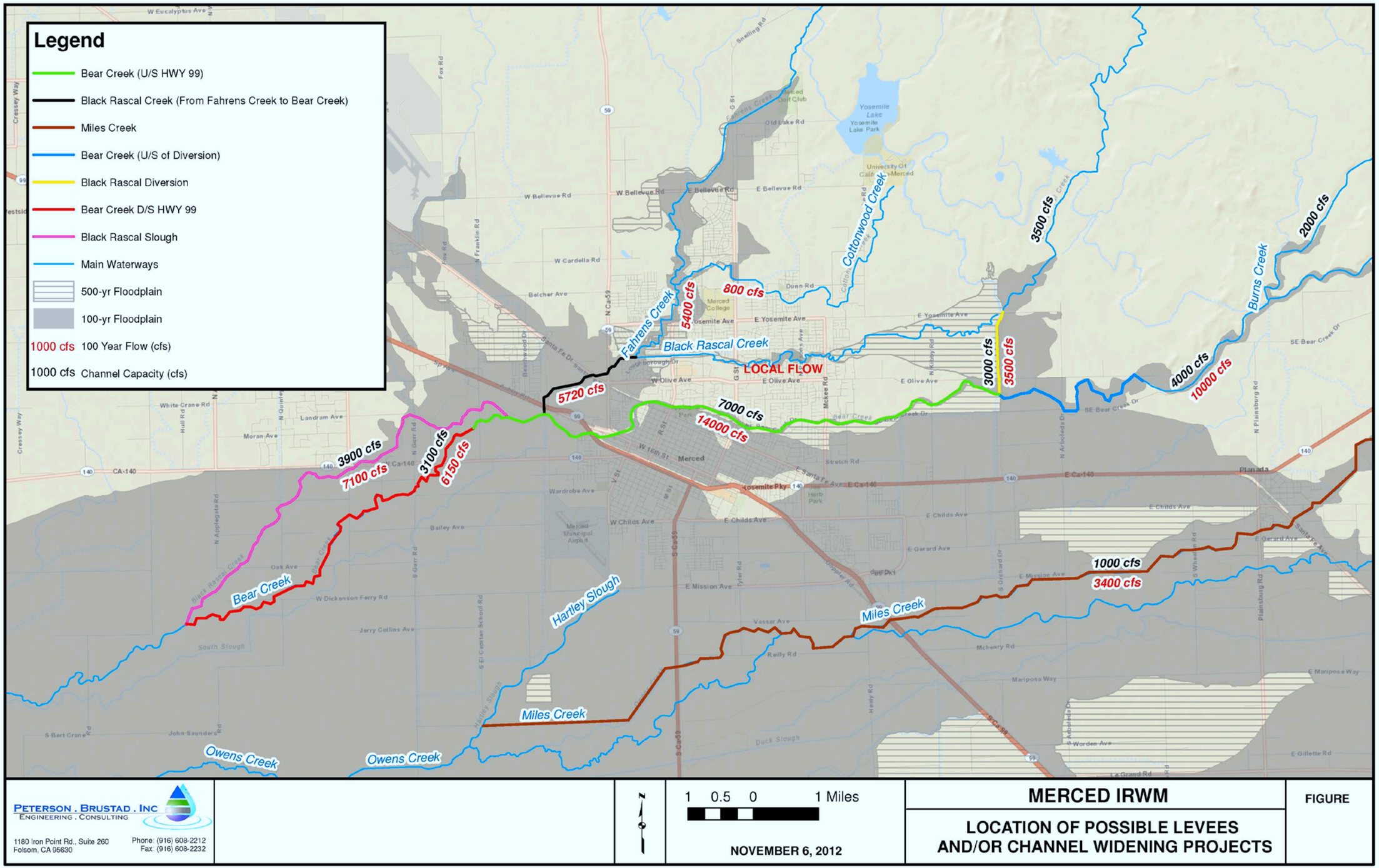


FIGURE 11 – Location of Possible Levee and/or Channel Widening Projects



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PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST FOR A FEASIBILITY STUDY:
$500,000

Tier 2 Projects (High Priority)

PROJECT:
CONSTRUCT RING LEVEES AROUND FLOOD-PRONE AREAS

RESPONSIBLE AGENCY:
Merced County/MID/City of Merced

PROJECT DESCRIPTION:
A ring levee is a levee that completely encircles an area subject to inundation from all directions. These can effectively protect structures or areas from shallow flooding. Ring levees are generally less than 5-feet tall, and have minor impacts to the floodplain outside the ring. Ring levees may be constructed around single facilities, or could encircle larger areas. For example, Marysville, CA is encircled by a ring levee. A recent residential subdivision on Hotchkiss Tract (RD799) included a ring levee to reduce the likelihood of flood damage to these structures. A key to the feasibility of ring levees, particularly on discrete facilities, is the availability of right-of-way and the acceptability of risk of remaining inside during a flood, with evacuation routes cut off.

Merced is prone to flooding from Bear Creek, Black Rascal Creek, and Fahrens Creek. Ring levees may be constructed around single facilities or areas to protect these areas from flooding.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management

The applicability of these objectives and strategies to the project were determined by the RAC.

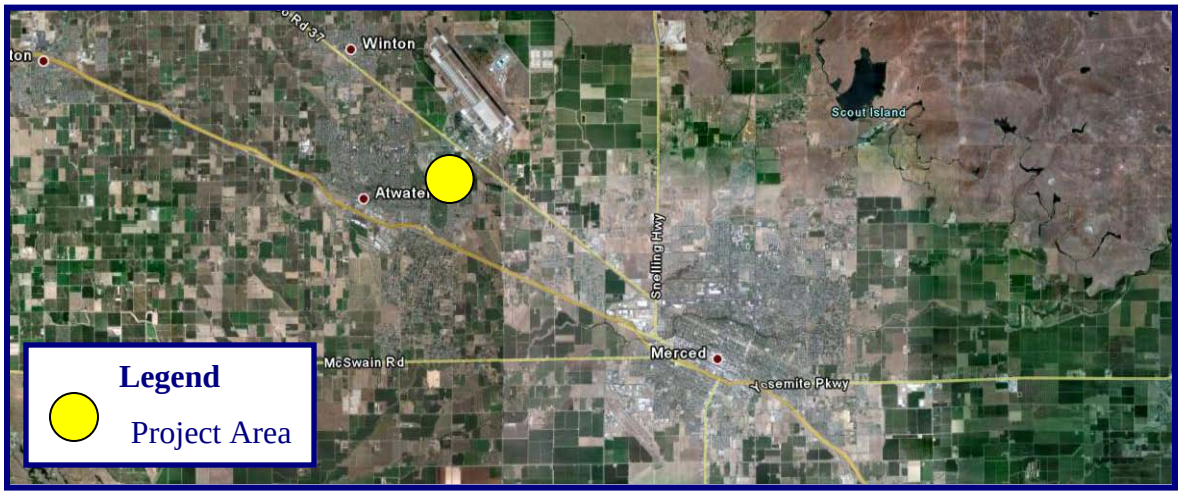
CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN/DESIGN/CONSTRUCT:
$5,000 / LF

Tier 2 Projects (High Priority)

PROJECT:
LIVINGSTON CANAL LINING PROJECT



RESPONSIBLE AGENCY:
Merced Irrigation District

PROJECT DESCRIPTION:
The project would line a portion of the canal section of the Livingston Canal through the City of Atwater. The project reduces the chances of abrupt canal failure which could cause significant flooding to residences and businesses in the area.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Operational Efficiency and Transfers • Improve Flood Management • Practice Resources Stewardship

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO PLAN/DESIGN/CONSTRUCT:
$7,000,000

Tier 2 Projects (High Priority)

PROJECT:
WINDMILL DITCH DRAINAGE

RESPONSIBLE AGENCY:
Merquin County Water District

PROJECT DESCRIPTION:
Installation of approximately 4,500 feet of pipeline to transport drainage waters to an existing ditch that discharges to the San Joaquin River. The existing Windmill Ditch intercepts flood water upstream of the community in the northeast area. This installation would allow the flood waters to be moved around the community.

The project would provide flood protection to the community of Stevinson, which would benefit both residential and agricultural properties. As a severely ranked DAC, any loss of production property within the community's agricultural economic base has an effect throughout the whole community.

PRIMARY BENEFIT:
Flood Management

PROJECT OBJECTIVES & STRATEGIES:

Primary Objectives	Strategies
• Manage flood flows for public safety, water supply, recharge, and natural resource management. • Address water-related needs of disadvantaged communities (DACs).	• Improve Flood Management • Improve Operational Efficiency and Transfers

The applicability of these objectives and strategies to the project were determined by the RAC.

CURRENT STATUS OF PROJECT:

	■			
Conceptual	***Planning***	***Permitting/ Design***	***Construction***	***O&M***

ESTIMATED COST TO DESIGN/CONSTRUCT:
$1,300,000

Glossary

ACE —Annual Chance Exceedance

CVFPB—Central Valley Flood Protection Board

CVFPP—Central Valley Flood Protection Plan

DSOD—California Division of Safety of Dams

DWR—California Department of Water Resources

FCSSR—Flood Control System Status Report

FEMA—Federal Emergency Management Agency

IRWMP—Integrated Regional Water Management Plan

MID – Merced Irrigation District

MSG—Merced County Stream Group

NFIP—National Flood Insurance Program

O&M—Operations and Maintenance

RAC – Regional Advisory Committee

RFMP—Regional Flood Management Plans

SB5—Senate Bill 5

SB1278 —Senate Bill 1278

SPFC—State Plan of Flood Control

TM—Technical memorandum

ULDC—Urban Levee Design Criteria

ULOP—Urban Level of Flood Protection

USACE—United States Army Corps of Engineers

USFWS—U.S. Fish and Wildlife Service

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