

# SACRAMENTO COUNTY

NFIP COMMUNITY 060262



## WATERSHED MANAGEMENT PLAN

2009

By:  
Sacramento County Department of Water Resources  
Drainage Development, Hydrology and Floodplain Management Section

## TABLE OF CONTENTS

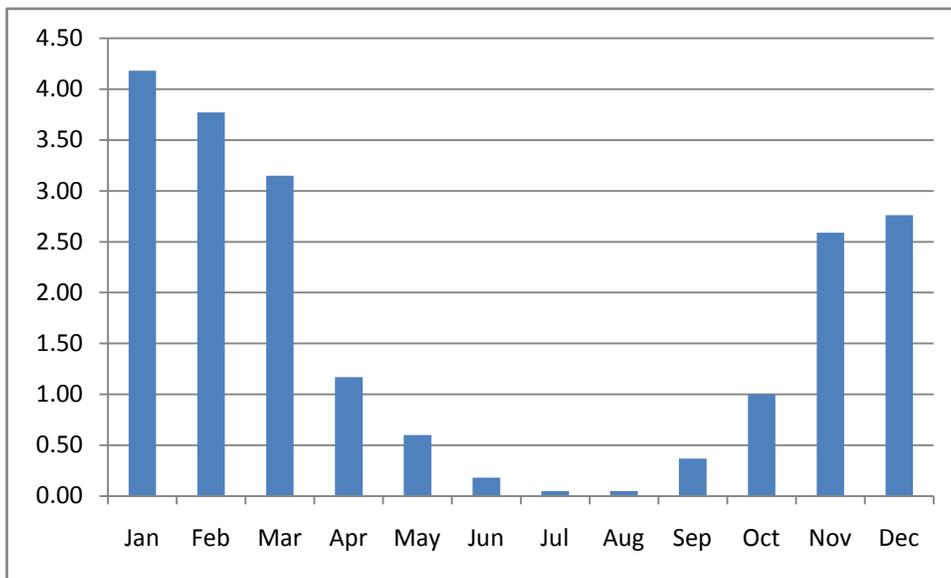
Overview.....	3
Standards for Development .....	5
Design Standards and Review .....	5
Hydrology Standards.....	6
Funding.....	7
Watersheds in Sacramento County.....	8
Watersheds From Outside Sacramento County.....	9
Zone 11A Drainage Master Plans.....	9
Drainage studies for Zone 11A developing areas.....	11
Zone 11B Drainage Master Plans.....	13
Drainage studies for Zone 11B developing areas, and areas in need of improvement .....	14
Zone 11C Drainage Master Plans.....	15
Drainage studies for Zone 11C developing areas, and areas in need of improvement .....	17
Limited Land Use Areas .....	18
Natomas .....	18
South County Agricultural Areas .....	18
Cooperative Technical Partnerships.....	19
Watershed Agreements.....	20
Sacramento County and Placer County.....	20
Sacramento County and City of Sacramento .....	20
Sacramento County and City of Rancho Cordova .....	21
Sacramento County and City of Elk Grove .....	21
County of Sacramento and City of Citrus Heights .....	22
City of Folsom.....	22
City of Galt.....	22
City of Isleton .....	22

OVERVIEW

Sacramento County lies mostly in the trough of the Sacramento Valley in the northern portion of the Central Valley of California. The county is bound on the east by the Sierra Nevada foothills and extends to the southwest into the Sacramento Delta. The county totals 994 square miles and has seven incorporated cities. The unincorporated county is 813 square miles with an estimated 662,000 population. Herein, unincorporated county will simply be referred to as county, meaning NFIP community 060262.

Sacramento County Flood Insurance Rate Maps were first issued March 15, 1979 and Sacramento has been a community in good standing with the National Flood Insurance Program ever since.

**Average Sacramento Precipitation (inches)** [www.weather.com]



The prevalent soil in Sacramento County is Soil Conservation Service Type D, tightly bound and low permeability. Summertime humidity is quite low but the winter is more humid with lower temperatures (40 to 60 degrees Fahrenheit). Freezing conditions are rare, but there are

often extended periods of fog. Consequently, soil remains quite moist throughout the rainy season.

## Sacramento Weather History

Summary									
	Temp. (°F)	Relative Humidity		Extreme Temp.		Rain (Inches)	Cloudiness (Days Per Month)		
		A.M.	P.M.	Below 32°	Above 90°		Average	Clear	Partly Cloudy
January	45.2	91%	71%	6	0	3.7	7	6	19
February	50.7	89%	61%	2	0	2.9	8	7	13
March	53.6	85%	53%	0	0	2.6	10	9	12
April	58.3	82%	44%	N/A	N/A	1.2	12	10	8
May	65.3	82%	39%	0	5	0.3	17	9	5
June	71.6	78%	32%	0	12	0.1	22	6	2
July	75.7	77%	29%	0	22	0.1	27	3	1
August	75.1	77%	29%	0	19	0.1	26	4	1
September	71.5	77%	31%	0	13	0.4	24	4	2
October	64.2	79%	37%	0	3	1.1	19	6	6
November	53.3	86%	57%	1	0	2.7	10	8	12
December	45.3	88%	67%	7	0	2.5	8	6	17
<b>Annual</b>	<b>60.8</b>	<b>83%</b>	<b>46%</b>	<b>16</b>	<b>74</b>	<b>17.5</b>	<b>188</b>	<b>77</b>	<b>100</b>

[www.cityrating.com]

### DESIGN STANDARDS AND REVIEW

Piped storm drain systems are designed to convey the County design flow which approximates the peak run off from a five year storm event. The larger less frequent storm events exceed the pipe capacities and travel through streets and overland from the upper shed areas to the receiving creek. Water is typically allowed to pond in streets up to 30-minutes (+/-) until the storm subsides. Development designers must analyze the 100-year, 1% annual recurrence, storm event and assure that ponding and overland flow is safely managed and that freeboard is adequate for each new structure. The impact downstream and adjacent to the proposed development must also be analyzed and mitigated.

Large development plan areas, known as specific plans and community plans, must prepare a detailed drainage study often including channel improvements and peak flow detention basins.

New levees to reclaim floodplain are discouraged and whenever such are proposed they must be constructed to at least a 200-year (0.5% annual recurrence) level of protection, and meet FEMA certification standards (44CFR65.10).

All discretionary applications are routed to Water Resources for comments and conditions. The County has a computer system that tags all parcels with known flood hazards and all building permits for those parcels are routed to Water Resources for review and approval.

From the safety element of the General Plan:

- SA-12 The County shall require all new urban development projects to incorporate runoff control measures to minimize peak flows of runoff and/or assist in financing or otherwise implementing Comprehensive Drainage Plans.

Improvement Standards require:

- 9-1G All new structures shall be protected from the 100-year (1-%) flood event...
- 9-1H The design of a new storm drain system shall include consideration of the downstream creek or storm drain. The consulting engineer shall show that the existing storm water system can convey the proposed drainage without adverse flooding, erosion or other water quality impacts to upstream, downstream or adjacent facilities or areas; or that such facilities or areas are being improved or protected to the point where the drainage can be conveyed without adverse impacts.

## HYDROLOGY STANDARDS

Sacramento County developed hydrology standards that were adopted in 1996 and have been approved for FEMA map revisions. These standards include regional rainfall tables of depth-duration-frequency; design storms of various durations, infiltration rates based on land use and soil type, and employ the unit hydrograph theory. The County has three hydrologic rainfall zones. Sacramento County developed a hydrology calculator known as SacCalc, which is available at no cost to consulting engineers. SacCalc is a preprocessor to the US Army Corps of Engineers HEC-1 hydrology computer program.

Flood control detention basins are constructed when there is need to attenuate impacts to peak flow in a watershed. Such basins are generally designed as off-line taking the peak flow off of an open channel. Stormwater quality basins are used to treat storm water pollution by maintaining a residence time at zero velocity allowing suspended solids to settle before the water is discharged, normally by gravity, to the adjacent open channel. Combined basins have a flood control volume over a permanently wet volume serving as storm water pollution prevention. Basins are designed to be aesthetic amenities for the developing community.

Urban drainage is conveyed by piped storm drain systems to the nearest open channel, creek or stream. Water quality treatment is required in accordance with the county's storm water permit from the State Regional Water Quality Control Board under Section 401 of the Clean Water Act. This is a joint permit with the cities, the County and our neighboring county of Placer as well as the City of Roseville. The group prepared a Stormwater Quality Design Manual, dated 2007.

Hydromodification and geomorphologic studies are being prepared for urbanizing watersheds to assure minimized impact to the erosion and deposition characteristics of the streambed. This is regulated by the State Regional Water Quality Control Board and the findings will be made a part of the forthcoming regional permit. It is not anticipated that mitigation for hydromodification will have an impact on the FEMA 100-year floodplain but it will likely require additional care in the design of developments including low impact development features, attenuating flows below the 10-year event.

The Sacramento County Department of Water Resources Drainage Development Hydrology and Floodplain Management Section review all grading and drainage projects in the County for conformance with drainage improvement standards and the Floodplain Management Ordinance. A grading permit is required for any project that moves more than 350 cubic yards

of soil. Improvement plans are required for any on-site or off-site development and for any drain pipe other than a driveway culvert. All grading plans and improvement plans are reviewed and approved by Water Resources to assure adherence to design standards. Staff also assures that new homes are constructed safely above the highest determined base flood elevation whether mapped on the FEMA Flood Insurance Rate Map or designated by County study of future condition hydrology.

## FUNDING

Sacramento County Storm Water Utility funds maintenance and improvement of existing storm drain systems within the urban services area. This fee is billed bi-monthly on the County Utility Bill. Routine repairs and improvements are made on a continuous basis throughout the unincorporated county. Citizens are encouraged to call the drainage hotline at (916)875-RAIN to request immediate maintenance, improvement projects, or on-site technical assistance related to all drainage matters. The Sacramento County Water Agency Zone 11 Drainage Impact Fee Program has been in existence since 1965. New storm drainage systems are generally constructed by contractors working for private developers. Drainage fees are collected prior to improvement plan approval on a schedule rate based on percent impervious area impact to the watershed. Components of the fee include piped storm drain, open channel peak flow impact, detention volume impact, and stormwater quality. Zone 11 is divided into three sheds, 11A is the Morrison Creek and Beach Stone Lake Stream Groups, 11B is natural streams draining toward the American River, 11C is the Dry Creek and Natomas East Main Drainage Canal shed area. The fees collected are used to finance comprehensive drainage plans for urban streams.

Developers are credited and reimbursed for construction of trunk drainage facilities that are permanent and efficient systems in accordance with County standards. Trunk drainage is defined as a 30-acre water shed area or greater within a Zone of the Sacramento County Water Agency Drainage Fee Plan.

Supplemental drainage fee plans are prepared for specific plan areas where there are costs associated with trunk drainage that are not covered by Zone 11, such as environmental mitigation and channel rights-of-way.

## WATERSHEDS IN SACRAMENTO COUNTY

The urban and urbanizing areas of the County, including the Cities of Rancho Cordova, Elk Grove and Citrus Heights, are divided into three zones of the Sacramento County Water Agency, a statutorily created district operating under the authority of and pursuant to the provisions of the Sacramento County Water Agency Act (West's California Codes, Water Code Appendix, Chapter 66, commencing at Section 66-1, et seq.; Deering's California Codes, Water, Uncodified Acts, Act 6730a), as follows:

➤ **Dry Creek and NEMDC and Tributaries (Zone 11C)**

- Dry Creek
- Antelope Creek
- East Antelope Creek
- Magpie Creek
- Robla Creek
- Sierra Creek
- Linda Creek and Tributaries
- Natomas East Main Drainage Canal (NEMDC, known as Steelhead Creek)
- NEMDC Tributaries

➤ **Natural Streams Group and Tributaries (Zone 11B)**

- American River
- Arcade Creek
- Arcade Creek South Branch
- Brooktree Creek
- Mariposa Creek
- Carmichael Creek
- Chicken Ranch Slough
- Cripple Creek
- Diablo Creek
- San Juan Creek
- Sunrise Creek
- Verde Cruz Creek
- Kohler Creek
- Coyle Creek
- Alder Creek (not Folsom City)
- Manlove Creek
- Fair Oaks Stream Group
- Buffalo Creek
- Mayhew Slough
- Minnesota Creek
- Strong Ranch Slough
- Boyd Station Channel
- Cordova/Coloma Stream Group

➤ **Morrison Creek Stream Group (Zone 11A)**

- Elder Creek
- Gerber Creek
- Elk Grove Creek
- Florin Creek
- Laguna Creek Morrison Creek
- Strawberry Creek
- Unionhouse Creek
- Whitehouse Creek

\*See Appendix A for map of watersheds and calculated areas

## WATERSHEDS FROM OUTSIDE SACRAMENTO COUNTY

The three counties with watersheds draining into Sacramento County are Placer, El Dorado, and Amador counties.

- Placer County. Dry Creek is the main creek entering Sacramento County from Placer County. It is a master planned creek described later in this report in Zone 11C Drainage Master Plans, and Watershed Agreements. The upper portions of the NEMDC and tributaries drain from Placer County. They are also described in Zone 11C.
- El Dorado County. Most of the area draining into Sacramento County from El Dorado County is undeveloped. Within that, however, is El Dorado Hills, an 18 square mile residential/commercial master planned community that was developed periodically between 1962 and recent years. It drains into Carson Creek, a tributary to Deer Creek, and has had negligible impact on Sacramento County.
- Amador County. About 11 square miles of undeveloped (agricultural) watershed drains either directly into, or to Arkansas Creek and then into, the Cosumnes River.

## ZONE 11A DRAINAGE MASTER PLANS

The Morrison Creek Stream Group (Zone 11A) may be deemed 100% master planned for peak flow, volume, and stormwater pollution prevention. The majority of growth in Sacramento County will occur in this area. Consequently, a great deal of effort has been put forth to master plan the necessary trunk drainage improvements.

Elder Creek – 7632 acres, 100% developed condition master planned for the approved North Vineyard Station and proposed Florin Vineyard Specific Plans, see North Vineyard Station Drainage Master Plan approved in 2004, deemed current.

Elk Grove Creek- 4019 acres, 100% developed condition master planned for the East Elk Grove Specific Plan, City of Elk Grove.

Florin Creek – 2857 acres, 100% developed condition master planned for the proposed Florin Vineyard Specific Plan

Gerber Creek – 2579 acres, 100% developed condition master planned for the approved North Vineyard Station Specific Plan and the approved Vineyard Springs Specific Plan. The latter is superseded by the North Vineyard Station Drainage Master Plan dated 2004, deemed current.

Laguna Creek - Headwaters in the City of Rancho Cordova is 100% master planned for the proposed Suncreek Specific Plan. Laguna Creek between the cities of Elk Grove and Rancho Cordova is fully master-planned in the Vineyard Springs Specific Plan approved documents. The primary flood control facility is the Triangle Rock aggregate pit currently being excavated and permit application has been submitted to the Corps of Engineers. This facility will control flood flows that tend to jump from the Laguna Creek to Gerber Creek watershed at the CCTRR railroad embankment. The total Laguna Creek watershed is 21176 acres draining from just upstream of the City of Rancho Cordova's eastern boundary, through the planned development area over the Folsom South Canal, through Mather Field and preserve areas to the Vineyard Springs development area and into the City of Elk Grove ultimately discharging to Beach Stone Lakes. Elk Grove has modeled the creek up to the northern city boundary (Calvine Road) and County Water Resources has modeled the creek from the top of the shed to Calvine Road. All models are existing condition and developed condition. The study by Wood Rodgers dated 2006 and the study by MacKay & Somps dated 2009 are deemed current.

Laguna Creek and Tributary 1 in the City of Elk Grove was modeled with the 2009 submitted FEMA letter of map revision. Morrison Creek – 34592 acres, Upper Morrison Creek is 100% master planned as part of developments in the City of Rancho Cordova. Middle Morrison Creek flood control is occurring at the Aspen 6 aggregate mine where there is a constructed weir. Lower Morrison Creek is in the City of Sacramento and has been fully studied by the Corps of Engineers who are designing a floodwall project. The hydrology study dated 2009 by Wood Rodgers is deemed current.

Strawberry Creek and Jacinto Creek– Total 5588 acres partially in cities of Elk Grove and Sacramento is almost fully developed and master planned with several flood control and storm water quality detention basins. The study by Water Resources staff in 1993 is deemed current.

Unionhouse Creek – 2193 acres tributary to Strawberry Creek and Morrison Creek is 100% master planned for the proposed Florin Vineyard Specific Plan. The developed condition drainage study by Civil Solutions dated 2007 is deemed current.

Whitehouse Creek – 100% master planned and developed in City of Elk Grove.

City of Elk Grove watersheds -

Whitehouse Creek and Elk Grove Creek are tributaries to Laguna Creek which drains to the City of Sacramento then to the Beach Stone Lake Preserve

Strawberry Creek is tributary to Unionhouse Creek draining into the City of Sacramento and the South Sacramento Streams Group flood control project, then to the Beach Stone Lake Preserve.

Beach Stone Lake Tributaries drain the western half of the City of Elk Grove toward the Beach Stone Lake Preserve.

Mitigation of impacts to the Beach Stone Lake floodplain is discussed later in this document.

## DRAINAGE STUDIES FOR ZONE 11A DEVELOPING AREAS

The following lists the current drainage master plans including existing condition and fully development condition hydrology.

### Vineyard Springs Comprehensive Plan

The drainage plan for this planning area was developed by the Spink Corporation in 1999, and updated by Water Resources staff in 2003 and 2007. It was first adopted by the Sacramento County Board of Supervisors in 2003 and most recently in 2007. The plan is being used by Water Resources to condition development.

### North Vineyard Station Specific Plan

The drainage plan for this planning area was developed by Borcalli & Associates in 2001 and updated by MacKay & Soms Engineers in 2006. It was approved by the Board of Supervisors in 2006. The plan is being used by Water Resources to condition development.

### Florin Vineyard Gap Community Plan

The drainage plan for this planning area was approved by Water Resources in 2007. The drainage plan is being used by Water Resources to condition development.

### Strawberry/Jacinto Creek Drainage Master Plan

This drainage master plan was developed by Water Resources staff in 1993. It was used to regulate pending development in the watersheds at the time, and is still used to

condition development. The precipitation data is still appropriate, as well as the hydrology (HEC-1). The hydraulic model is updated from HEC-2 to HEC-RAS as necessary. The land use plan for the remaining undeveloped areas in the watershed is still appropriate.

#### Lower Laguna Creek Drainage Master Plan

This drainage master plan was developed by Water Resources staff in 1996. It was used to regulate pending development in the watersheds at the time, and is still used to condition development. The precipitation data is still appropriate, as well as the hydrology (HEC-1). The hydraulic model is updated from HEC-2 to HEC-RAS as necessary. The land use plan for the remaining undeveloped areas in the watershed is still appropriate.

#### Whitehouse Creek Drainage Study

This drainage study was first developed by Water Resources staff in 1996 and updated in 2006. It is being used by Water Resources to condition development.

#### Upper Morrison Creek

The Rio del Oro, Anatolia, and Sunridge drainage master plans in the City of Rancho Cordova serve to attenuate peak flow at the constraints crossing the Folsom South Canal.

#### Beach Stone Lake

Zone 11A watersheds converge to Morrison Creek, Laguna Creek which flow through the cities of Sacramento and Elk Grove, respectively, and ultimately to the preserve area known as Beach Stone Lake. In the Zone 11A program, is an impact fee that is collected, and separately accounted, for Beach Stone Lake mitigation. The Beach Stone Lakes Cumulative Impact Analysis dated September 1992 by Ensign and Buckley Consulting Engineers for Sacramento County used the DWR NETWORK unsteady-state hydraulic model to analyze the floodplain and the impacts of Zone 11A development. Subsequently, the Elliott Ranch South floodplain encroachment was presented in the Final Supplemental Environmental Impact Report for Elliott Ranch South General Plan Amendment (County Control Number 98-0617, dated July 1999, and an analysis of the impact of developing Shed B through the East Franklin Specific Plan and Laguna Ridge, in the City of Elk Grove was presented in those EIRs. This model is the current analysis of development impact to Beach Stone Lake.

## ZONE 11B DRAINAGE MASTER PLANS

Drainage master planning in the natural streams and areas, draining to the American River (Zone 11B), is deemed 100% master planned. The 'natural streams' are protected by the county zoning code. These natural streams are generally lined with established oak and other vegetation serving as habitat and shade canopy. The county opposes disruption to these sensitive areas encompassing most of the Zone 11B creeks and primary tributaries.

American River - 100% master planned and controlled by state and federal regulators. Folsom Dam and a system of certified levees control the flows in this river. Any proposed land development in the lower reach of this 2100 square mile watershed could not have any significant impact on peak flow.

Arcade Creek - 6508 acre watershed with only 54 acres of infill area remaining. There is no valid location for peak flow detention; however, as redevelopment occurs there will be opportunities for installation of stormwater quality treatment devices. Modeling on Arcade Creek was by County Water Resources staff (in 1995-98 and upstream of Auburn Blvd in 2007) and the resulting profile is used where it is higher than recorded high water and FEMA flood insurance study.

Arcade Creek South Branch - 1657 acre watershed in which lies the approved (104 acre) Gum Ranch Specific Plan, which is slated for a peak flow detention basin when the project is constructed by the development interests. The Gum Ranch hydrology study used in the project environmental impact report is deemed current.

Brooktree Creek - City of Citrus Heights, is fully developed.

Mariposa Creek - City of Citrus Heights, is fully developed.

Carmichael Creek - 2725 acre watershed draining to the American River. The watershed is 97.3% developed.

Chicken Ranch Slough - 3722 acre watershed draining to the American river via Pump Station D-05. The watershed is 99% developed.

Cripple Creek - 4327 acre watershed in Citrus Heights draining to Arcade Creek.

Diablo Creek is a 948 acre watershed draining to Arcade Creek and is 99.6% developed.

Fair Oaks Stream Group – Comprised of several smaller watersheds draining to the American River totaling 7819 acres and is 98.5% developed.

Alder Creek - 7226 acre watershed draining to Lake Natomas reservoir on the American River. The Glenborough Easton Specific Plan includes a drainage study, which is deemed to be the current hydrology data considering existing condition and fully developed condition. There is no need for flood flow or volume detention since the flow is to a federally operated reservoir. Hydrofluvial geomorphology is being studied to assure the limiting of erosion.

Manlove Creek - 1893 acre watershed is 99.9% developed.

Kohler Creek - Also known also as Date Creek, is a 694 acre watershed draining to Arcade creek and is 97.1% developed.

Buffalo Creek - 9167 acre watershed draining to the American River. The Westborough Drainage Master Plan accounts for the area known as Aerojet which is slated for development. There will be peak flow detention in order to not exacerbate the downstream floodplain. The drainage master plan will be incorporated in the environmental impact report for the forthcoming project.

Mayhew Channel - 2959 acre watershed draining to the American River. The shed is 99.9% developed.

Minnesota Creek - 1095 acre watershed draining to the American River and is 96.4% developed.

Strong Ranch Slough - 4573 acre watershed draining to the American River via Pump Station D-05.

Sunrise Creek – The watershed is entirely in the City of Citrus Heights.

Verde Cruz Creek - 1226 acre watershed draining to Arcade Creek and is 98.9% developed.

Boyd Creek - Also known as Boyd Station Channel the 2201 acre watershed drains to the American River and is 99.9% developed.

Cordova/Coloma Stream Group – Comprised of several smaller shed areas draining to the American River totaling 1728 acres and is 79.3% developed. This is in the City of Rancho Cordova.

#### DRAINAGE STUDIES FOR ZONE 11B DEVELOPING AREAS, AND AREAS IN NEED OF IMPROVEMENT

Chicken Ranch Slough Drainage Master Plan was first developed by Water Resources staff in 1991 to identify solutions to flooding problems. Several large public meetings were held. A lack of consensus on an overall solution resulted in only one part of a recommended plan being implemented – revised channel maintenance procedures. Residences with low finish floor elevations were identified for elevating but home owners were not interested. The HEC-1 and HEC-2 models developed in the study were used as best available information until they were updated by staff in 2006 with SacCalc and HEC-RAS models.

Strong Ranch Slough/Sierra Branch A drainage study was developed by David Ford Engineers for Water Resources in 2006 to analyze flood control alternatives. Staff expanded on the modeling in 2007 and developed a website and flood warning system for the area. The models are used by staff to analyze capital improvement projects.

The D-05 drainage pump station serves Strong Ranch and Chicken Ranch Sloughs. A 2003 Corps of Engineers Feasibility Study identified doubling the capacity of the D-05 pump station as the only feasible solution to reducing flooding in the area. There is no cost effective solution that provides 100-year protection.

Arcade Creek Water Resources commissioned a drainage study at Auburn Boulevard at the City of Sacramento Border in 2003 by a consultant to determine the level of protection for the Evergreen Estates floodwall. The county recently applied for provisional accreditation of this levee.

South Branch Arcade Creek Drainage studies were performed as referenced in the approved environmental impact reports for the Gum Ranch and Sheltonham developments. Hydrologic models were developed to analyze development impacts and mitigation measures.

Easton, Weston, Glenborough Drainage studies were developed associated with the proposed redevelopment of a portion of the Gentech- Aerojet site in the Alder Creek and Buffalo Creek watersheds. These studies developed hydrologic and hydraulic modeling to determine development impacts and mitigation measures.

## ZONE 11C DRAINAGE MASTER PLANS

The drainage master planning in the Dry Creek and Steelhead Creek (Natomas East Main Drainage Canal, NEMDC) tributary watersheds (Zone 11C) are fully master planned for pending development. These areas are generally large lot agricultural-residential parcels with roadside ditches and culvert crossings. There are two large developments being proposed known as Elverta Specific Plan, and South Placer Vineyard (the latter being in Placer County). The urban area known as Antelope was constructed in the late 1980s and early 1990s and is 86.4% developed and was fully master planned.

Dry Creek - 4138 acres in Sacramento County draining to the lower NEMDC, then to the American River, there are 48,966 acres upstream in Placer County. The Dry Creek study, dated 1992, was approved by both counties. There is a current effort in Placer County to update the hydrology study for Dry Creek and its tributaries. The two counties have enjoyed a good working relationship and technical cooperative partnership.

Basin A - A tributary to Antelope Creek draining toward Placer County and into Dry Creek. It was part of the Antelope community development master planning in the early 1990's and is fully developed.

Magpie Creek - 3789 acre watershed draining to the former McClellan Air Force Base (now a business park) and is master planned through the Base property and into the City of Sacramento. There is a 2008 study by West Yost that when constructed would serve to reduce flood risk to OptiSolar and adjacent buildings. There is no opportunity for major infill upstream of the McClellan Business Park.

Robla Creek - 5141 acre watershed in the county before it enters the City of Sacramento toward the confluence with Dry Creek and the NEMDC. It is 99.8% developed.

Linda Creek and Tributaries - 3580 acre watershed in Orangevale area draining to the City of Roseville which is a tributary to Dry Creek ultimately draining back to Elverta and Rio Linda in Sacramento County. The Linda Creek watershed is 99.5% developed.

Sierra Creek - 1743 acre watershed draining to Dry Creek in the Antelope community.

The Natomas East Main Drainage Canal (NEMDC) - Also known as Steelhead Creek has a backwater floodplain along the east side. The zoning in the eastern area is generally agricultural residences. American River backwater into the NEMDC is controlled by Pump Station Number D-15, which serves to reduce the base flood elevation upstream. There is a volume concern and there is a mitigation fee component of Zone 11C. No filling is allowed in the NEMDC backwater floodway area unless compensatory excavation is demonstrated. A fee is collected under the Sacramento County Water Agency Code for the future addition of a pump at this pump station. Currently, floors are set based on a one pump failed scenario which generally provides an extra one foot of freeboard in the backwater area.

NEMDC Tributary 1 flows to the NEMDC and conveys flows from southwest Placer County. There are 1526 acres in Placer County and 865 acres in Sacramento County. South Placer Vineyard Development will pay the Pump Station D-15 mitigation fee.

NEMDC Tributary 2 is a 2744 acre watershed area with no planned infill development, except the Elverta Specific Plan, which will attenuate peak flow and volume impacts with large detention basins.

NEMDC Tributary 3 is a 1567 acre watershed area with no planned infill development, except the Elverta Specific Plan.

East Natomas is an 1816 acre watershed area with no planned infill development.

#### DRAINAGE STUDIES FOR ZONE 11C DEVELOPING AREAS, AND AREAS IN NEED OF IMPROVEMENT

NEMDC Tributaries drainage study was developed by Borcalli & Associates in 1994. It is being used by Water Resources to condition development. The precipitation data and land use are still appropriate, as well as the hydrology (HEC-1). The hydraulic model is updated from HEC-2 to HEC-RAS as appropriate.

The Elverta Specific Plan has an approved drainage master plan that would include peak flow detention to minimize the impact to Tributaries 1 and 2.

Dry Creek Watershed Flood Control Plan was sponsored by both Placer County Flood Control District and the Sacramento County Water Agency and has been in use since 1992. It is currently being updated by Placer County. It is being used by both Placer County and Water Resources to condition development.

Robla/Maggie Creeks Drainage Study was developed by Borcalli & Associates for SAFCA, and the City and County of Sacramento in 1998, and updated by Mead & Hunt Engineers in 2007. It is being used by Water Resources to condition development.

South Placer Vineyard drainage study for the County of Placer.

## LIMITED LAND USE AREAS

There are large areas of the County that are excluded from the Watershed Management Plan and CRS Activity 450 because of their land use and lack of impact to urban and urbanizing watersheds. Natomas is surrounded by levees and all of the stormwater is pumped from the basin to the river. The south county agricultural areas are zoned large lot agriculture and there is an extremely small level of proposed development.

### NATOMAS

Located in the northwestern corner of Sacramento County is Natomas Basin Reclamation District 1000. 53,548 acres includes areas of Sutter County, the City of Sacramento, and Unincorporated Sacramento County. 26,449 acres of this reclamation district area is in Sacramento County. Sacramento Area Flood Control Agency with the State of California and the Corps of Engineers is constructing a massive levee improvement project to bring the levees protecting the basin up to a 200-year level of protection (0.5% annual recurrence). The US Army Corps of Engineers lifted their previous certification of this levee system and FEMA remapped the area as an AE flood zone effective December 8, 2008. Building permits will no longer be issued after that date awaiting reaccreditation of the levees and revised flood insurance rate maps. Internal drainage canals and pumps to the river system are operated by Reclamation District 1000. Developments are conditioned to attenuate discharge flows to predevelopment levels in areas where RD1000 pumps are not being improved.

There is some industrial development in the unincorporated county in the Natomas area all draining to reclamation district channels and pump plants. The unincorporated portion of the Natomas area is 87.5% agricultural and 5% developed and 7.5% developing. The major development is the Metro Air Park which attenuates its peak flow discharge to the RD1000 channels and pumps.

This is the very bottom of the 2100 square mile American River watershed and nearly the bottom of the 27,000 square mile Sacramento River watershed so discharge from RD1000 would not exacerbate peak flow in the river.

### SOUTH COUNTY AGRICULTURAL AREAS

The Southeastern part of the County is primarily zoned large lot agricultural with a population of 23,509 at an average density of 39 people per square miles. This area is controlled as agricultural land by the County General Plan. The FEMA special flood hazard designation

envelopes 31% of the land in this area. The FEMA flood insurance studies and California Department of Water Resources advisory floodplain study suffice to protect the modest amount of expected construction in this area.

Coyote Creek is being master planned and FEMA mapped as part of a proposed development known as Cordova Hills.

Deer Creek is being master planned and FEMA mapped as part of a proposed development known as Cordova Hills.

Cosumnes River is a wild and scenic river with agricultural levees and no flood control. The floodplain assumes levee breaches and is quite wide. The zoning within the floodplain area is large lot agricultural.

Beach Stone Lake floodplain is caused by Laguna and Morrison Creek watershed, Cosumnes River and backwater from the Delta. This expansive floodplain area is zoned large lot agricultural.

The Delta area is protected by levees that were first built during the Gold Rush era and have subsequently been improved by various state and federal programs. The Delta is an integral feature in the state water project providing water to the greater central and southern California agricultural and urban areas. The state and federal governments are working on a long term Delta Vision with a goal of sustainability. The communities of Walnut Grove, Locke, Courtland, Hood, and Freeport in the unincorporated county and incorporated City of Isleton lie in areas of flood risk should there be levee failure on various Delta islands. Internal drainage is managed by Reclamation Districts who are also charged with maintenance of the levee systems. There are 78,324 acres already in the FEMA floodplain in the Delta. There are 84.8 miles of levees that are accredited and protecting 34,000 acres of land currently mapped by FEMA as Zone X. Sacramento County is in the process of a FEMA map modernization project and anticipates that some of this area may be de-accredited and remapped as an A zone. With the exception of the towns listed above, the Delta is large lot agricultural zoning.

## COOPERATIVE TECHNICAL PARTNERSHIPS

Sacramento County has a cooperative technical partnership agreement with each of its seven cities and with neighboring Placer County and the City of Roseville.

## WATERSHED AGREEMENTS

### SACRAMENTO COUNTY AND PLACER COUNTY

Dry Creek conveys flows from Placer County. The Dry Creek drainage study dated 1992 was a joint effort of both the counties of Placer and Sacramento. Placer County agreed to attenuate peak flow impacts. Sacramento County agreed to pay a fair share impact fee for development in watersheds draining toward Placer County (Linda Creek and north flowing Dry Creek Tributaries such as Parkway Greens).

The South Placer Vineyard proposed development north of the Sacramento County line drains mostly to Steelhead Creek, known also as Natomas East Main Drainage Canal, tributaries. The development is conditioned to pay the Steelhead Creek Fair Share Fee as described in the Zone 11C Engineer's Report dated August 16, 2004.

### SACRAMENTO COUNTY AND CITY OF SACRAMENTO

The following watersheds flow from the County to the City: Morrison, Elder, Gerber, Florin, Unionhouse, Strawberry, Whitehouse, Laguna and Elk Grove Creeks.

The South Sacramento Streams Group Flood Control Plan is an ongoing US Army Corps of Engineers project working with the Sacramento Area Flood Control Agency as the lead agency and the County and City as local sponsors. This is primarily a floodwall project in the City of Sacramento on the following creeks:

- Lower Morrison
- Florin
- Elder
- Unionhouse

A drainage study was recently performed on Upper Morrison Creek by a consultant for Water Resources. The study focused on a reach of aggregate strip mines from the City boundary upstream to the Aspen VI/Vineyard I mining pit just upstream of Jackson Road. High flows from the channel are diverted into the Aspen VI/Vineyard pit over a weir constructed in a realigned channel. This weir controls peak flows downstream. The study developed hydrologic (SacCalc) and hydraulic (HEC-RAS) models that are being used for planned development throughout the

reach. It also ensures that design flows for the South Sacramento Streams Group floodwall project on Morrison Creek will not be exceeded.

#### SACRAMENTO COUNTY AND CITY OF RANCHO CORDOVA

The Sacramento County Department of Water Resources provides drainage services to the City of Rancho Cordova including floodplain management, review of drainage studies and improvement plans, and maintenance of the storm drainage systems. Rancho Cordova is located within Zone 11 A and B of the Sacramento County Water Agency which charges a development fee to new projects to fund the planning, design and construction of new trunk drainage systems. The City of Rancho Cordova charges city residents a Rancho Cordova Stormwater Utility Fee to pay for the bulk of drainage program services. Generally, Rancho Cordova is upstream of the unincorporated county.

#### SACRAMENTO COUNTY AND CITY OF ELK GROVE

Elk Grove has their own drainage and floodplain management staff but the City still lies within Zone 11A of the Sacramento County Water Agency and participates in the regional trunk drainage development fee program. City residents pay an Elk Grove Storm Water Utility Fee for drainage services provided by the City. All of the watersheds in the City have been master-planned. The city sits low in the county watersheds and drains to the Beach Stone Lake floodplain. Development in Zone 11A pay a Beach Stone Lake volume mitigation fee held in a trust for a future project. The Laguna West and Laguna Stonelake projects paid lump sum fees toward Beach Stone Lake Mitigation. Proposed projects for agricultural residences in the Beach Stone Lake floodplain include elevation, berms, and walls. The County Department of Water Resources pays flood insurance premiums for many homes in this floodplain from interest earned on funds held in the account.

Upstream watersheds draining into the City of Elk Grove include Strawberry Creek and Laguna Creek. Strawberry Creek is built out. Laguna Creek is master-planned and there is a flow rate at the city border that will be held as the maximum 100-year peak. This is memorialized in a FEMA Letter of Map Revision. The County is planning to utilize a large aggregate mine as a peak flow detention basin, known as Triangle Rock, to control flood flows while allowing a range of lower frequency flows to maintain aquatic habitat and geomorphologic characteristics.

## COUNTY OF SACRAMENTO AND CITY OF CITRUS HEIGHTS

Citrus Heights is almost entirely built-out and is located in the upstream (northeast) portion of the natural stream watersheds. The largest infill is at Gum Ranch on South Branch Arcade Creek, which is slated for a regional detention basin. This basin will serve to attenuate peak flow immediately downstream and at the confluence with Arcade Creek.

The City of Citrus Heights is in Zone 11B and residents pay the Stormwater Utility Fee. The City's General Services Department provides over site for its drainage program, however, the bulk of City drainage services are provided by under an agreement with the County of Sacramento.

## CITY OF FOLSOM

The City of Folsom is at the top of its watersheds and drains directly to the American River. Because of this there is little interaction between agencies regarding drainage and floodplain issues.

## CITY OF GALT

The City of Galt is located in the middle of the rural unincorporated south County and is a pass-through for upstream rural County runoff as it drainage southwest. Deadman's Gulch and Hen Creek are the two primary watersheds serving the City. There is much cooperation between the City of Galt and the County of Sacramento Department of Water Resources associated with managing flows in these watersheds. Peak flow detention is not deemed necessary on the main branches of these streams, but there is need for detention basins to attenuate flow where there are storm drain system deficiencies. Much of the area is topographically flat and the defined drainage systems handle about a 2-year storm event.

### West Galt Drainage Study

This drainage study was developed by Water Resources in 2003. It was approved for use by Sacramento County and the City of Galt. It is being used by Water Resources to condition development. The precipitation data and land use are still appropriate, as well as the hydrologic (HEC-1) and hydraulic (HEC-RAS) methods.

## CITY OF ISLETON

The City of Isleton is on Andrus Island and is isolated from drainage systems managed by the County.

Stormwater and watersheds are managed in accordance with County Standards, including:

- Volume 2 Hydrology Standards, 1996 [www.saccounty.net -search: volume 2 hydrology standards]
- Improvement Standards, 2006 [www.saccounty.net -search: improvement standards]
- Floodplain Management Ordinance, 2007, County Zoning Code [www.saccounty.net -search: floodplain management ordinance]
- County of Sacramento General Plan, 1993, and as currently being updated [www.saccounty.net -search: general plan]
- Stormwater Quality Design Manual, 2007 [www.saccounty.net -search: stormwater quality design]
- Sacramento County Code, 2008 [www.saccounty.net -search: county code]
- Local Floodplain Management Plan, 2001 for Sacramento County was replaced with Multi-Hazard Mitigation Plan, 2004, Chapter 6.1 [www.saccounty.net -search: hazard mitigation plan]
- Title 1 and 2 of the Sacramento County Water Agency Code and the Zone 11 Fee Plan, 2004 [www.saccounty.net -search: zone 11]