CHAPTER 2. FLOOD CONTROL/DRAINAGE PLANNING

There are three potential levels of SCWA involvement in flood control/drainage planning and implementation in the County. These levels are based on the geographical extent of each flood control problem, the relative cost of their solutions, and the potential level of financial participation by SCWA. The three levels are listed below and outlined in Table 2-1.

1. Solving the problem using the existing SCWA flood control/drainage project grant program.
2. Coordination and development of a regional solution by SCWA through the development of a local Watershed Management Plan (WMP).
3. Participation in a U.S. Army Corps of Engineers (COE) Watershed Management Plan (WMP).

Table 2-1. Methods of Flood Control/Drainage Planning

Flood Control/Drainage Grant Program
Generally only addresses the local problems noted in Table 1-1 or part of a problem area
Not normally a complete solution to an area's problem, but may reduce the severity of the problem
Problem solutions require minimal study or permitting efforts and can be readily implemented
Examples of small projects include: • clearing vegetation and debris from channels • flood mitigation measures such as raising or building berms around structures • erosion control measures such as rip-rapping and revegetating stream banks • installing cross drains
The grant program could be expanded to include cost sharing incentive funds for projects such as tailwater return systems, wildlife ponds, drop pipes, field ponding programs, winter cover crops, filter buffer strips, and winter tillage.
Local Watershed Management Plans
Address a problem area or several problem areas within a watershed
Require significant investigation, data gathering, and studies of the problems and drainage systems to determine the most viable solution and to minimize downstream impacts
May require more complex permitting
Require more complex funding mechanisms, such as the formation of a benefit assessment district or outside funding from state or federal agencies
COE Watershed Management Plans
Address the problems throughout a watershed or a region
Generally require large planning/study efforts
Require significant funding from local and outside sources

The following sections describe these three levels of SCWA participation in more detail, review past flood control efforts in each region and recommend the most appropriate level to address the local problems and problem areas in each region.

FLOOD CONTROL/DRAINAGE PROJECT GRANT PROGRAM

The SCWA Board of Directors approved funding of a flood control/drainage grant program in 1996-97 and 1997-98. The program provides permitting and funding assistance for eligible local flood control and drainage projects. The types of projects completed under this program include erosion protection, vegetation removal, levee repair and drainage improvements. The program received 28 applications in 1996-97, of which 11 projects were funded, for a total cost of $66,206. Two of the 1996-97 applications were completed using Ulatis Project funds and three of the projects were carried over into 1997-98 due to permitting constraints. In 1997-98, 26 applications were received and 14 funded, for a total cost of $118,620. Note the grant program has been funded nominally at $100,000 per year. $22,000 of unspent 1996/97 funds were added to the $100,000 appropriated for program year 1997/98.

Project eligibility is based on the following five criteria.

1. Landowners must give permission for the work to be done and waive any liability.
2. Projects are limited to a maximum cost to SCWA of $10,000. Contributions of money or in-kind services from landowners or others can reduce projects costs.
3. The project must benefit more than one property owner.
4. The project can not significantly adversely impact those downstream or upstream.
5. Landowners must agree to continue regular maintenance after the project is completed.

The program has required significant funds and staff time. The grant application assistance, permitting, and project oversight has required approximately three person-months of staff time each year the program has been active.

The program has provided SCWA with a mechanism to address significant localized flooding and drainage issues. Because the projects must be initiated by the interested parties, the program has established a precedent for landowner or outside agency involvement. The program also gives SCWA a stronger presence in County flood control issues. It increases interaction between SCWA, other agencies, and landowners which is valuable not only in solving short term problems, but will be beneficial in implementing longer term solutions in an area. It also gives SCWA a feel for the level of cooperation and interest from other agencies and landowners that can be expected with larger projects.

Erosion control projects have been eligible for funding in the program. The appropriate level of SCWA funding for these projects should be evaluated in the context of overall sediment management programs for watersheds and sub-watersheds. The erosion control projects are effective in protecting property, but it is unknown whether these projects significantly reduce

downstream sedimentation. Erosion control projects should meet County and/or federal standard specifications as a prerequisite for funding.

An annual review of the program would be valuable to ascertain the success and quantify the benefits where possible of the different types of projects. This information would be helpful in prioritizing future applications to assure maximum benefit for the dollars spent. As a part of the follow-up, an annual winter weather maintenance reminder should be sent to each project grant applicant after completion of the project for two to five years. Should the applications to this program grow, SCWA may want to consider minimal cost share requirements in the future.

Consideration should be given to expanding the current SCWA grant program to encourage farm-based conservation practices which reduce runoff and improve water quality. The Flood Control Task Force Work Groups and the local Resource Conservation Districts (RCDs) have identified farming practices which meet these goals. These practices are summarized below. The revised program could be developed in cooperation with the local RCDs which are familiar with implementing the recommended farm based conservation practices.

Tailwater Return Systems. Tailwater return systems are normally used to conserve summer water use, however, a tailwater return can be designed as a sediment settling basin and also a detention basin during winter peak storm events. Advantages are that sediment is kept on site and not in the drainage ditches and winter runoff is held back during peak times to allow the drainage ditches to function efficiently. One-time, cost-share funds could be applied toward the costs of installation.

Wildlife Ponds. Wildlife ponds are similar in concept to the tailwater returns but are not used for agricultural practices and are more heavily planted with wildlife habitat trees and shrubs. These ponds can be located in the foothills (*e.g.*, upper Sweeney Creek and its tributaries) to help detain winter water and sediment during peak flows.

Drop Pipes. Drop pipes are easy devices to keep sediment on-site. Properly operated and maintained, water runoff is slowed and sediment is allowed to drop out before water runs into the drainage ditch system (summer or winter). Note: some farmers or their tenants own and farm several agricultural fields. In addition, Dixon Resource Conservation District (DRCD) provides an additional incentive by reducing the landowner's DRCD drainage fee by a set percentage. A drop pipe with outlet pipe costs about $400. One-time, cost-share funds per field could be applied toward the costs of the drop pipe and its installation ($600 to $800).

Restricted Size Pipes Installation. Field drainage pipes can be sized to restrict the peak winter runoff flows, either by pipe replacement or added pipe insert. This practice will not affect summer drainage, but will slow water drainage from the lower end of a field. The concept is that landowners may willingly allow the bottom of their fields to flood during peak periods and plan accordingly around the restriction. This practice can be combined with the drop pipe mentioned above. Cost per pipe with collar is about $400 plus $800 installation. In some cases, a berm may need to be added to help hold the water, costing an additional $1,500 (1.5' high and 2,300' long). One-time, cost-share funds per field could be applied toward the costs of drop pipe installation.

Mole/Cross Drains. Mole/cross drains can be encouraged to slow winter runoff from fallow agricultural ground. The concept involves cutting perpendicular (to the field slope) "mole": drains to slow water and allow for percolation and suspended sediment to drop out. Cost-share funds per field could be applied toward the costs of renting the proper "mole" equipment or paying the farmer an equivalent price for use of equipment if already owned.

Winter Cover Crops. Winter cover crops can slow water flow, increase infiltration, and trap sediment on fallow ground or on permanent crops such as orchards. It is a proven fact that cover crops are excellent runoff filters to keep sediment in place. Cost-share funds per field could be applied toward the costs of seed and/or renting the proper equipment or paying the farmer an equivalent price for use of equipment if already owned.

Filter Buffer Strips. Filter buffer strips at the end or bottom of the field do not act as efficiently as a cover crop, but slow water and trap sediment before leaving the field. Cost-share funds per field could be applied toward the costs of seed and/or renting the proper equipment or paying the farmer an equivalent price for use of equipment if already owned.

Reduced Tillage or Ridge Tillage. Reducing tillage or using ridge tillage (*i.e.* leaving the ground rough) over the winter involves not discing the previous crop, and leaving stubble and residue on the fallow ground, and retaining the furrows and beds. The following spring or summer planting takes place directly into the residue. Winter water infiltration is increased, and erosion and sedimentation are reduced by retaining crop residues on the surface, creating an uncompacted soil bed. Reduced tillage and ridge tillage are new practices to this area (but are a predominant practice in the Midwest), and cost-share funds can be applied for rental of equipment or paying the farmer an equivalent price for use of equipment if already owned. A flat rate acreage fee can also be offered for "risk-taking" with a new "pilot" practice.

LOCAL WATERSHED MANAGEMENT PLANS

Solving flood control problems for a problem area or an entire watershed requires a more comprehensive and coordinated planning effort than solving local problems. Typically, additional data gathering and studies of the problems and drainage systems to determine the most viable solution and to minimize downstream impacts are necessary. In addition, the solutions may require more complex permitting and funding mechanisms. The development of WMPs is the first step in addressing these problems.

WMPs provide the mechanism to assess the natural resources in a watershed, set goals, identify ways to solve resource problems and develop a watershed program to implement solutions. The plans are not focused solely on flood control but on a number of natural resource issues such as flood prevention, erosion and sediment control, water quality management, fish and wildlife habitat improvement, wetlands creation and restoration, groundwater management, and water supply.

Recommended solutions in WMPs may include both flood control facilities and watershed management programs. Flood control projects are defined in this report as measures which include construction of, or modifications to, a drainage system to solve a flood related problem.

Examples of projects include; clearing, enlarging or building channels, constructing detention or sedimentation basins, dredging, and building levees or flood protection embankments.

Watershed management programs can provide another mechanism to eliminate, reduce or prevent flood related problems. These programs can be used alone or in conjunction with a project. The programs would focus on incentives to landowners and local agencies to implement farm-based conservation practices which sustain or enhance natural resources. Examples of these practices were described in the previous SCWA grant program section.

Many of the problem areas identified in the Dixon, Ulatis, and Suisun regions would benefit from management programs. The intensive agricultural practices in many of the problem areas have led to increased runoff and flooding. In addition, sediment from many of these areas is settling out in Hass Slough, Cache Slough, and Cordelia Slough, reducing channel capacity and damaging wetlands.

WMPs could address problem areas individually, or be prepared in conjunction with other problem areas in a larger watershed plan. The size of the planning area should be commensurate with the local issues and needs. Table 2-2 shows potential flood control projects and watershed management programs for each problem area which could be included in a WMP. Table 2-2 also shows the agencies SCWA would need to work most closely with in developing the plans.

SCWA could provide technical and financial assistance toward the development of these WMPs. The plans would be developed in cooperation with all the stakeholders (*e.g.* landowners, government agencies, environmental organizations, *etc.*) within the proposed planning area. SCWA could assist in funding of the plans, but recommended projects or management programs would not likely be funded by SCWA unless they are funded through the Flood Control/Drainage Project Grant Program. SCWA's participation in local WMPs would include:

1. Coordinating with local agencies in the development of WMPs.
2. Performing or funding studies and/or hydrologic and hydraulic modeling needed for the WMPs.
3. Designing or funding design of conveyance systems or storage facilities.
4. Preparing grant proposals/requests for outside funding or setting up funding arrangements.
5. Providing project construction oversight.
6. Developing pilot projects to demonstrate individual management program elements and their potential for integration into a watershed program.

U.S. ARMY CORPS OF ENGINEERS (COE) WATERSHED MANAGEMENT PLANS

SCWA and other agencies in the County are considering the possibility of addressing some of the major flood control problems through joint sponsorship with the COE of WMPs in the Dixon, Ulatis, and Suisun regions. In August 1997, the COE completed Expedited Reconnaissance Studies (ERS) for a Vacaville-Dixon study area and for a Fairfield Streams and Cordelia Marsh study area. These study areas encompass the majority of flood control problems

in the County. The objective of these studies was to identify flood control problems and potential solutions, and to determine whether a federal interest exists in funding more detailed studies to examine the feasibility of solutions. The reconnaissance studies recommended that WMPs be developed for both study areas. It was recommended that the plans focus on restoration alternatives to improve flood control and fish and wildlife habitat, and reduce erosion.

The COE would fund half of the cost of these WMPs; local and state sponsors are required to contribute the remaining half. SCWA can contribute to the cost through in-kind services such as data collection and developing hydrologic models. The costs of local WMPs may also count as part of the local share of the COE studies. The COE, SCWA, and other agencies are currently developing a Project Study Plan (PSP) and a Feasibility Cost Sharing Agreement (FCSA) for the WMPs. Each management plan is anticipated to cost between one and two million dollars. If the COE WMPs lead to authorization of the design and construction of a flood control project, the federal government will provide 50% to 75% of the project cost.

Table 2-2. Local Watershed Management Plans – Potential Projects and Programs

Region	Watershed	Problem Area	Participating Agencies	Projects	Management Programs
S	Freeborn Creek	Freeborn Creek	COE, CalTrans, SRCD	Investigate feasibility of sedimentation basins for the watershed.	Work with landowners to reduce overgrazing and its impact on erosion and flooding. Encourage stock watering outside riparian corridors. Monitor effectiveness of SRCD and SCWA erosion control projects.
	American Canyon Creek	American Canyon Creek	CalTrans, SRCD, COE, DWR	Review erosion protection on drainage facilities near I-80 and assure the integrity of dam on East Fork of Lynch Creek. Investigate feasibility of sedimentation basins for the watershed.	
	Jameson Canyon Creek	Jameson Canyon Creek	COE, CalTrans, SRCD	Investigate feasibility of sedimentation basins for the watershed.	
	Green Valley Creek	Upper Green Valley Creek	DOT	SCWA is acquiring permanent easement for the Volkhardt drain and implement regular maintenance schedule based on annual inspection. Channel clearing, detention basins, channelization, procurement of floodplains are potential projects.	
		Lower Green Valley Creek	COE, CalTrans, SRCD	Investigate feasibility of sediment basin upstream of piped diversion of Hennessey Creek to Green Valley Creek.	
	Dan Wilson Creek	Dan Wilson Creek	SCWA	Clear channel.	
	Cordelia Slough	Cordelia Slough	SRCD, COE, DWR, CALFED	Dredge slough.	
	Suisun Creek	Upper Suisun Creek	City of Fairfield, SRCD	Channel clearing, detention basins, channelization, procurement of floodplains are potential projects.	
		Lower Suisun Creek	City of Fairfield, SRCD	Evaluate existing channel capacity and estimate flows. Determine need for channel improvements.	
	Ledgewood Creek	Upper Ledgewood Creek	City of Fairfield, SRCD, COE	Evaluate existing channel capacity and estimate flows. Determine need for channel improvements.	
		Lower Ledgewood Creek	City of Fairfield, SRCD, CalTrans, COE	Determine actual water course, channel capacities, flows and floodplain boundaries. Determine need for channel improvements.	
U	McCune Creek	Winters Road	URCD	Compare feasibility of facilities required to drain area to Putah Creek versus McCune Creek.	Create cost-share incentives with landowners to develop wildlife pond and/or tailwater return systems that can double as winter storage, flood control facilities, and sediment traps. Create cost-share incentives with farmers to leave their winter fallow ground rough or plant a cover crop. Create cost-share incentives with farmers to install and maintain drop pipes/flash boards for irrigation outlets into drainage conduits.
		Wolfskill	URCD, SID	Examine existing drainage patterns and systems, investigate the effect of SID canals on drainage, consider increasing capacity of existing channels, constructing additional conveyance facilities, and diverting water through alternative routes. Determine if increased maintenance of McCune creek along Freedom lane would provide significant benefit. Increase capacity of SID drains to carry runoff.	

Table 2-2. Local Watershed Management Plans – Potential Projects and Programs, Cont'd.

Region	Watershed	Problem Area	Participating Agencies	Projects	Management Programs
		Halley Road	URCD, SID	Determine facilities required and feasibility of an area-wide system to convey flows from McCune Creek, Dry Arroyo, the southerly tributary which crosses Kobert Rd. and the channel along Sweeney Road. Consider an extension of Farmers ditch from Halley Rd. to I-505 and storage within the area. Implement flood hazard mitigation measures such as building berms and raising structures.	
		Farmer's Drain	URCD, SID	Landowners provide easements to SCWA for future channel maintenance.	
	Sweeney Creek	Allendale Road	URCD	Determine channel capacities and identify potential improvements to ditches and culverts along Allendale Road. Implement flood hazard mitigation options such as building berms and raising structures.	Work with URCD and landowners to reduce over grazing and its impact on erosion and flooding. Work with URCD to encourage stock watering outside of riparian corridors. Monitor effectiveness of URCD and SCWA erosion control projects.
		Above Timm Road	URCD	Landowners along English and Sweeney Creeks and tributaries continue working with URCD and NRCS to achieve erosion control recommendations.	
		PSC to Timm Road	URCD	Landowners provide permission for URCD channel maintenance project for initial clean-up of channels and assume maintenance responsibility thereafter. Implement flood hazard mitigation options such as building berms and raising structures.	
		Ulatis Project to PSC	URCD	Landowners provide easements to SCWA for future channel maintenance and clean debris, vegetation from lower 1/3 of channel.	
		Lower Sweeney Creek	URCD	Clear channel at beaver dam.	
	Gibson Canyon Creek	Gibson Canyon Creek	URCD	Implement flood hazard mitigation measures such as building berms and raising structures, and installing flap gates.	
	Horse Creek	Horse Creek	URCD	Implement flood hazard mitigation options such as building berms and raising structures, and installing flap gates.	
	Ulatis Creek	Ulatis Creek	City of Vacaville	Implement flood hazard mitigation options, such as building berms and raising structures.	
	Alamo Creek	Alamo Creek	City of Vacaville	Implement flood hazard mitigation options, such as building berms and raising structures.	
D	Dixon	Batavia	SID, City of Dixon	Properties could participate in proposed new outfall from the City of Dixon and enlargement of Basin A to improve drainage. Coordinate with SID to improve culverts along Olsen drain and increase size of outfall into McCune Creek.	Create cost-share incentives with landowners to develop wildlife pond and/or tailwater return systems that can double as winter storage, flood control facilities, and sediment traps. Create cost-share incentives with farmers to leave their

Table 2-2. Local Watershed Management Plans – Potential Projects and Programs, Cont'd.

Region	Watershed	Problem Area	Participating Agencies	Projects	Management Programs
		City of Dixon	City of Dixon	The City of Dixon Draft Storm Drainage Master Plan Update, 1996, recommended constructing storm basins to store runoff and reduce downstream peak discharges to comply with existing discharge agreements.	winter fallow ground rough or plant a cover crop. Create cost-share incentives with farmers to install and maintain drop pipes/flash boards for irrigation outlets into drainage conduits.
		North of Dixon	DRCD	Increase capacity of existing drainage facilities, construct additional channels and culverts, enlarge outfall facilities.	
		Milk Farm	CalTrans, City of Dixon, DRCD	A developer of the Milk Farm property, SCWA, CalTrans, and the adjacent landowners are reviewing improvements to reduce ponding in this area, including conveyance facilities to the existing I-80 culverts, and off-line detention storage.	
		Northeast of Dixon	DRCD	Increase capacity of existing drainage facilities, construct additional channels and culverts. Properties could participate in proposed City of Dixon Basin D outfall.	
		East of Dixon	DRCD	Increase capacity of existing drainage facilities, construct additional channels and culverts.	
		South of Dixon	DRCD	Increase capacity of existing drainage facilities, construct additional channels and culverts.	
		Maine Prairie	MPWD, DRCD, RD2068	Replace under-capacity culverts. Projects done as part of overall basin-wide plan due to contractual constraints.	
		RD2068 Main	RD2068	Replace under-capacity culverts. Projects done as part of overall basin-wide plan due to contractual constraints.	
		Hass Slough	DWR, DFG	Dredge slough.	
		Cache Slough	DWR, DFG	Dredge slough.	
	Yolo Bypass	RD2068 East	RD2068, DRCD	Replace under-capacity culverts.	
		RD2068 PS5	RD2068, DRCD	Replace under-capacity culverts. Acquire land or purchase flood easements.	
	Putah Creek	Putah Creek	Rec Bd, DWR	Evaluate draining area to Putah Creek. Regrade roadways to reduce overtopping.	
V	Sulphur Springs Creek	Sulphur Springs Creek	City of Benicia	Implement flood hazard mitigation options, such as building berms and raising structures. Examine feasibility of detention basins and channel improvements.	
	Homeacres	Homeacres	VSFCD	Increase capacity of existing drainage facilities. Review need for new facilities.	
M	Barker Slough	Barker Slough	DWR, DFG	Dredge slough.	
	Rio Vista	Rio Vista	City of Rio Vista	Flood-proof flood prone areas by building retaining walls and raising structures. Install flap gates on outfalls.	

The COE Vacaville study area is equivalent to the Ulatis region described in this Phase II report; the COE Dixon study area is equivalent to the Dixon region. The reconnaissance level study reviewed the problems in the study area and suggested channel improvements, levee construction, and detention basins as flood control measures. The study also proposed a number of environmental restoration measures. Although the ERS completed by the COE combined the Vacaville and Dixon areas, the next phase would more than likely separate the two areas. The Vacaville area has the greatest local and outside interest and is expected to have a higher cost/benefit ratio.

The COE Fairfield Streams and Cordelia Marsh study area is approximately the same as the Suisun Region referred to in this Phase II report. The COE report described two main issues: 1) flood control in the lower reaches of the Green Valley, Dan Wilson, Suisun, and Ledgewood Creeks and 2) sediment deposition in Cordelia Slough and contributing streams. The study area is tributary to the Suisun Marsh, protection of which is the overriding concern of the study.

REVIEW OF REGIONS

The following sections provide a short summary of the flood control issues of each region discussed in Phase I, review the previous studies and alternatives suggested for each region, and identify a recommended approach for SCWA involvement in efforts to address the problems areas in each region.

There are overlaps between the SCWA grants, local WMPs, and COE WMPs. For example, grant projects may be completed as part of a local WMP, or studies and recommendations from a local WMP may be incorporated into a larger COE WMP. The objective in this Phase II report was to select the most appropriate approach given the current understanding of the problem areas and perceived interests of the stakeholders. The local and COE WMPs may require significant coordination and planning, and the financial participation of other agencies, likely beyond SCWA's resource capabilities. The level at which the problem area solutions are developed and the final geographical extent of recommended WMPs will be subject to the input received during review of this Phase II report and associated public meetings.

Suisun Region

Located at the western side of the County, this region includes the following watersheds: Fairfield Streams, (McCoy Creek, Laurel Creek, Union Avenue Creek, Pennsylvania Avenue Creek, and Ledgewood Creek), Suisun Creek, Green Valley Creek, Hennessey Creek, Jameson Canyon Creek, American Canyon Creek and Freeborn Creek. All of the region is tributary to the Suisun Marsh, and the western watersheds are tributary to the Cordelia marsh, a portion of the Suisun Marsh.

As noted in the COE Fairfield Streams and Cordelia Marsh reconnaissance study and the SCWA Phase I Master Plan report, there are two main issues in the Suisun region: 1) flood control in the lower reaches of the Green Valley, Dan Wilson, Suisun, and Ledgewood Creeks, and 2) sediment deposition in Suisun Marsh and it's contributing streams. There have been a few studies of individual watersheds, which gathered data, defined the problem and provided conceptual solutions. Some of the larger studies are summarized below.

A Reconnaissance Level Investigation Of Flood Protection Needs In The Green Valley And Suisun Valley Regions Of Unincorporated Solano County, December, 1991. This report, prepared by SCWA, presented reconnaissance level data on flood protection needs in the Green Valley and Suisun Valley watersheds, potential solutions to existing flooding problems, potential funding sources and the flood protection role of SCWA.

Report on Storm Water Runoff and Siltation in the Cordelia Area, July, 1996. This study by Charles Beck of the City of Fairfield provides information to document that the Hennessey Creek tributary is the source of the majority of sediment in Green Valley Creek. A walking inspection of the upper portions of the Hennessey Creek watershed indicated major scour, with near vertical sides and channel depths up to 35 feet.

Analysis of the American Canyon Creek Watershed, February, 1997. This study, prepared by the Environmental H2Ology for private interests in the lower watershed, estimated the relative contributions of sources of sediment in American Canyon Creek, and the change in the sediment delivery to Suisun Marsh in the past 10 to 50 years.

SCWA and other agencies have sponsored several grant projects in the Suisun region. These projects have been focused on vegetative channel clearing in the Green Valley and Ledgewood watersheds, levee repair on lower Suisun Creek and sediment removal in the Suisun Marsh. These projects are beneficial in the short term and will require long-term maintenance. Given the level of sediment loading on some streams and the extensive vegetation, it may be difficult for landowners to effectively maintain these areas. Continued monitoring of past projects will provide a better understanding of the effectiveness of these projects in the future.

Local WMPs in the Suisun region should be focused on flood control in the Green Valley, Suisun and Ledgewood Creek watersheds. These plans would require some flow data collection and hydrologic and hydraulic studies. Ultimate projects that may result from these studies include channel clearing, detention basins, channelization, artificial high flow channels or procurement of flood plain, restrictions on flood plain development, and development of early warning systems. Management programs to reduce erosion and runoff such as reduction of overgrazing and stream bank protection measures may also be included in the plans.

A WMP for Ledgewood Creek would define the Ledgewood creek flows and flood plain. The current FEMA flood insurance rate maps were based on a COE study for the Fairfield Streams Project which indicates a bifurcation and redirection of 2,500 cfs toward I-80 near Alonzo Drain. This bifurcation occurred for the first time on February 3, 1998 and caused flooding and closure of I-80 for five hours. The pipeline under I-80 at the Alonzo Drain was inadequate to handle the flow that spilled the banks of Ledgewood Creek above this area. Downstream areas (south of I-80) did not flood during this event, but the flood plain map used for flood insurance should still be revised. Fairfield is interested in extending the COE Fairfield Streams project on Ledgewood Creek up to Mankas Corner Road. The proposed project would require a hydrologic and hydraulic study outlining the 100-year capacity flood plain of Ledgewood Creek. This plan would be developed in close coordination with the City of Fairfield.

There is some uncertainty whether there exists sufficient interest in WMPs or feasible consequent projects and programs in the Green Valley and Suisun Creek watersheds. The

SCWA reconnaissance report described earlier noted that numerous lots in the Green Valley Country Club estates were located in the flood plain. However, DEM has received several Letters of Map Revision (LOMR) to the flood plain indicating in fact that many of the structures are above the flood plain. The SCWA reconnaissance study also noted projects could be costly and of questionable benefit. Given the limited severity of the problems and the lack of funding for solutions, management plans in this area should be focused on management programs to maintain or enhance the current drainage system in partnership with the local landowners.

The flood control related issues of the Freeborn, American Canyon, Jameson Canyon and Green Valley Creeks are erosion within the watersheds and consequent sediment deposition in the lower creek reaches and Cordelia Slough. Each of the watersheds could address the erosion and sedimentation individually, however if the primary goal is to protect managed wetlands, the focus should be on the most problematic watersheds and a multi-watershed plan should be developed. The first step to address these problem areas would be to collect sediment and flow data from all the above tributaries to determine the greatest sources of sediment and the most beneficial locations for erosion control programs and sedimentation basins

The COE WMP for the Fairfield Streams and Cordelia Marsh area encompasses the entire Suisun Region. This plan would be the most effective avenue for addressing the flood related problems in this region. The focus of a COE WMP project would be the preservation of the managed wetlands of the Suisun marsh primarily through the control of sediment from western tributary watersheds described in the preceding paragraph. The majority of the calculated benefits of the plan would be determined based on the fish and wildlife habitat evaluation procedures, which consider the increase in habitat quality and the number of species benefited.

Although habitat restoration is not a top priority of SCWA, there are many side benefits to this work which further the agency's flood control goals. The proposed COE management plan would consider sediment basins to reduce peak flows and remove sediment which would settle out in the lower stream reaches, reducing channel capacity. The flood control issues on Ledgewood Creek will also be addressed as part of the COE plan.

Because of the state and federal interest in the preservation of the managed wetlands in the Suisun Marsh, there is potential for significant funding from outside the County. The COE study is an opportunity for local (non-federal) interests, including SCWA, the City of Fairfield, the Suisun Resource Conservation District, and the State of California to leverage federal funds. It is recommended that SCWA participate in the COE plan and consider developing a local watershed management plan for the Ledgewood creek watershed as an in-kind contribution to the overall plan.

Ulatis Region

The Ulatis region is defined by the boundaries of the Ulatis watershed. The greatest flood control problems in the Ulatis region are in the rural Sweeney and McCune Creek watersheds, and in the urbanized areas of the Alamo and Ulatis Creek watersheds. Flood protection improvements for this region were built in the 1960s under Public Law 566. Improvements to the channels in the Ulatis watershed consisted of realigning and widening some existing creek channels, constructing new channels, and building several miles of levees. The improvements were

intended to protect the area from the 10-year storm event and maintain a design freeboard of 1.5 to 3.5 feet. The objective was to provide flood protection for the agricultural lands east of Vacaville, and to carry some increased flows from the developing City of Vacaville. SCWA is responsible for the operation and maintenance of these channels. Most of these facilities have limited capacity and have been overwhelmed in recent years because of large rainstorms and higher runoff resulting from land use changes including development and more intensive agricultural practices.

SCWA has sponsored a number of small projects through its grant program in the areas within the Sweeney and McCune Creek watersheds to clear debris and vegetation from selected reaches of Sweeney and McCune Creeks. The projects require that the land owner assume future maintenance responsibility. The DOT and URCD have also assisted in these projects. SCWA is in the process of obtaining easements from landowners along some reaches of these creeks so that SCWA may carry out future maintenance. Future small projects in this region would include vegetation removal, erosion control, and flood hazard mitigation measures such as constructing berms around structures and raising structures.

Local WMPs in the Ulatis region are most applicable to problem areas in the Sweeney and McCune Creek watersheds. These plans would require data collection and hydrologic and hydraulic studies to determine design flows, examine existing drainage patterns, consider increasing capacity of existing drainage channels and/or constructing new channels, and investigating upstream storage opportunities. Work groups have been established by SCWA and the Ulatis RCD in the Ulatis Region. These work groups are anticipated to lead local WMPs in the Ulatis Region. Work groups in the McCune Creek watershed have identified the extension of Farmer's Drain to I-505 as a specific project which could be considered in the McCune plan. Such a channel from Farmer's Drain to the confluence of McCune and Dry Arroyo Creek was initially proposed as the M-2 unit of the Ulatis project in the original 1960 Ulatis project design memorandum. This also included the construction of the Haralson lateral from Farmer's Drain along Sweeney Road up to I-505. This portion of the project was not included in the 1969 design memorandum. The cost of this project was $73,000 1961 dollars ($403,000 1998 dollars).

Both the Sweeney and McCune Creek plans should also include management programs, such as bank stabilization and detention ponds, to reduce runoff and erosion. The Sweeney Creek watershed in particular has widespread erosion problems which would be best addressed through the changing of management practices throughout a watershed rather than particular grant projects. Coordination of landowners and a demonstrated interest in financial and in-kind funding is an important first step for these plans. These plans could benefit from the URCD's current knowledge of the area's problems and stakeholders' concerns. SCWA can provide technical support for plan development and administrative assistance in setting up benefit assessment districts, as outside funding appears to be limited.

A WMP could also be developed to address the problem areas in the Alamo, Horse, Gibson, and Ulatis watersheds. The problems in these watersheds lie within the drainage of the Ulatis Project. The City of Vacaville has already investigated projects for these watersheds in a draft Storm Drainage Master Plan Update completed in July, 1997. The City identified improvements to provide 100-year flood protection to proposed development and maintain the existing level of

protection (10-year) for already developed areas within the City of Vacaville. The Master Plan also identified improvements to eliminate existing flooding problems within the urbanized areas of the Alamo and Ulatis Creek watersheds. The latter improvements included the following $15.1 million in detention storage:

- Alamo Creek – 275 acre-feet upstream of Pleasants Valley Road and 175 acre-feet on Encinosa Creek above Pleasants Valley Road at a cost of $4.0 and $2.6 million, respectively.
- Laguna Creek – 200 acre-feet upstream of Cherry Glen Road and 140 acre-feet immediately upstream of Alamo Creek at a cost of $2.9 and $2.0 million, respectively.
- Ulatis Creek – 250 acre-feet at a cost of $3.6 million.

Given the high costs of eliminating the existing flooding problems, the City of Vacaville opted for a plan which would provide 100-year protection to new development and maintain discharges downstream to pre-development or lower levels.

The proposed COE WMP for the Ulatis region would cover all of the local WMPs discussed above. Participation in a COE WMP is an opportunity to leverage local funds to improve the Ulatis Project and solve the problems of all the contributing watersheds. SCWA could provide a hydrologic and hydraulic model of the Ulatis watershed and analysis as in-kind contributions to the cost of the COE plan. However, a preliminary investigation of feasible financing options for plan implementation should be a prerequisite to participation in the study. If the probability of ultimately funding the COE plan is low, then SCWA should proceed with the development of the local McCune and Sweeney Creek WMPs.

Dixon Region

The Dixon region encompasses three major watersheds: the Dixon watershed which drains to Hass Slough to the south, the Putah Creek watershed which drains to the north, and the Yolo Bypass watershed which drains to the east. This region experiences the greatest extent of flooding in the County. The large flat areas drain slowly and the problem is sometimes exacerbated by high tailwater in the downstream system. The flooding problem is largely due to a lack of facilities and inadequate capacity of existing systems. Most facilities for drainage generally are sized for irrigation tailwater and cannot convey runoff from large storms. As a result, large rural areas continue to store runoff during and after large rainstorms. The lack of capacity, in combination with increased runoff due to more intensive farming practices and increased urbanization, have led to more frequent and severe flooding over time.

Historically, fields subject to inundation were not farmed during the winter because of the high probability of crop damage or complete loss. Low spots held runoff for extended periods and had low productivity. Today, there is much more winter production and fields are prepared in the fall for early spring planting. The fields are graded for complete drainage to minimize residual wet areas that could reduce productivity or could delay early spring activities. This desire for complete drainage adds to the total runoff. As a result, there is more frequent flooding of longer duration.

Several studies investigating alternative solutions for part or all of the Dixon watershed have been completed. All of the previous studies recommended adding or enlarging channels to more adequately convey runoff from the watershed to one or more outfalls on either Putah Creek, Yolo Bypass, Hass Slough, or the Ulatis Project to the west. Previous studies and some of the proposed projects are summarized below.

Curry Group Drainage Project - Preliminary Report, May 1966. The Curry Group Drainage Report, prepared by the SCS, developed an alternative for providing flood protection to approximately 2,300 acres of farmland to the north of Dixon across Interstate 80. Facilities proposed as part of this project consisted of construction of approximately 3.4 miles of new channel. Channel construction was proposed to begin near the intersection of Curry and Sievers Roads, proceed south to the vicinity of the Milk Farm, and extend easterly under Interstate 80 through the existing culvert. The new channel was proposed to continue east to the Southern Pacific Railroad tracks crossing under the tracks through a new 54-inch culvert and continuing for approximately 1.3 miles until intersecting the existing Tremont Drain No. 3. The proposed plan also included enlargement and improvements to the existing Tremont Drain No. 3 extending from the point of discharge to the RD2068 system. No improvements to the RD2068 system were proposed as part of this plan.

The Dixon Main Drain Extension - Preliminary Report, February 1981. The SCS conducted this study at the request of RD2068 with the objective of alleviating flooding problems in the area where the Dixon Main Drain enters the RD2068 main canal at Swan Road just east of the Sacramento Northern Railroad crossing. It was proposed to reroute some of the flow in the existing Dixon Main Drain. At a point along the east side of Robben Road and in the southwest corner of the naval reservation radio station, another new drainage channel was proposed to be constructed southward approximately 2 miles, then eastward a short distance along Maine Prairie Road, discharging into Haas Slough. It was estimated that this new channel would carry runoff produced from approximately 12 square miles of watershed which would otherwise drain into the RD2068 system. Sufficient investigation was conducted, including a preliminary field survey showing a 6-foot elevation difference from one end of the proposed channel to the other, to conclude that the project was technically feasible.

The Dixon Regional Drainage Master Plan, 1985. This Master Plan outlined alternatives (1, 2) to drain storm water runoff resulting from the 10-year storm event in the City of Dixon and the surrounding agricultural area in the Dixon watershed to Hass Slough. The Master Plan also outlined an alternative (4) to drain runoff from Dixon and the agricultural area north of Dixon to Putah Creek. The cost of the alternatives was approximately $20 million ($28 million in 1997 dollars), with approximately $7 million in costs to Dixon and $13 million in costs to the rural interests.

Report on an Alternative Diversion for Drainage Areas North of Midway Road and Contributing to the DRCD Lateral System, 1997. Moorehead Engineering prepared this report for DRCD and presented the results to the Dixon City Council Workshop on Drainage in September 1997. The report proposes conveying all runoff from the contributing areas to Tremont 3 channels, the DRCD laterals 1, 2 and 3, and the Pitt School Road drainages that lie north of Midway Road and diverting them east along Midway road to the Yolo Bypass. The

report assumes that these channels would be designed to handle 5-year runoff peak flows and detention storage within Dixon to reduce flow peaks. The cost of the project was roughly estimated to be $11.7 million.

The Draft Storm Drainage Master Plan Update, City of Dixon, 1997. The master plan estimated runoff for existing and future development conditions within Dixon's general plan boundary, and developed and evaluated drainage detention ponds and outfall alternatives for eight drainage areas. Recommendations are provided for handling drainage crated in all city watersheds, and capital improvements are identified, as are their costs and funding.

The Dixon Resource Conservation District and the City of Dixon, Memorandum of Understanding, 1965. This MOU outlines the understanding between the two parties related to discharge of storm water from Dixon into the DRCD system. The MOU limits Dixon's discharge into DRCD to 77.6 cfs. The MOU requires Dixon to limit discharge as stated above, contribute to the annual O&M costs for the downstream DRCD channels which convey city runoff, and for Dixon to be responsible for and bear their fair share of costs for planning, design, and construction of improvements to Lateral 2, the Dixon Main Drain and the diversion channel from the Main Drain to Hass Slough. This also includes other improvements that are deemed necessary by Dixon and DRCD to increase the DRCD channel system capacity downstream of Dixon discharges, to accommodate the increased discharges provided for in the MOU.

None of the above proposed alternatives have been implemented, with the exception of detention basin construction in Dixon, primarily due to lack of funding. The political entities in the region have struggled with agreements on equitable solutions for both the urban and rural areas. The rural areas have limited financial resources and Dixon can only pay for that portion of proposed projects which provides clear direct benefit to city residents. Even with cost sharing by Dixon, a considerable amount of money would still be required from the rural areas. Funding from the agricultural areas of the region would be required and this would likely be difficult.

The SCWA grant projects could relieve localized drainage problems and flooding in all three Dixon region watersheds, for example by implementing more effective channel clearing or culvert capacity increases. Other grant projects could include raising or flood proofing homes which could potentially suffer flood damage. These projects may not fully address the problem, however they can reduce the severity of the problems in several areas.

A local WMP comprised of projects and management programs tailored to the financial limitations of the watershed appears to provide the best approach for the Dixon Watershed. A WMP is important in this area because many problem areas in the Dixon watershed outlet to other downstream problem areas and downstream impacts are unavoidable and lead to contentious issues in this watershed.

Projects to consider in the plan would include construction of additional drainage channels or enlarging existing channels in the northern areas, acquiring lands or purchasing flood easements for frequently flooded land in the southern areas, and dredging Cache Slough.

Another way to reduce flooding in the region would be to reduce the runoff before it concentrates and causes more severe problems through the implementation of management

programs in both the urban and rural areas. The management programs to reduce on-farm runoff such as installing tailwater return systems or drop pipes and leaving winter fallow ground rough or planting cover crops, coupled with urban storm water management practices such as parking lot and swale detention, would not only reduce runoff but would also have the additional benefit of improving water quality.

It is anticipated that projects resulting from a COE WMP would have a low benefit/cost ratio and would be more heavily concentrated on the environmental issues rather than the flood control issues of the region. Assuming this to be the case, it would be very difficult to generate the local portion of the costs of the plan and to fund the plan recommendations. A local WMP is recommended over a COE plan because it would allow local interests to tailor limited funding in the area to specific needs.

SCWA should require a demonstrated local interest in developing a plan in this region prior to becoming involved. An approximate formula for funding and participation among DRCD, Maine Prairie Water District, RD2068, Dixon, and sufficient interest by local landowners will be important in initiating plan development. A Dixon Area Drainage Task Force has been formed and will likely be the vehicle for plan development. Given the lack of rural funding options, it is recommended that in-kind services by the landowners be considered in the development of projects and programs and that state and local funding be actively pursued.

Vallejo and Montezuma Hills Regions

The Vallejo region contains the cities of Vallejo and Benicia. These cities have developed Storm Drainage Master Plans to address their local flood control issues. The region also contains the large Sulphur Springs watershed which discharges to Suisun Bay in the City of Benicia. In June of 1989, the City of Benicia completed a Storm Drainage Master Plan for the Lake Herman/Sulphur Springs Creek drainage basin to address flooding and environmental impacts of increased runoff caused by development of the basin. The City of Benicia identified a preferred alternative to carry the 100-year peak flows downstream of Lake Herman. The alternative included six detention basins downstream of Lake Herman and channel improvements. The cost of the project in 1989 was $15 million. The alternative was not pursued because of the expense and lack of interest by beneficiaries in cost sharing. Since the study, several of the businesses in the lower reaches of Sulphur Springs Creek have implemented flood control measures. Based on the results of this study, grant projects are the most viable assistance SCWA could provide to this area. The Homeacres area in the Vallejo area also has flooding and drainage problems. Any studies or projects in this area will be done in coordination with the Vallejo Flood Control and Sanitation District.

The Montezuma region covers the Southeast portion of the County. Problem areas in this region include Barker Slough and the City of Rio Vista. Highway 113 within the Barker Slough watershed is subject to flooding and there are concerns of sediment build-up in the slough. The North Bay Aqueduct, a drinking water supply for cities in Solano and Napa counties, extracts water from the Delta through Barker Slough. The public agency water users and local landowners have been meeting to develop a Barker Slough watershed program to address potential water quality improvements. The current watershed program efforts should be expanded to include a flood control and drainage component.

The problems in the City of Rio Vista are related to high flows in the Sacramento River, which are difficult to control on a County level. Therefore, grants for local projects to protect the city and mitigate damage are recommended.

SUMMARY OF RECOMMENDATIONS

Table 2-3 provides a summary of the recommended level of planning for each of the watersheds containing problem areas.

Table 2-3. Recommended Planning Level for Watersheds

Region	Watershed	Problem Areas	Local WMP Only	Local WMP Developed in Conjunction with COE WMP	Included within COE WMP
S	Freeborn Creek	Freeborn Creek			✓
	American Canyon Creek	American Canyon Creek			✓
	Jameson Canyon Creek	Jameson Canyon Creek		✓	✓
	Green Valley Creek	Upper and Lower Green Valley Creek			✓
	Dan Wilson Creek	Dan Wilson Creek			✓
	Cordelia Slough	Cordelia Slough			✓
	Suisun Creek	Suisun Creek		✓	
	Ledgewood Creek	Upper and Lower Ledgewood Creek		✓	
U	McCune Creek	Winters Road, Wolfskill, Halley Road, Farmers' Drain		✓	
	Sweeney Creek	Allendale Road, Above Timm Road, PCS to Timm Road, Ulatis Project to PCS, Lower Sweeney Creek		✓	
	Gibson Canyon Creek	Gibson Canyon Creek			✓
	Horse Creek	Horse Creek			✓
	Ulatis Creek	Ulatis Creek			✓
	Alamo Creek	Alamo Creek			✓
D	Dixon	Batavia, City of Dixon, North of Dixon, Milk Farm, Northeast of Dixon, East of Dixon, South of Dixon, Maine Prairie, RD2068 Main, Hass Slough, Cache Slough	✓		
	Yolo Bypass	RD2068 east and to PS5	✓		
	Putah Creek	Putah Creek	✓		
V	Sulphur Springs Creek	Sulphur Springs Creek	✓		
	Homeacres	Homeacres	✓		
M	Barker Slough	Barker Slough	✓		
	Rio Vista	Rio Vista	✓		