CHAPTER 3. SCWA SUPPORT ACTIVITIES

Chapter 2 focused on specific solutions to flood related problem areas and potential SCWA involvement. This chapter outlines general activities that are important for overall flood control planning in the County. These activities include a hydrologic data collection program, updating the County Hydrology Manual, revising the Ulatis Flood Control Project model, assisting with the National Flood Insurance Program, and managing stormwater quality.

HYDROLOGIC DATA COLLECTION PROGRAM

The flow rates and expected recurrence intervals of runoff caused by damaging hydrologic events are generally unknown because there is very limited hydrologic data available. If data were available, better decisions could be made regarding the relative need for projects and the size and scope of drainage improvements to meet a reasonable level of protection.

Hydrologic data is invaluable when major projects are being considered and the best data is usually available from gages with the longest records. The reliability of data collection programs increases with age. The recommended program described in this section should be continued for at least ten years, preferably much longer.

Existing Gages and Data Collection Programs

There is very little historic hydrologic data available within the County, mainly because most of the watersheds are relatively small and there was not sufficient interest by public agencies to collect data. Recently however, several intense storms, widespread development, and numerous flooding problems have created an interest in drainage. The public wants a better understanding of their local drainage problems. Some ongoing data collection programs are described below.

Rainfall Data. The City of Vacaville Department of Public Works - Utilities Division has been collecting rainfall data at five stations located throughout Vacaville since the fall of 1995. The recording rain gages are located at the Brown's Valley Reservoir, the Community Center, the D.E. Water Treatment Plant, the Gibson Canyon Industrial Wastewater Treatment Plant, and near the Putah South Canal south of Alamo Drive. These locations are shown on Figure 3-1. The data from four of the rain gages is telemetered to the Easterly Wastewater Treatment Plant where it is stored on a computer for use in the inflow/infiltration reduction program. Data from the battery-operated rain gage located along the Putah South Canal near Alamo Drive is manually collected by City of Vacaville staff once a month. This gage will be moved to the TGIF facility in late 1997 or early 1998. In addition to Vacaville's rain gages, the National Weather Service (NWS) has a weather station where total daily rainfall is measured once a day at the fire station located on Eubanks Court. The NWS has had a daily rainfall station in Vacaville at several different locations since 1880.

Figure 3-1. Existing and Proposed City of Vacaville Rainfall and Stream Flow Gaging Sites

The rainfall data collected by Vacaville staff during the winter of 1995/96 was reviewed by WYA staff as part of their work for the City of Vacaville. The five rain gages provide reasonable coverage of Vacaville's developed area. It was found that the data is generally consistent in terms of the rainfall amounts recorded, with intensity being greater for those stations closer to the Vaca Mountains compared to stations farther east on the flatter terrain. It appears that the existing network of rain gages is adequate for collecting rainfall information within Vacaville's city limits for use in stormwater modeling. However, additional rainfall information is desirable for the City's sanitary sewer infiltration and inflow (I/I) study. Also, the existing rain gages do not provide data for the rainfall characteristics of the upper watersheds in the Vaca Mountains and do not provide early warning information because their locations are within the City of Vacaville. Three additional rain gages will be installed within the city limits. These will be located at the California Department of Corrections (CDC) facility located in southern Vacaville, at Well No. 9, and at the Easterly WWTP located east of the city.

Vacaville is also adding rain gages on Gibson Canyon Creek at Browns Valley Road and a rain gage near the top of Mt. Vaca. The rain gage at Browns Valley Road is expected to provide accurate rainfall information for the small drainage basin of Gibson Canyon Creek. A data pod will be manually collected on a periodic basis. The Mt. Vaca rain gage will provide useful information concerning intensities at the higher elevations and may be used for an early warning station in the future. This rain gage will have a dedicated phone line to transmit real-time data to the Easterly Wastewater Treatment Plant.

The City of Fairfield maintains two rain gages. These gages are located at their Northbay Regional and Waterman Water Treatment plants. The Waterman Water Treatment Plant has a recording gage that has been in service for about three years. The NWS maintains a daily rain gage at this water treatment plant. The Fairfield-Suisun Sewer District also maintains a rain gage at their wastewater treatment plant.

The Solano County Water Agency has three California Irrigation Management Information System (CIMIS) weather stations located, at Suisun Valley, Dixon, and Hastings Island. There is also a rain gage at Liberty Island in RD2068.

The State Department of Water Resources and NWS have current weather information on the Internet that can be accessed by the public. The information includes hourly ALERT rainfall data, satellite imagery updated every 15 minutes, radar scans showing rainfall intensities, weather forecasts, and disaster preparedness information and activities. The NWS has two websites that provide current and forecasted weather and rainfall information that would be helpful in identifying potential flooding events. These sites are for the NWS's San Francisco Bay Area and Sacramento regional offices. The Internet addresses for their home pages are:

San Francisco Bay Area:	WWW.NWS.MBAY.NET/HOME.HTML
Sacramento:	WWW.NIMBO.WRH.NOAA.GOV/SACRAMENTO

Streamflow Data. The City of Vacaville has recently completed the installation of five stream flow gages in the Ulatis watershed. These gages are shown on Figure 3-1, and identified as follows:

1. Gibson Canyon Creek at Browns Valley Road
2. Horse Creek at Leisure Town Road
3. Ulatis Creek at Leisure Town Road
4. Alamo Creek at Vanden Road
5. Alamo Creek at Marshall Road

The Gibson Canyon Creek gage site represents a small, mostly rural basin north of Vacaville. The Horse Creek and Ulatis Creek gage sites represent all of the flow from the upstream mountains and the City of Vacaville. The two gage sites along Alamo Creek are located upstream and downstream of Vacaville, and are expected to provide information concerning the city's contribution to peak runoff and an estimate of runoff from the city compared to runoff from the upstream mountains.

SCWA in cooperation with SID will be monitoring three sites on the Ulatis project, listed below. The equipment at these sites is used by SID to monitor irrigation flows in the summer. SCWA will use these same sites to monitor winter storm flows.

1. Brown Alamo Dam
2. Dam 5
3. Dam 3

The first two sites are equipped with Stevens recorders, which obtain readings every 15 minutes. The third site records the flow on a Stevens chart.

In the Suisun region, the Department of Water Resources (DWR) maintains stream gages on Green Valley and Suisun Creeks.

Sediment Data. Suspended sediment concentrations along Green Valley and Hennessey Creeks were measured on several occasions from 1993 to 1996 by the City of Fairfield. The results are presented in a report by Charles J. Beck, Assistant Public Works Director, entitled "Report on Storm Water Runoff and Siltation in the Cordelia Area," dated July 1, 1996. The report also described sediment transport along American Canyon Creek, Jameson Creek, and Freeborn Creek, but did not include sediment sampling. Fairfield is now sampling sediment on American Canyon and Jameson Canyon Creeks.

In the near future (1998-1999), it is expected that suspended sediment samples will be collected at the gage sites at the five recently installed Vacaville streamflow gage sites. Sediment data will be collected for several years to develop estimates of sediment loads within each of the gaged watersheds. Sediment data is also being collected in the Barker Slough area by the State Department of Water Resources.

SCWA Proposed Automated Data Acquisition Program/Early Warning Flood Control System

SCWA is developing a plan to install an automated data acquisition and early warning system for Monticello Dam, the Inter-Dam Reach, the Putah Creek Diversion Dam facilities, the Lower

Putah Creek, the Lake Berryessa watershed, and the Ulatis and Green Valley Flood Control Projects. The plan objectives are to:

1. Quantify rainfall versus runoff into Lake Berryessa
2. Provide an early warning system for the Monticello Dam and County-wide flood prone areas
3. Collect historical data.

SCWA intends to use *Geomation Inc.* monitoring systems for the proposed data acquisition system. A more detailed discussion of the equipment requirements is given in the draft SCWA Automated Data Acquisition Program/Early Warning Flood Control System, May, 1996. The plan includes three phases with the following equipment installed at each phase, as shown in Table 3-1.

Table 3-1. SCWA Automated Data Acquisition Program/Early Warning Flood Control System Equipment List

Phase	Rain Gages	Stream Gages	Other
I		4 - Lower Putah Creek	Putah Creek Diversion Dam • Network monitoring station • Motorized gate control • Venturi flow meter • Lake elevation automation
II	2 - Lake Berryessa watershed	1 - Pleasants Valley Creek 2 - Ulatis Flood Control Project • McCune Creek downstream of Sweeney Creek confluence • Sweeney Creek upstream of the Ulatis Creek Confluence	• Monticello Dam – Upgrade network monitoring stations and automated gate controls • Inter-Dam Reach – Link to USGS gaging station
III	3 - Lake Berryessa watershed	2 - Ulatis Flood Control Project • Gibson Creek Near I-80 • Ulatis Creek Upstream of Horse Creek Confluence 2 - Green Valley Flood Control Project • Green Valley Creek near Rockville Road • Suisun Creek	

Recommended Changes and Additions to SCWA Proposed Program

The focus of the proposed SCWA program is optimizing water supply and early warning systems for flood control. It is recommended that some of the program stream gage locations be revised and additional precipitation and stream gages be installed to also provide data in support of watershed flood control planning. The locations of the SCWA gages were evaluated considering the recent installation of gages by the City of Vacaville to avoid duplication and to extend

maximum regional coverage. The recommended rainfall and stream gages locations are described below.

Rainfall Gages. Rainfall data collected from the proposed SCWA program will be useful, but will not provide hydrologic information from the Ulatis or Suisun regions. Four recording rain gages are recommended to provide hydrologic data to support flood control planning in these regions. In the Ulatis region, the City of Vacaville gages will provide significant data for the lower Ulatis watershed. It is recommended that an additional rain gage be located in the foothills of the northern sub-watersheds to supplement the Vacaville data. In the Suisun region, three additional rain gages are recommended. These gages would help calibrate rainfall-runoff models in the region and assist Fairfield in developing an early warning system. The approximate locations of the recommended rainfall gages are:

1. Within upper Sweeney Creek watershed
2. Near Lake Madigan
3. Near the intersection of Green Valley and Rockville Roads
4. Within the American Canyon Creek watershed near the Interstate-80 crossing

It is also recommended that SCWA coordinate with the DRCD and URCD to develop a "fence post rain gage" network throughout the Ulatis and Dixon regions. The fence post rain gage collects rainfall for a period defined by the person that reads and records the rainfall and empties the gage. These are inexpensive and could be installed and maintained throughout the County by the local residences. There are likely many local residents and growers that currently collect this type of data. This network would provide estimates of total rainfall only, but would provide valuable information to correlate agricultural runoff with total rainfall. The information could also be used to in calibrating hydrologic models. Recording rain gage information can be extrapolated to other areas in the county based on the rainfall depths.

Stream Gages. Phase 2 of the SCWA program identified two Ulatis Project stream gages sites. It is recommended these gages be located on Sweeney Creek and McCune Creek at Midway Road. Both gages would be near the downstream ends of their respective watersheds. These gages would not provide early warning data but would provide needed flow information to determine peak runoff and storm volumes. Coupled with the Vacaville gages, timing of hydrographs and the relative contributions of the various creeks could then be estimated. This information would also be useful in calibrating the Ulatis watershed HEC-1 rainfall runoff model.

Because the Vacaville stream gages will provide adequate information for the Gibson and Horse Creek watersheds, it is recommended that the two Ulatis Project stream gages in Phase 3 be installed on Ulatis Creek at Highway 113 and Sweeney Creek at Timm Road. There are two stream gage sites included in Phase 3 in the Green Valley Flood Control Project. Both were generally sited along Green Valley Creek. It is recommended one gage be sited along Green Valley Creek near Rockville Road or further downstream, and the second gage be moved to Suisun Creek at Suisun Valley Road. An additional gage on Ledgewood Creek near Abernathy Road is also recommended.

In summary, seven stream flow gage sites would be installed, one more than the SCWA proposed plan. The recommended phasing and site locations are listed below and shown in Figure 3-2.

Figure 3-2. Proposed SCWA Stream Flow Gaging Sites

Phase 2
1. McCune Creek at Midway Road
2. Sweeney Creek at Midway Road

Phase 3
3. Ulatis Creek at Highway 113
4. Sweeney Creek at Timm Road
5. Green Valley Creek near Rockville Road
6. Suisun Creek at Suisun Valley Road
7. Ledgewood Creek near Abernathy Road

Flow data on the other creeks that drain to the Suisun Marsh such as Suisun Creek, Jameson Canyon Creek, American Canyon Creek, and Freeborn Creek would be desirable. However, there are high levels of sediment movement and the channels are not stable. Developing a stage-discharge relation could be quite difficult. As a result, no gages are recommended at the lower reaches of these creeks.

Sediment Data. As described earlier, the City of Vacaville is expected to collect sediment data on several of the Ulatis region watersheds. It is recommended that SCWA monitor this program, then coordinate with the City of Vacaville to expand the program to at least include Sweeney Creek and McCune Creek at Midway Road.

Sediment data has been collected by the City of Fairfield. If a major project goes forward for the Suisun Marsh, data collection is expected to be part of the project. Absent a major project, SCWA could coordinate with the City of Fairfield, Caltrans, and other agencies to develop a sediment sampling program. Sediment data from Barker Slough collected by the State Department of Water Resources should also be obtained.

Summary of Estimated Costs

Elements of Phase I and Phase II of the SCWA automated data acquisition and early warning system of the have already been installed. A summary of the remaining costs revised to include the additional recommended rain and stream gages are provided in Table 3-2. The rain and stream gage costs were based on the recent installation costs incurred by Vacaville for their gaging program. The average cost for equipment, telemetry, and installation was approximately $12,000 for a rain gage and $22,000 for a stream gage.

Table 3-2. Cost for SCWA Automated Data Acquisition and Early Warning System (Flood Control Portion)

Phase	Item	Estimated Cost, dollars
I	Ulatis and Suisun Region, 4 Rain Gages	48,000
II	Ulatis Project, 2 Stream Gages	44,000
III	Ulatis Project and Suisun Region, 5 Stream Gages	110,000
Total		202,000

A review of the data collection program is recommended. The purpose of this evaluation would be to ensure adequate and accurate data are being collected and to determine areas where additional data would be useful. The review is not to determine if the collection program should be continued. It is strongly recommended to continue the program for a minimum of ten years, and preferably much longer. There is no substitute for accurate data.

COUNTY HYDROLOGY MANUAL UPDATE

The Solano County Department of Public Works developed the Solano County Hydrology and Drainage Design Procedure Manual in 1977. The manual is a helpful reference that outlines the hydrologic criteria, methods, and parameters for the calculation of rainfall runoff peak flows and volume. The runoff calculations are used to design and evaluate drainage improvements planned as part of development and for major drainage facilities master planning. Vacaville and Fairfield require the use of the manual in their drainage design specifications.

Because the manual is twenty years old, some of the data and methods are somewhat dated. The precipitation data which is statistically derived from historical records needs to be reevaluated based on more recent rainfall records. In addition, the hydrologic method for drainage areas greater than 2 square miles is cumbersome and does not take advantage of commonly used computer models. For these reasons, the cities are reluctant to use the manual. In fact, Dixon has developed and Fairfield is developing updated methods for sizing detention basins to better meet their needs.

The hydrology manual should be updated to maintain and encourage an accurate and consistent approach to drainage design in the County. The revised manual should be adopted by the Board of Supervisors, SCWA, and the cities using the manual for reviewing proposed drainage improvements and providing hydrologic methodology for future watershed studies and master planning efforts. The manual could be expanded to include additional useful information that is common in many other county drainage manuals, such as a summary of county drainage policies, requirements for various county permit applications, and recommendations on the design of detention facilities. Recommended tasks to update and enhance the drainage manual are outlined below. The final scope for manual update should be based on input from the city and County agencies.

Task 1. Coordination

SCWA should lead this effort in partnership with the other County agencies, cities, RCDs, and irrigation and reclamation districts. Because the manual was originally developed by the Solano County Department of Public Works, the responsibilities of which are now divided between the Department of Environmental Management (DEM) and the Department of Transportation (DOT), SCWA should first seek the partnership of these agencies in revising the manual.

SCWA should also contact all the cities to determine interest in revising the manual, and their level of financial or advisory participation. Their current policies, criteria, and methods related to drainage should be gathered and comments solicited where policies and revised methods are needed. The scope of the tasks in revising the manual should be focused on the needs of the users. The surrounding counties have developed drainage manuals in recent years which will provide SCWA with good examples.

Task 2. Evaluate Design Storm Criteria

The manual contains recommended storm recurrence intervals for drainage facility sizing and design based on the contributing drainage area and the degree of urbanization. Recommended design storms are the 10-year storm for areas up to one square mile, the 25-year storm for areas

between one and five square miles, and the 100-year storm for areas larger than five square miles. If the percentage of urbanization is over 75% in areas greater than one square mile the 100-year storm is recommended. This is a very broad criterion which provides a reasonable degree of flood protection in the design of structures. However, it does not specifically address the type of facilities being designed and the potential risk and damage to life and infrastructure should a facility fail. For instance, a bridge may have a drainage area of five square miles, but may cross a major highway. In this case, a higher recurrence interval may be warranted.

Alternatively, it may be prudent to require facilities to be designed to adequately convey the 10-year storm and provide a secondary system to convey the 100-year storm without major property damage and loss of life. For example, should a channel overtop for flows greater than 10-year, the overflow could be diverted away from homes and significant infrastructure. In addition to design storm criteria, the County may also want to include specific criteria for the design of facilities where needed (*i.e.* minimum culvert sizes or bridge clearance requirements).

Task 3. Revise Precipitation and Estimates of Precipitation Losses

Precipitation is applied to a drainage basin to determine the runoff, commonly by using a design storm. Design storms are based on rainfall depth-duration-frequency (DDF) relationships. The DDF information is statistically derived from historical precipitation records. The DDF information in the current manual was based on work by the United States Geologic Survey (USGS) and the Department of Water Resources in 1971 and 1976. Since that time an additional twenty years of precipitation data has been gathered and should be used to update the DDF statistics. In 1993 James D. Goodridge, a consulting engineer, reanalyzed the local precipitation data as part of a drainage study of the Covell Drain in Yolo County and developed new DDF data. A cursory comparison of the data in that study indicates a 20% or more increase in rainfall intensities for the 100-year storm compared to the rainfall intensities shown in the 1977 manual. The analysis by Mr. Goodridge should be incorporated into the manual, and the DDF curves updated accordingly.

The DDF data derived by Mr. Goodridge is point precipitation, related to rainfall at a particular rain gauge. Because of the spatial variability of precipitation, the distance for significant correlation between point precipitation gauges is a few miles for short duration statistics (under an hour) and up to one hundred miles for long duration statistics (over an hour). Factors to adjust point precipitation to area precipitation have been estimated by the National Oceanic and Atmospheric Administration . These factors were not provided in the manual and should be included in an update.

A design storm uses the DDF data and distributes the precipitation over time to represent a rainfall event. The design storm in the manual distributes the precipitation according to a cumulative distribution of rainfall over time derived by the Soil Conservation Service (now the Natural Resources Conservation Service) for areas in the western United States. This distribution pattern assures that the rainfall depth over the entire storm matches the statistical depth for a storm of the given duration. Another method of precipitation distribution, the nested design storm, assures that the critical precipitation depth for intermediate durations less than the duration of the design storm are nested within the storm. The nested storm is frequently used and is recommended for inclusion in the manual revision.

While design storms are intended to represent actual rainstorms, agencies have found historical storms valuable in evaluating the design of some drainage facilities, particularly detention storage. Sacramento County has developed 5- and 10-day storms based on several historical storms, with precipitation distributions which more closely resemble the bursts of precipitation that occur throughout a storm. The City of Dixon is also considering adopting a historical 1986 storm to verify the design of its storage facilities. The County should also consider adopting a historical storm to verify adequate operation of drainage facilities.

Precipitation losses due to infiltration, depression storage and interception are represented by a loss rate, estimated in the manual by two charts derived by the USGS for the San Francisco Bay region. The loss rates are based on the mean annual precipitation and the percent urbanization of the drainage basin. The charts do not consider two significant factors, the hydrologic soil type and the specific land use, in determining loss rates. The method of determining losses should be reviewed, and a method more tailored to the area and amenable to the requirements of hydrologic models should be adopted.

Task 4. Revise Runoff Computation Methods

Runoff computation methods in the manual are the Rational Method for areas up to two square miles, a hydrograph method for areas up to five square miles, and a routing component in combination with the hydrograph method for areas greater than five square miles.

The Rational method is a very common empirical method for determining peak runoff. The method is typically used to design drainage improvements for small developments. The cites of Vacaville and Fairfield allow use of the Rational method and refer to the County manual for hydrologic parameters and information on the method. The method is easy to use and sufficient for these applications, but the County and cities should review whether use of this method should be more limited. Drainage areas of two square miles represent the upper limit of its recommended application.

For larger drainage areas the manual recommends the use of a hydrograph method. Runoff hydrographs are used for large watershed studies and master planning because the cumulative effects of the routing and combination of runoff from several drainage basins can be evaluated. In addition, runoff hydrographs are used to evaluate the required storage to limit downstream peak flows. Hydrograph methods use unit hydrographs, to calculate runoff hydrographs, the time distribution of runoff due to one inch of excess rainfall. The hydrograph method in the manual was developed by USGS for the San Francisco Bay region in 1971. The method assumes the shape of the runoff hydrograph is a triangle, with the peak and base of the triangle based on the basin lag. The basin lag is the time lapse from the center of the unit rainfall to the centroid of the unit hydrograph. The peak of the hydrograph is based on the drainage area and the time base of the hydrograph. This method was adopted because it is fairly simple and allowed for manual calculation of the runoff hydrograph through graphical methods. Since the development of the manual, there has been additional research in unit hydrographs to better represent the runoff from different types of terrain: urban, valley, foothill, and mountainous.

Since the completion of the drainage manual, computer programs which aid in the calculation of hydrographs have become very popular. These programs have made the technical computation,

summation and routing of runoff hydrographs much easier. The most common program is HEC 1, a hydrologic model developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center. The model can generate runoff hydrographs based on user supplied hydrologic parameters for one of three hydrograph methods (SCS, Snyder's, or Clark's), or from parameters and a user supplied unit hydrograph. Most cities and counties use the HEC-1 hydrology model to determine runoff hydrographs, but use different parameters and unit hydrographs to generate the hydrographs.

The Solano County manual should be updated to take advantage of a computer model, such as HEC-1. The available hydrograph methods should be evaluated to determine which would best simulate the distribution of runoff from the drainage basins in Solano County. Several nearby counties (Sacramento, Placer, and San Joaquin) have recently developed new drainage manuals incorporating hydrograph methods. These manuals could serve as examples for Solano County. In adopting a hydrologic method, a key criterion should be a balance between increased accuracy of more detailed methods and the difficulty of method use. The manual should also provide sufficient data and information on the selection of hydrologic parameters to assure consistent application of the method.

After a methodology has been selected it should be verified by modeling a watershed with the proposed methodology and recommended hydrologic parameters. The results of the model should be compared to historical runoff records. The methodology should be checked for applicability to steep, flat, rural, and urban basins. SCWA is considering updating the model of the Ulatis system, and this would be a good candidate for this validation process.

Because most drainage design in urban development uses the Rational method, and most master planning will be done using a hydrograph method, it will also be important to analyze the possible disparity of results from the two methods and the possible consequences.

Task 5. Revise Hydrograph Routing Methods

Hydrograph routing simulates the movement of runoff through a channel or reservoir, taking into account the effect of storage and flow resistance on the shape and timing of the hydrograph. The manual recommends the storage-indication hydrograph routing method and demonstrates the hand calculations for this method. Hand calculations for the routing of hydrographs is labor intensive. There are several routing methods available in HEC-1: Muskingum, Muskingum-Cunge, Modified Puls and Kinematic Wave. The best routing method depends on the situation. Muskingum and Muskingum-Cunge are frequently used for routing through natural channels, Modified Puls is the best method for routing hydrographs through reservoirs, and Kinematic Wave is frequently used for urbanized channel systems. A standard routing method in HEC-1 should be chosen by the County with recommendations of when other methods should be used.

Task 6. Prepare Revised Manual

The parameters and methods recommended in the manual should be reviewed and approved by the cities and County throughout its development comments should also be solicited from developers and consulting engineers. Technical memoranda to document Tasks 2 through 4 will be prepared for these reviews, as well as a draft manual. Review comments will be integrated and a final manual will be produced.

Costs

Estimates of cost for the drainage manual work tasks are shown in Table 3-3.

Table 3-3. County Hydrology Manual Update, Estimate of Costs

Task	Cost ($)
Task 1. Coordination	7,000
Task 2. Evaluate design storm criteria	2,500
Task 3. Revise precipitation and estimates of precipitation losses	14,000
Task 4. Revise runoff computation methods	18,000
Task 5. Revise hydrograph routing methods	10,000
Task 6. Prepare revised manual	7,000
Total	$58,500

ULATIS FLOOD CONTROL PROJECT MODEL REVISIONS

All of the Ulatis region is drained by Ulatis Creek and its tributaries. The watershed comprises approximately 150 square miles in the northwestern portion of Solano County. The major tributary creeks are Ulatis Creek, Alamo Creek, Horse Creek, Gibson Canyon Creek, Sweeney Creek, and McCune Creek. The creek system drains to Cache Slough, which outlets into the Sacramento River.

In the 1960s, improvements to the channels in the Ulatis watershed were built by the U.S. Department of Agriculture's Soil Conservation Service (SCS) to provide flood protection for the agricultural lands east of Vacaville, and to carry some increased flows from the developing City of Vacaville. Responsibility for the operation and maintenance of the improved channels was transferred to SCWA upon completion of the Project.

Evaluating the impact of major drainage improvements within the Ulatis watershed on the Project is among SCWA's responsibilities. To assess the impact of land use changes and drainage improvements on the Project's limited capacity, updated and calibrated hydrologic and hydraulic models of the Ulatis Creek watershed are needed.

Types of Models

There have been significant land use changes in the Ulatis watershed since the completion of the Ulatis Project, including the more intensive agricultural practices, development in and around the City of Vacaville, and rural residential development in the lower portions of the foothills and across the valley floor. Most drainage improvements within the watershed have been constructed by the City of Vacaville and include local channel improvements and detention storage. No improvements have been made to the Ulatis Project channels since the completion of the original project.

HEC-1 models are the most commonly used hydrologic models for large watersheds. HEC-1 models generate runoff hydrographs for drainage basins based on the precipitation and parameters related to drainage basins, such as, basin shape and slope, drainage area, soil type, and land use. The runoff hydrographs from the basins are routed through channels and combined to model the

entire watershed. HEC-1 models are often used to determine the peak flows at various points in the watershed which can be used in hydraulic models. This model is valuable in determining the effects of changes in the watershed such as increased urbanization or changes in agricultural practices. The model can also be used to determine the effects of changes to the drainage system, such as adding detention storage.

HEC-2 models are the most commonly used hydraulic models for open channels and natural streams. HEC-2 models generate the water surface elevations in channels based on the flow and channel geometry and roughness. This model is helpful in determining the effect of channel cross-section changes or obstructions to water surface elevation, for example, determining the effects of a bridge or culvert on a creek. This model is also used to easily determine the capacity of the channel or the change in water surface elevation as a result of changes in capacity. Information from HEC-2 models can also be input back into HEC-1 models to refine the hydrograph routing accuracy.

Existing Models

In 1990 Camp, Dresser and McKee (CDM) prepared a HEC-1 model of the Ulatis watershed for the City of Vacaville and SCWA. The model was used by the City to identify existing and future flooding problems and to formulate alternatives to mitigate those problems. The model was later revised and more detail was added by WYA for evaluation of changes in the Alamo, Upper Ulatis, Horse and Gibson Creek watersheds as part of the City of Vacaville Storm Drain Master Plan Update in 1996. This same model was also revised by WYA in 1997 to evaluate improvements to Sweeney and McCune creeks for SCWA. In using the CDM model, WYA found some problems and inconsistencies in the model related to drainage basin delineation and the hydrograph generation and routing methodologies.

In 1994 Borcalli and Associates (B&A) was retained by the Federal Emergency Management Agency (FEMA) to perform a flood insurance study for the City of Vacaville. B&A evaluated the CDM model for use in the Flood Insurance Study (FIS). Having similar concerns as WYA, B&A opted to create an alternative HEC-1 model of the Alamo and Ulatis watersheds for the FIS.

HEC-2 models for some of the streams in the Ulatis watershed were also developed as part of the WYA and B&A FIS studies mentioned above.

Recommendations

WYA recommends SCWA update the hydrologic model of the Ulatis Creek watershed to evaluate the effects of changes to land use and drainage projects in the watershed. The FIS HEC-1 model of the Alamo and Ulatis Creek watersheds developed by B&A should be used as a base and expanded to cover the entire Ulatis Creek watershed. It is strongly recommended that the updated model be calibrated to actual precipitation and runoff data. The current hydraulic models are sufficient for current County needs. Additional hydraulic models can be developed based on needs of particular studies or projects such as channel construction or modifications. A brief scope of work and estimated costs for the tasks to develop and calibrate the HEC-1 model follows.

Task 1. Determine Model Parameters

Collect hydrologic soil type and land use information for the watershed to determine infiltration rates and hydrograph lag and peaking parameters. Delineate watershed boundaries and subbasins and determine watershed lengths and slopes from USGS 7.5 minute quadrangle maps. Conduct field visits to verify watershed delineation, to estimate drainage basin and channel roughness parameters, and to estimate channel cross-sections where hydraulic models do not exist. Verify parameters used in previous FIS study.

Task 2. Develop Updated HEC-1 Model

Develop HEC-1 model, using the existing FIS HEC-1 model from the Vacaville FIS study of Alamo and Ulatis Creek as a base, and expand the model for the remainder of the watershed. Use hydrologic methods and parameters consistent with those outlined in the FIS study. Use the Snyder Unit Hydrograph Method to develop the runoff hydrographs, and the Modified Puls method for channel routing where HEC-2 information is available, and the Muskingum method where information is not available.

Task 3. Calibrate Model to Hydrograph Timing, Peak Flow and Volume

A model is constructed by inputting several parameters related to the characteristics of the basins and channels in the watershed. The parameters are an approximation of real conditions and must be adjusted to match specific watershed characteristics. The cost and effort in calibration or some manner of model verification is small in comparison to the cost of any project designed based on its output. For example, in determining the most cost effective locations for detention storage in a watershed, the relative runoff peak flows, volume and timing are significant factors in siting the storage. Should the model have inaccurate precipitation, hydrograph or routing parameters, the result could be the design of storage where it not effective or worse, harmful to operation of the overall system.

Currently the precipitation and streamflow data is insufficient within the Ulatis watershed for calibration. Data will be obtained by SCWA in the next few years if the data collection program is implemented. Both streamflow and precipitation information for mountainous and valley watersheds should be collected. It is important to have both pieces of information in these basins because the delay between the peak of the precipitation and runoff will provide a good indication of the basin lag. Knowing the precipitation pattern and depth will provide insight to the infiltration and the hydrograph peaking factor. It is important to have data from the two types of watersheds because the information gleaned from these basins can then be extrapolated to basins with similar characteristics. Additional calibration points at the major junctions in the drainage system are also needed to verify routing times through the channels, and as an additional check on parameters estimated for other basins.

Precipitation depth data from bucket rain gage surveys across the County would also be valuable. These data provide a view of the precipitation variation across the watershed for a given storm. It is not possible to get time series precipitation data in every basin of the watershed, but time series precipitation data collected in one basin can be weighted to neighboring basins based on the

bucket surveys. The County annual precipitation maps could also be used to weight the rainfall, but every storm is different and may not follow the average precipitation pattern.

The model should also be calibrated for a number of storms. The amount of calibration effort depends upon the idiosyncrasies of the watershed and the level of accuracy desired. To estimate the cost it has been assumed that the model will be calibrated to three storms at four points in the watershed. The estimate also assumes precipitation data and stream flow data are provided from the SCWA program in a readily useable format.

Task 4. Determine Flow Diversions for Large Storms

When storm runoff exceeds the capacity of the channels, flow will leave the channels and sometimes be diverted out of the basin, returning to the channel system downstream. Modeling and calibration of models for these scenarios is very difficult. The timing and the shape of the hydrographs are greatly changed by out of bank flows and temporary floodplain storage. This work has been separately scoped for this reason, and can be completed right away or not until the need arises. It would be difficult to calibrate to or verify until data are available for this type of infrequent event.

Task 5. Document Model Development and Calibration

After the model is verified through calibration or some comparison to actual data, it can be used to estimate flows for the design of new structures. Design flows, *i.e.,* 2-, 5-, and 10-year peak flows can be estimated by inputting statistical precipitation into the model. The design precipitation should be based on the depth-duration-frequency information developed by James Goodridge in 1993 for the FIS study. The model should be well documented with comments within the model input and with supporting documentation explaining the input and how the model was verified. The documentation should also summarize the design flows at key points within the watershed.

Task 6. Coordination/Review with Affected Agencies.

A draft report summarizing model setup, input, and results should be prepared and submitted for review to SCWA and other affected agencies. Review questions and comments could then be addressed and incorporated into the model or draft report where appropriate. A final report should then be submitted to SCWA.

Costs

Estimates of cost for these work tasks are shown in Table 3-4.

Table 3-4. Ulatis Flood Control Project Model Revisions, Estimate of Costs

Task	Cost ($)
Task 1. Determine model parameters	12,000
Task 2. Develop updated HEC-1 model	12,000
Task 3. Calibrate model to hydrograph timing, peak flows, and volume	18,000
Task 4. Determine locations of flow diversions for infrequent storms.	10,000
Task 5. Document model development and calibration	10,000
Task 6. Coordination/review with affected agencies	5,000
Total	$67,000

NATIONAL FLOOD INSURANCE PROGRAM ASSISTANCE

Solano County and all the cities within Solano County participate in the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP). The NFIP requires that Flood Insurance Studies be conducted to accurately assess the flood risk within each participating flood prone community, and that insurance premium rates be established based on the risks involved. The primary requirement for community participation in the NFIP is the adoption and enforcement of floodplain management regulations that meet the minimum standards of the NFIP regulations. Local community officials administer and enforce the floodplain management requirements of the program. The program encourages states and local governments to adopt more stringent regulations than the national regulations in instances where the community believes it is in the best interest of its citizens.

Flood Insurance Studies

Flood Insurance Studies for the NFIP are conducted by contractors under the supervision of FEMA for the flood prone communities. Communities have the opportunity to review and comment on the study results. The results of the Flood Insurance Studies are then issued to the community in the form of Flood Insurance Rate Maps (FIRM). The FIRMs show the extent of a 100-year flood, and in some cases the elevation of the 100-year flood waters, called the Base Flood Elevation (BFE). In the incorporated areas in the County, the Flood Insurance Studies used hydrologic and hydraulic analyses to develop FIRMs with designated floodways, risk zones and BFEs. In the unincorporated areas of the County the maps only show Zone A, which is an approximately studied special flood hazard area for which no BFEs have been established. Table 3-5 summarizes information on the communities in Solano County in the NFIP and their FIRMs.

The dates of the most current effective maps shown in Table 3-5 are the most recent date of publication of the maps for the entire community. There may be more current Letters of Map Amendment or Letters of Map Revision to the maps. Letters of Map Amendment are areas which are no longer in the floodplain, for example a lot which has been raised above the flood plain. These areas will not be shown on the FIRM. Letters of Map Revision are requested revisions to the map by the local government based on studies which show the results of physical changes to the floodplain or analyses using more detailed information. After their approval by FEMA, map revisions are then incorporated into the following publication of the map. The local flood plain

administrator (Department of Environmental Management in Solano County) can provide the most recent floodplain information.

Table 3-5. National Flood Insurance Programs in Solano County

Community Identification Number	Community Name	Date of Entry into NFIP	Most Current Effective Map
060368	Benicia	5/31/77	8/03/89
060369	Dixon	5/19/81	5/19/81
060370	Fairfield	7/05/84	9/15/93
060371	Rio Vista	5/19/81	8/04/87
060372	Suisun City	6/01/82	6/01/82
060373	Vacaville	8/02/82	1/17/97
060374	Vallejo	10/17/78	02/22/83
060631	Solano County[(a)]	8/02/82	07/16/96

[(a)] Unincorporated areas only

Map revisions by a community require the submission of appropriate application and certification forms. FEMA recovers costs associated with reviewing and processing requests for modifications to published flood information and maps. For FEMA to restudy a community and publish new FIRMs, there must be significant changes in the floodplain or to the drainage system to warrant a restudy. A restudy must be requested by the community through the State Flood Insurance Agency which compiles a list of requests for FEMA. FEMA then prioritizes the lists from the State and retains consultants to conduct the studies.

Floodplain Administration for Solano County

The local administrator of the NFIP for the unincorporated areas in the County was the Department of Public Works, which is now the Department of Transportation. In 1995, the responsibility was transferred to the Department of Environmental Management (DEM). DEM reviews all building permits to determine if the development lies within a Special Flood Hazard Area (SFHA). Should the development lie within the SFHA, the structures are required to have the lowest floor elevation at least one foot above the BFE. Non-residential structures are not required to meet this standard if they can be flood proofed. Because the BFEs are not provided on the County FIRMs, the permit applicant is required to have a civil engineer determine the BFE and file an Elevation Certificate with DEM.

Flood Hazard Mitigation Programs

FEMA has two post-disaster mitigation programs which provide mitigation assistance after a presidential-declared Major Disaster Declaration, the Hazard Mitigation Grant Program (HMGP)

and the Public Assistance Program. For each presidential-declared disaster, the amount of HMGP money available is based on 15 percent of the Federal funds spent on the Public and Individual Assistance programs in response to the disaster, minus the administrative expenses. FEMA can fund up to 75 percent of the eligible costs of each mitigation project. The state sets priorities and allocates funding among the applicants that meet the state program objectives.

The Public Assistance Program provides funding for repair, restoration, or replacement of damaged facilities belonging to governments and to private non-profit entities, and for other associated expenses including emergency protective measures and debris removal. The program also allows for funding of mitigation measures related to the repair of the existing damaged facility. The measures must be required by code or be cost-effective, and comply with program guidance. FEMA will fund at least 75 percent of the eligible costs of the mitigation measure.

FEMA is also establishing a Pre-Disaster Mitigation Fund Program. The program will provide financial incentives for communities in high-risk areas to better protect vulnerable infrastructure and buildings before disaster occurs. In 1997 Congress allocated $2 million to initiate this program. It is anticipated funding for this new program will be increased in the future.

After the January 1997 storm events, the DEM assessed the damage to structures and property. Damage figures were provided to the State Office of Emergency Services (OES) and FEMA to aid their post flood grant and loan assistance program. DEM worked with the OES on two Hazard Mitigation Grant Proposals, totaling one million dollars. The grants included vegetation removal, related earthwork, and debris disposal on Dry Arroyo Creek and Sweeney Creek. The DEM revised the grant application numerous times to meet the program requirements, however, the proposal was not accepted.

Recommendations for SCWA Involvement

The floodplain mapping in the unincorporated area of the County was created through approximate methods. There were no detailed hydrologic or hydraulic analyses completed to compute water surface elevations. There were numerous reported flood problems between 1995 and 1996 which were not within the mapped Special Flood Hazard Area used by DEM in the building permit process. SCWA could assist in designating areas at risk that are not shown in the flood plain mapping by providing additional information to the DEM. Flooding documentation reported to SCWA would be valuable for this. SCWA could also obtain historical aerials of flooding in 1997 and other past major storm events taken by other local agencies to better identify at-risk areas. Historical satellite images are also available at 10-, 20-, and 30-meter resolution.

It is recommended that, in the future, SCWA take aerial photos after flood producing storms, and determine the recurrence interval of the storm. An aerial flight resolution of 1"=200' provides an effective balance between cost and the usefulness of the photos. High water mark data should also be collected to integrate with the aerials.

Under current County ordinances, the DEM can not deny building permits or require elevation of a structure unless it is within the designated SFHA. DEM with SCWA assistance should consider using the aerial information and reported flooding problems to determine if a more stringent ordinance based on historical records should be considered. The NFIP Community Rating System

establishes flood insurance premium discounts of up to 45 percent for policy holders within communities that have a floodplain management program that exceeds the NFIP requirements. This measure may further reduce premiums in the unincorporated area and should be investigated further.

Sizable Community Rating System credits are available for communities that develop BFEs for areas designated as approximate Zone A on their Flood Hazard Boundary Map or FIRM, or that require site-specific engineering analyses for development proposals. DEM currently requires site specific BFEs to be calculated. If the DEM anticipates significant development in areas with a possible risk of flooding, it would be better if a study was done for the entire area and BFEs established rather than each development determining a BFE individually. SCWA could use more detailed hydraulic studies to help establish the BFEs. This would ensure more consistent standards of development. The costs could be borne by the development community because they would have to develop this information anyway. In some areas, such as in the Sweeney and McCune watersheds, the model of the Ulatis system could be used to determine BFEs.

The Flood Insurance Programs administered by the cities and the County, all comply with the Federal guidelines, however standards for compliance within each agency are different. SCWA could work with the other agencies to develop standardized and integrated floodplain management regulations. This would eliminate inconsistencies in requirements at the limits of the city and County jurisdictions.

STORM WATER QUALITY MANAGEMENT

Over the past few years, the United States Environmental Protection Agency (EPA) and the California State Water Resources Control Board (State Board) have adopted new regulations intended to reduce pollutants entering surface waters in runoff from urban areas. This section identifies several fundamental issues to be considered by policy makers as they develop an appropriate response to the control of pollutants associated with urban runoff.

The Federal Clean Water Act establishes protections for surface water in the United States. Two areas of the act directly affect drainage in Solano County. The first requires states like California to establish a permit program regulating pollutants in storm water runoff. The second calls for numerical limitations on pollutant discharges of any kind (including storm water) to surface waters.

NPDES Storm Water Permit Program

The Federal Clean Water Act (Amendments) of 1972, as amended by the Water Quality Act of 1987, requires the US EPA to implement National Pollutant Discharge Elimination System (NPDES) permitting programs for municipal and industrial "storm water point sources." A program was adopted by EPA, and subsequently by the State Board. It was structured in two phases. Phase I requires communities with a population of 100,000 or more to control urban runoff pollutants to the "maximum extent practicable" (MEP), under a municipal storm water NPDES permit. "Phase II" of this program addresses smaller cities and has been under development and review for several years.

The most recent final rule, issued in August 1995, postpones permit applications for Phase II dischargers until 2001, and obligated the EPA to propose the supplemental Phase II rule by September 1, 1997 (delayed until November 25, 1997) and a final rule by March 1, 1999. This supplemental rule will outline what the specific responsibilities of Phase II discharges will be.

EPA has set up a committee of Phase II stakeholders, including representatives of state, local, tribal and federal government, environmentalists and industry, to help develop the supplemental rule. The group, Storm Water Phase II Federal Advisory Subcommittee, was directed to develop proposals by late Spring 1996 and deliver final recommendations to EPA by the end of the year. This process has been delayed, but it appears that storm water dischargers will be placed into three categories:

- Tier I — includes all municipalities associated with Phase I that serve populations over 100,000. The Fairfield Suisun Sewer District and the Vallejo Flood Control and Sanitation District are in this tier.
- Tier II — includes municipalities in urbanized areas with populations of 50,000 or more and with population densities of 1,000 per square mile not associated with the first phase of the storm water permitting program. This tier will also cover tribal facilities, state facilities (e.g. Departments of Transportation, or colleges and universities), and federal facilities (e.g. military bases). Vacaville would be included in this tier.
- Tier III — includes all remaining municipalities. Dixon, Rio Vista and Benicia would be included in this tier.

EPA will develop criteria to determine which dischargers, such as those with significant water quality impacts, will be covered. Storm water management plans and monitoring requirements for Tier II will be less intensive than Tier I, and Tier III discharges will only have to address the specific problems that trigger their inclusion in the permitting program.

Three types of NPDES storm water permits may potentially apply to communities within Solano County. The three types apply to 1) general industrial activity, 2) general construction activity and 3) urban discharges (the municipal permit). Requirements of each type of permit are intended to meet the goal mandated by the clean water act, to reduce pollutants to the maximum extent practicable.

General Industrial Permit. The State Board adopted the "General Industrial Activity Storm Water Permit" on November 19, 1991, and an amended version on September 17, 1992. All discharges of runoff associated with industrial activity (as defined in the regulations), must comply with the requirements of this permit. Conditions of the permit require implementation of two programs at each construction site, the Storm Water Pollution Prevention Plan, and a Monitoring Program. These programs focus on identifying and eliminating potential sources of runoff contamination, and monitoring runoff to verify the effectiveness of the control measures.

General Construction Activity Permit. Similar to the Industrial Permit, all construction activities requiring a storm water permit will be covered under the General Construction Activity Permit unless the Regional Board requires a site specific permit. Coverage under the general

permit is acquired by submitting a Notice of Intent (NOI) to the State Board. The permit prohibits non-storm water discharges and discharges containing hazardous substances. It requires implementation of any controls necessary to meet water quality standards, but does not place numerical effluent water quality limitations on storm water runoff. Monitoring is required to evaluate the effectiveness of the control measures. A Storm Water Pollution Prevention Plan identifying appropriate source control and structural control measures is required for each construction site. The Phase II rule will likely reduce the size of construction projects from 5 acres to 1 acre that have to submit a NOI to the State Board.

The general construction activity permits in the unincorporated areas of the county are administered by the Solano County Department of Environmental Management (DEM) as part of the required erosion control plan of county grading permits.

Municipal Storm Water Permit. Municipal storm water permits for larger cities (Tier I) typically require the owner or operator of the municipal separate storm sewer system (MS4) to implement source control measures and construct facilities to reduce pollutants in runoff. The agency's programs may include a variety of BMPs to meet this goal, such as public education through school programs, public service announcements, or mailers; hazardous materials collection days; street cleaning; and construction of water quality control features in storm drainage facilities. Runoff sampling and analysis is necessary to identify pollutants in runoff, and to identify potential sources of those pollutants so appropriate BMPs can be implemented. Watershed mapping and runoff sampling are important early phases of obtaining and implementing a municipal permit, and of developing a cost effective storm water quality management program.

The Phase 2 rule will cover Tier II municipalities. Although the rule has not been finalized yet, the February 4, 1997 draft requires Tier II municipalities to develop and implement a storm water management program which includes at least the following components:

- Public education and outreach — Under this component educational materials will be distributed to the community describing the impacts of storm water discharges on water bodies, and the steps to reduce storm water pollution. The materials should cover individual and household activities such as ensuring proper septic system maintenance, limiting the use and controlling runoff of garden chemicals, and proper disposal of motor oil and household chemicals. Other informational materials should target commercial, industrial, and institutional entities which potentially could cause significant storm water impacts. To accomplish this program component, municipalities are encouraged to work with state or other education/outreach programs.

- Public involvement/participation — Under this component, the public should be involved in both the development of the storm water management program and the ongoing operation of the program. The public participation process should make efforts to reach out and engage all economic and ethnic groups.

- Illicit discharge detection and elimination — Under this component the storm sewer operator would be required to develop maps of the storm sewer system, and identify

areas of concentrated activities which are likely to be a source of storm water pollution. The operator would be required to prohibit illicit discharges, and to develop and implement a program to detect and address illicit discharges. This component would also require the operator to inform public employees, businesses, and the general public of the hazards associated with illegal discharges and improper disposal of wastes.

- Construction site storm water discharge control — The storm sewer operator must use an ordinance or other regulatory mechanism to control erosion and sediment to the greatest extent practicable or allowable under law. The program must also control other construction site wastes such as discarded building materials, concrete truck washout, and sanitary waste. The program must include requirements for construction site owners or operators such as implementation of BMPs, provisions for pre-construction review and approval of site plans, regular inspections of the construction site, and penalties for noncompliance.

- Post-construction storm water management in new development and redevelopment — Reducing the discharge of pollutants after they have entered a storm sewer system is often more expensive and less efficient than reducing the discharge of pollutants at the source. Thus, under this component, owners and operators of MS4s must develop and implement a program to control storm water discharges into the storm sewers from development and redevelopment projects using site-appropriate and cost effective structural and nonstructural BMPs. The program should ensure that water quality impacts are minimized and ensure the long term operation and maintenance of the BMPs. The EPA would provide guidance on conventional on-site BMPs (detention/retention ponds, constructed wetlands, and pond/wetland systems), small scale watershed planning, prevention based site design of infiltration facilities, and model local ordinances.

- Pollution prevention and good housekeeping of municipal operations — Proper operation and maintenance of the storm sewer and pollution control BMPs is essential to the long term successful operation of these facilities. This component would require that the MS4 operators develop and implement a cost effective operation and maintenance program with the ultimate goal of reducing pollutant runoff from municipal operations. The program must include employee training regarding storm water pollution prevention in government operations like park and open space maintenance, fleet maintenance, planning, building oversight, and storm sewer maintenance.

Notably, end of pipe water quality monitoring is not included in the above storm water management program components. Instead, municipalities would be required to demonstrate program compliance, effectiveness of BMPs, and achievement of measurable goals. However, the permitting authorities would have the authority to examine existing water quality and assess whether monitoring is necessary.

During the first permitting period of the Tier II municipalities, MS4 owners/operators would be required to submit annual reports, and in subsequent permit periods this reporting may be reduced

to years 2 and 4 of the permit period. The reports would include the status of compliance with permit conditions, results of information collected and analyzed, a summary of planned activities for the next reporting cycle, and any change in identified measurable goals.

Local Programs

The Fairfield-Suisun Sewer District (FSSD) and the Vallejo Sanitation and Flood Control District (VSFCD) are involved with the municipal stormwater permitting process for their jurisdictions. A summary of these activities is provided below.

Fairfield Suisun Sewer District. The FSSD was issued a NPDES Municipal Storm Water Discharge Permit on April 19, 1997. Included as the terms and conditions (by reference) in that permit is FSSD's Storm Water Management Plan. The nine major components of the plan include:

1. Overall program management
2. Legal authority
3. Control of illicit discharges
4. Control of pollutants in storm water from industries
5. Municipal government maintenance activities
6. New development and redevelopment
7. Watershed awareness and collaborative activities
8. Public information/participation
9. Evaluation of controls

The staffing for the FSSD program includes about 60 percent of the time of one full time staff member, and occasional help from other FSSD staff and City of Fairfield and City of Suisun staff (Bahr). The annual budget for this program is about $200,000 per year (Bahr).

FSSD is responsible for runoff only from within the Fairfield and Suisun City boundaries. However, program staff hope to coordinate the program with County and other local flood control/storm water quality programs.

Vallejo Sanitation & Flood Control District. The VSFCD is in the process of applying for a NPDES Municipal Storm Water Discharge Permit. The program would have regulatory, new development requirements, education, public information, and illicit discharge control components.

Staffing for the program is not yet determined, but is anticipated to include one full time staff member, and occasional help from other VSFCD staff and City of Vallejo staff (Hoehn). The annual budget for this program is expected to be about $100,000 per year.

VSFCD is responsible for runoff only from within the City of Vallejo, however, program staff hope to coordinate the program with County and other local flood control/storm water quality programs.

Impacts on County-Wide Flood Control Plans

The current regulations are focused on point source pollution from industrial, urban, and construction activities. FSSD, VSFCD and DEM have complied with the current regulations. Non-point sources of pollution will be the future focus of water quality regulations. This will require compliance over larger areas and more activities, possibly including agriculture. Because much of the County is tributary to the Suisun Marsh and Delta, SCWA should include water quality as an additional goal to any flood control project or watershed management plan. This will be useful in complying with future regulatory programs after they have been finally adopted.