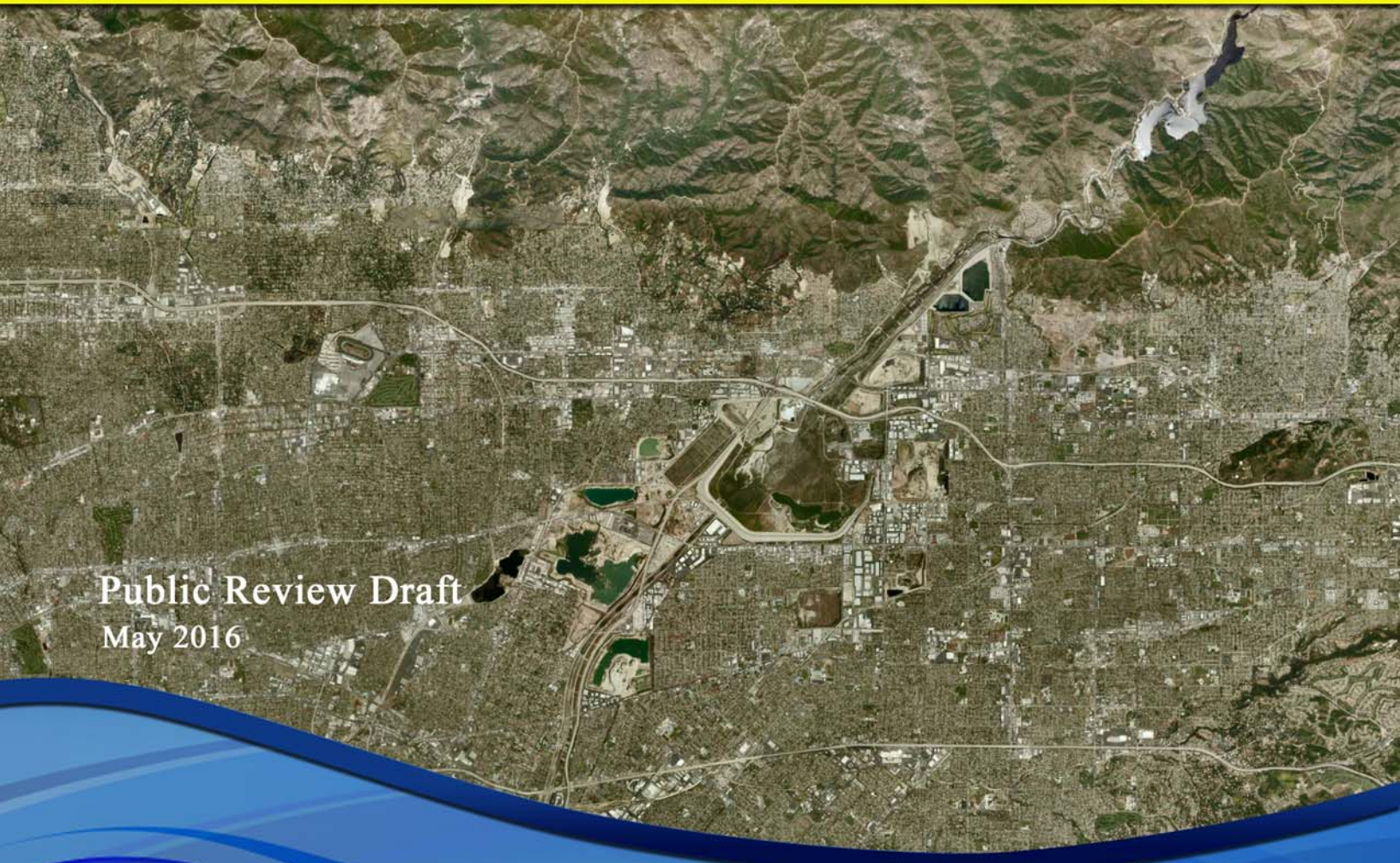
# Comprehensive Floodplain Management Plan



Public Review Draft
May 2016

TETRA TECH

# Los Angeles County
# COMPREHENSIVE FLOODPLAIN MANAGEMENT PLAN

## PUBLIC REVIEW DRAFT

MAY 2016

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Los Angeles County
# Comprehensive Floodplain Management Plan

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# EXECUTIVE SUMMARY

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## WHY PLAN FOR FLOODING?

Despite the record drought affecting Southern California today, the potential for flooding that results in personal and economic losses remains an issue in Los Angeles County. Since 1969, communities in Los Angeles County have been affected by 13 flood-related events for which federal disaster declarations were issued, and others that caused damage though no federal declarations were made, such as the following recent occurrences:

- In the fall of 2015, a severe storm brought torrential rains, flooding and mud and debris flows to the Antelope Valley. In Palmdale, a motorist was killed as a result of the flooding. Mudflows shut down Highway 58 and several homes were severely damaged (Pamer et al., 2015).
- In 2014, Hurricane Marie brought one of the largest hurricane-related surf events in decades to Southern California, leading to overall losses of $20 million. Hurricane Marie is the seventh most-intense Pacific hurricane on record (Wikipedia, 2016).
- In the summer of 2013, 1.16 inches of rainfall in one hour was recorded in the Antelope Valley, resulting in flash flooding that caused road closures (Lopez, 2013).

Los Angeles County has implemented many mitigation and flood control projects and plans, but is constantly seeking additional ways to mitigate flood impacts on the community. This update of the *Los Angeles County Comprehensive Floodplain Management Plan* reviews existing programs and recommends enhancements to them. This is the third iteration of the County's floodplain management plan and the first that comprehensively addresses all unincorporated areas.

The floodplain management plan is an important component of the County's participation in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS). Developing a floodplain management plan is among the activities that earn CRS credit toward reduced flood insurance rates. The CRS program sets forth requirements that floodplain management plans be updated on a five-year cycle and that progress on meeting plan objectives be reviewed annually.

## WHAT IS A FLOODPLAIN MANAGEMENT PLAN?

Hazard mitigation is defined as "sustained action taken to reduce or eliminate long-term risk to life and property." It involves planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards on a defined planning area. A floodplain management plan is "an overall strategy of programs, projects, and measures that will reduce the adverse impact of the hazard on the community and help meet other community needs." The responsibility for flood hazard mitigation lies with many, including private property owners, business, industry, and local, state and federal government. Recognizing that there is no one solution for mitigating flood hazards, planning provides a mechanism to identify the best alternatives within the capabilities of a jurisdiction. A floodplain management plan achieves the following in order to set the course for reducing the risk associated with flooding:

- Ensuring that all possible floodplain management activities are reviewed and implemented so that local problems are addressed by the most appropriate and efficient solutions.
- Ensuring that floodplain management activities are coordinated with one another and with other community goals and activities, preventing conflicts and reducing the cost of implementing each individual activity.

- Coordinating local floodplain management activities with federal, state and regional programs.
- Educating residents on the flooding hazard, loss reduction measures, and the natural and beneficial functions of floodplains.
- Building public and political support for mitigation projects.
- Fulfilling planning requirements for obtaining state or federal assistance.
- Facilitating the implementation of floodplain management and mitigation activities through an action plan that has specific tasks, staff assignments and deadlines.

The *Los Angeles County Comprehensive Floodplain Management Plan* identifies 35 mitigation action, chosen through a facilitated process that focused on meeting these objectives. A companion document prepared in conjunction with this plan, the *Los Angeles County Repetitive Loss Area Analysis*, provides a detailed assessment of areas in unincorporated Los Angeles County that have experienced repeated flood damage in the past, with recommended actions to mitigate flooding at each specific repetitive loss area.

## THE COMMUNITY RATING SYSTEM

The Community Rating System is a voluntary program within the National Flood Insurance Program that encourages floodplain management activities that exceed the minimum NFIP requirements. The CRS outlines 18 creditable activities that fulfill the program goals of reducing flood losses, facilitating accurate insurance rating and promoting awareness of flood insurance. The activities are in four categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

Flood insurance premiums in participating communities are discounted to reflect the reduced flood risk resulting from community actions to meet the CRS goals. Table ES-1 shows the discounts offered for the range of CRS community classifications, and the credits required for each classification.

Los Angeles County has participated in the CRS program since 1990. The County has a Class 7 rating, so citizens who live in a 100-year floodplain can receive a 15-percent discount on flood insurance; outside the 100-year floodplain they receive a 5-percent discount. This equates to a savings ranging from $66 to $475 per policy, for a total countywide premium savings of almost $350,000. The floodplain management plan will help the County maximize its credit potential under the CRS.

## PLAN DEVELOPMENT METHODOLOGY

The first priority for this plan is to benefit the citizens of unincorporated Los Angeles County by providing protection against the hazard posed by potential flooding. In addition, the plan has been developed to follow the guidelines for flood planning presented by FEMA for the CRS program. To earn CRS credit for a floodplain management plan, the community's process for developing the plan must include at least one item from each of 10 steps. The organization of this document corresponds with these steps:

- **Part 1—Planning Process and Project Background:**
  - Step 1, Organize
  - Step 2, Involve the public
  - Step 3, Coordinate

**TABLE ES-1.**
**CRS CLASSES, CREDIT POINTS AND PREMIUM DISCOUNTS**

| CRS Class | Credit Points | Premium Reduction[c] | |
|---|---|---|---|
| | | In Special Flood Hazard Area[a] | Outside Special Flood Hazard Area[b] |
| 1 | 4,500+ | 45% | 10% |
| 2 | 4,000-4,499 | 40% | 10% |
| 3 | 3,500-3,999 | 35% | 10% |
| 4 | 3,000-3,499 | 30% | 10% |
| 5 | 2,500-2,999 | 25% | 10% |
| 6 | 2,000-2,499 | 20% | 10% |
| 7 | 1,500-1,999 | 15% | 5% |
| 8 | 1,000-1,499 | 10% | 5% |
| 9 | 500-999 | 5% | 5% |
| 10 | 0-499 | 0 | 0 |

a. Zones A, AE, A1–A30, V, V1–V30, AO, and AH
b. Zones X, B, C, A99, AR, and D. Preferred Risk Policies are not eligible for CRS premium discounts because they already have premiums lower than other policies. Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage. Some minus-rated policies may not be eligible for CRS premium discounts.
c. Premium discounts are subject to change.

*Source*: CRS 2013 Coordinator's Manual

- **Part 2—Risk Assessment:**
  - Step 4, Assess the hazard
  - Step 5, Assess the problem
- **Part 3—Mitigation Strategy:**
  - Step 6, Set goals
  - Step 7, Review possible activities
  - Step 8, Draft an action plan
- **Part 4—Plan Maintenance:**
  - Step 9, Adopt the plan

    Step 10, Implement, evaluate and revise.

The following sections provide summaries of the planning process and recommendations of the *Los Angeles County Comprehensive Floodplain Management Plan* corresponding with the document organization presented above.

## PLANNING PROCESS AND PROJECT BACKGROUND

A 13-member steering committee, consisting of County staff, citizens and other stakeholders in the planning area, was assembled to oversee the development of the plan. This committee met nine times over a 12-month period to provide guidance and oversight to a nine-member planning team consisting of County staff and a technical consultant. The planning team was responsible for the development of the plan.

Coordination with regional, state and federal agencies involved in flood hazard mitigation occurred throughout the plan's development. A comprehensive review was completed of existing plans and programs that can support flood hazard mitigation.

The Steering Committee developed a public involvement strategy that was implemented by the planning team and included five public meetings, three town council presentations, an additional public meeting to review the draft plan, a flood preparedness/hazard mitigation survey, a County-sponsored website dedicated to the plan (http://dpw.lacounty.gov/WMD/NFIP/FMP/), and multiple media releases.

In addition to the public involvement strategy implemented during the plan development, the planning team facilitated the development of a Program for Public Involvement framework, according to CRS Activity 330 requirements. This framework sets the course for Los Angeles County to implement an annual public information program that will maximize credit potential under the CRS program.

## THE FLOOD HAZARD RISK ASSESSMENT

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards such as flooding. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The risk assessment for this plan used the best available data, science and technology, with tools that included GIS and FEMA's risk assessment platform, Hazus-MH. Hazus-MH is an analysis program that includes extensive inventory data, such as demographics, building stock, critical facilities, transportation facilities and utilities. It uses multiple models to estimate potential losses from natural disasters. The program maps hazard areas and estimates damage and economic losses for buildings and infrastructure. Some key findings from the risk assessment of this plan are as follows:

- The risk assessment profiles five types of flood hazards in unincorporated Los Angeles County: flooding in FEMA-designated Special Flood Hazard Areas (SFHA), flash flooding, non-SFHA urban drainage flooding, non-SFHA coastal flooding (storm surge, coastal erosion and tsunami), and dam and levee failures.
- There have been 13 flood events in Los Angeles County that caused sufficient damage to trigger a presidential disaster declaration since 1969. This equates to a significant flood event every 3.5 years over the past 50 years.
- Unincorporated Los Angeles County includes over 88,000 acres of mapped 100-year floodplain, which encompasses over 1,750 structures, most of which are residential.
- The analysis estimated $1.23 billion of building-and-contents exposure to the 100-year flood, representing 0.89 percent of the total replacement cost of the planning area, and $9.48 billion of building-and-contents exposure to the 500-year flood, representing 6.88 percent of the total replacement cost value of the planning area.
- The analysis identified the following exposure of critical facilities and infrastructure:
  - Nine critical facilities and over 70 critical pieces of infrastructure exposed to floods up to the 100-year event.
  - Over 70 critical facilities and over 120 critical pieces of infrastructure exposed to floods up to the 500-year event.
- An estimated 28.6 percent of the people within the households in the census blocks that intersect the 100-year floodplain are economically disadvantaged, defined as having household incomes of $20,000 or less.

- A 100-year flood event in unincorporated Los Angeles County could displace over 5,700 persons, with over 3,100 persons requiring short-term shelter.
- The analysis estimates that a 100-year flood event in unincorporated Los Angeles County could cause damage to over 1,300 structures, totaling over $162 million in property damage.
- A 100-year flood event in unincorporated Los Angeles County could generate over 5,700 tons of building-related debris.
- The average flood insurance claim paid in the planning area ($8,319) represents about 2.14 percent of the 2014 average replacement cost value of structures in the floodplain. Based on U.S. Army Corps of Engineers generic flood-depth/damage curves, this correlates to a flood depth of less than 1 foot for a 1-story structure with no basement.

# MITIGATION STRATEGY

## Mitigation Mission Statement, Goals and Objectives

The Steering Committee identified a mission statement, goals and objectives.

- Mission statement—Protect life, property, the economy and the environment of Los Angeles County by identifying and communicating risks and sustainable actions to reduce flood hazards.
- Goals
    1. Protect life, safety, property, and economy.
    2. Work with local citizens and watershed management groups so that residents understand the flood hazard of the region based on best available data and science.
    3. Increase resilience of infrastructure and critical facilities.
    4. Account for flood risk in land use and planning.
    5. Preserve, enhance, or restore the natural environment's floodplain functions.
    6. Encourage the development and implementation of long-term, cost-effective, and environmentally-sound mitigation projects.
- Objectives
    1. Work cooperatively with public agencies with responsibility for flood protection and with stakeholders in planning for flood and inundation hazards.
    2. Utilize best available data, science, and technologies to improve understanding of the location and potential impacts of flood hazards.
    3. Provide state, county, and local agencies and stakeholders with updated information about flood hazards, vulnerabilities, and mitigation measures.
    4. Create a public outreach strategy.
    5. Discourage new development in known flood hazard areas or ensure that, if development occurs in those areas, it is done in a way to minimize flood risk.
    6. Consider open space land uses within known flood hazard areas.

7. Provide the highest degree of flood hazard protection at the least cost by working with environmentally friendly natural systems and by using prevention as the first priority.
8. Retrofit, purchase, and relocate structures in known flood hazard areas, especially those known to be repetitively damaged.
9. Provide flood protection by maintaining flood control systems.
10. Sustain reliable local emergency operations and facilities during and after a flood event.
11. Consider climate change implications in planning for flood and inundation hazards.

These planning components all directly support one another. Goals were selected that support the mission statement, and objectives were identified that fulfill multiple goals. Mitigation initiatives were identified that achieve multiple objectives.

## Mitigation Initiatives

The action plan is a key element of the floodplain management plan. It is through the implementation of the action plan that unincorporated areas in the County of Los Angeles can strive to become flood disaster-resilient. The action plan includes an assessment of the capabilities of the County to implement hazard mitigation initiatives, a review of alternatives, and a mitigation strategy matrix and prioritization matrix that identify the following:

- Description of the action
- Objectives addressed
- Lead implementation agency (or agencies)
- Estimated benefits
- Estimated costs
- Timeline for implementation
- Funding sources
- Prioritization

For the purposes of this document, mitigation initiatives are defined as activities designed to reduce or eliminate losses resulting from the impacts of flooding.

Although one of the driving influences for preparing this plan was CRS, this plan does not focus solely on CRS credits. It was important to the County and the Steering Committee to examine initiatives that would work through all phases of emergency management. Some of the initiatives outlined in this plan fall outside CRS credit criteria, and CRS creditability was not the focus of their selection. Rather, the focus was on the initiatives' effectiveness in achieving the goals of the plan and whether they are within the County's capabilities. Table ES-2 presents a summary of the hazard mitigation initiatives identified in the action plan.

**TABLE ES-2.**
**SUMMARY OF HAZARD MITIGATION INITIATIVES**

| Initiative # | Description | Priority |
|---|---|---|
| 1 | Promote awareness of flood hazards to residents in flood hazard areas. | High |
| 2 | Develop and distribute flood protection information and materials to property owners, renters, and developers in high-risk areas. | High |
| 3 | Maintain a list of critical facilities located in FEMA-designated flood zones, provide flood protection information to operators of these critical facilities, and encourage the implementation of flood protection measures. | High |
| 4 | Investigate repetitive loss properties identified by FEMA and update the repetitive loss property and high-risk property list. Conduct the following flood control activities for these properties:<br>• Annually notify owners regarding local flood hazards and proper protection activities<br>• Provide technical advice regarding flood protection and flood preparedness<br>• Distribute a revised questionnaire to new repetitive loss properties. | High |
| 5 | Make sand bags available to flood risk property owners during the wet season, provide notifications of the availability of these materials, and track the distribution of the materials. | High |
| 6 | Provide public education about maintaining the stormwater system free of debris. | High |
| 7 | Continue to maintain/enhance the County's classification under the Community Rating System to address increased flood insurance costs and promote safety and preparedness. | High |
| 8 | Implement the Program for Public Information protocol identified in this plan including appropriate messaging for compliance with ADA. | High |
| 9 | Provide emergency preparedness and flood protection information to the general public. | High |
| 10 | Distribute information regarding flood prevention and flood insurance at emergency operations and emergency preparedness events. | High |
| 11 | Develop and maintain a list of priority maintenance-related problem sites. | High |
| 12 | Conduct routine maintenance of flood control facilities and additional maintenance as needed at priority maintenance-related flood problem sites. | High |
| 13 | Conduct a stormwater facilities condition assessment to identify the physical and hydraulic condition of the system and to support infrastructure management. | High |
| 14 | Evaluate storm drain, open channel, and flood retention basin facilities for future improvements. | High |
| 15 | Pursue appropriate flood hazard mitigation grant funding. | High |
| 16 | Consider the conversion of high-risk properties into open space. | High |
| 17 | Refine the plan check system to track properties in the flood zone and address drainage. | Medium |
| 18 | Flag repetitive loss properties in the plan, and check database for review and approval of building permit applications. | High |
| 19 | Maintain a database system for tracking all reviewed and approved elevation certificates prior to the closure of a building permit. | High |
| 20 | Evaluate opportunities for incorporating watershed ecosystem restoration into projects. | High |
| 21 | Where feasible, cost-effective and supported both publicly and politically, restore the natural and beneficial functions of floodplains. | Medium |
| 22 | Encourage the application of biological resource measures for the control of stormwater and erosion to the best of their applicable limits. | High |

**TABLE ES-2.**
**SUMMARY OF HAZARD MITIGATION INITIATIVES**

| Initiative # | Description | Priority |
|---|---|---|
| 23 | Maintain the Operational Area Emergency Response Plan. | High |
| 24 | Maintain standards for the use of structural and non-structural techniques that mitigate flood hazards and manage stormwater pollution. | High |
| 25 | Continue to require environmental review in the development process to provide for the creation or protection of natural resources that can mitigate the impacts of development. | High |
| 26 | Where appropriate, support retrofitting, purchase, or relocation of structures in hazard-prone (high risk) areas to prevent future structure damage. Give priority to properties with exposure to repetitive losses. | High |
| 27 | Use risked-based information from the *Los Angeles County Comprehensive Floodplain Management Plan* and the *Los Angeles County Hazard Mitigation Plan* to update the safety element of the County's general plan. | High |
| 28 | Continue to maintain good standing under the National Flood Insurance Program by implementing programs that meet or exceed the minimum NFIP requirements. Such programs include enforcing an adopted flood damage prevention ordinance, participating in floodplain mapping updates, and providing public assistance and information on floodplain requirements and impacts. | High |
| 29 | Consider the best available data and science to determine probable impacts on all forms of flooding from global climate change when making program enhancements or updates to the County's floodplain management program. | High |
| 30 | Identify flood-warning systems for properties where such systems can be beneficially employed. | Medium |
| 31 | Consider the development of a comprehensive flood warning and response plan for the unincorporated County that would become a functional annex to the Operational Area Emergency Response Plan and meet the Community Rating System Activity 610 requirements. | High |
| 32 | Continue to enforce the County's development regulations to prevent increases of the flood hazard on adjacent properties. | High |
| 33 | Conduct an evaluation of FEMA-designated flood zones and revise/update them to reflect current conditions. | High |
| 34 | Continue to maintain and update the Hazus-MH model constructed to support the development of this plan, in order to make flood risk information available to property owners. | High |
| 35 | Continue County coordination with other agencies and stakeholders on issues of flood control. | Medium |

## PLAN MAINTENANCE

After the plan has been adopted by the Los Angeles County Board of Supervisors and reviewed by the Insurance Services Office, the contractor for the CRS, plan implementation and maintenance will begin. This plan includes a plan implementation and maintenance section that details the formal process for ensuring that the plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every five years. Plan implementation and maintenance includes continued public involvement and incorporation

of the recommendations of this plan into other planning mechanisms of the County, such as the general plan, capital improvement program, and hazard mitigation plan.

Full implementation of the recommendations of this plan will require time and resources. This plan reflects an adaptive management approach in that specific recommendations and plan review protocols are provided to evaluate changes in vulnerability and action plan prioritization after the plan is adopted. The true measure of the plan's success will be its ability to adapt to the ever-changing needs of hazard mitigation. Funding resources are always evolving, as are programs based on state or federal mandates.

The County of Los Angeles has a long-standing tradition of proactive response to issues that may impact its citizens. The County's commitment to proactive floodplain management is evidenced by its participation in the CRS program and the development of this plan. Its well-established programs and policies have strived to maintain the flood risk at a steady level without increase. The framework established by this plan will help maintain this tradition in that it identifies a strategy that maximizes the potential for implementation based on available and potential resources. It commits the County to pursue initiatives when the benefits of a project exceed its costs. Most important, the County developed this plan with extensive public input. These techniques will set the stage for successful implementation of the recommendations in this plan. The Los Angeles County Board of Supervisors will assume responsibility for adopting the recommendations of this plan and committing County resources toward its implementation.

# PART 1 —
# PLANNING PROCESS AND PROJECT BACKGROUND

# CHAPTER 1.
# INTRODUCTION

## 1.1 BACKGROUND

Prior to the late 1960s, the typical approach to flooding in the U.S. focused on constructing flood-control works, such as dams, levees and seawalls, and providing disaster relief to victims when flooding occurred. This approach did little to discourage unwise development near waterways, and may actually have encouraged such development in some instances. At the same time, due to the high risk and seasonal nature of flooding, insurance companies were unable to provide flood insurance that was affordable to most Americans. Under these circumstances, government expenditures on flood disaster relief rose steadily over the years.

Finally, in 1968, the U.S. addressed the escalating cost of flood disaster relief by creating the National Flood Insurance Program (NFIP). The NFIP establishes an agreement between local communities and the federal government—if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks, then the federal government will make flood insurance available within the community as a financial protection against flood losses. The NFIP is administered by the Federal Emergency Management Agency (FEMA). All communities that participate in the NFIP must adopt and enforce minimum standards for managing construction and development in designated "special flood hazard areas." Communities that achieve a higher level of safety and protection than provided by the minimum standards can participate in the NFIP's Community Rating System (CRS) to obtain discounts on flood insurance premiums.

## 1.2 WHY PREPARE THIS PLAN?

Los Angeles County participates in both the NFIP and the CRS, and the *Los Angeles County Comprehensive Floodplain Management Plan* is an important part of the County's participation in those programs. Developing a comprehensive floodplain management plan is among the activities that earn CRS credits toward reduced flood insurance rates. This floodplain management plan was developed to meet the following objectives:

- Comply with local, state and federal requirements for floodplain management planning.
- Meet requirements allowing Los Angeles County to enhance its CRS classification.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.
- Create a linkage between the floodplain management plan and established plans of Los Angeles County so that they can work together in achieving successful mitigation.

This plan describes the flood hazard in unincorporated areas of Los Angeles County and presents measures to mitigate those hazards. The purpose of these measures is to reduce or alleviate the loss of life, personal injury, and property damage that can result from flooding. They involve long- and short-term strategies such as planning, policy changes, programs, projects, and other activities to mitigate the impacts of floods.

## 1.3 PREVIOUS FLOODPLAIN MANAGEMENT PLANS

On March 31, 1992, the Los Angeles County Board of Supervisors adopted the *Repetitive Loss Plan for the National Flood Insurance Program CRS for Los Angeles County*. The plan was approved by FEMA. A

subsequent floodplain management plan for the repetitive loss properties was later prepared, and FEMA approved it on March 8, 2002. FEMA requires that such plans be updated every five years, and the County prepared a complete update in 2007. The 2007 floodplain management plan update was adopted by the Board of Supervisors on May 11, 2010.

The County's previous floodplain management plans did not address all of unincorporated Los Angeles County, but only properties that had been identified by FEMA as "repetitive loss properties"—properties for which two or more claims of $1,000 or more had been paid by the NFIP within any 10-year period since 1978. The most recent plan identified 19 such properties in the Malibou Lake area, 7 in the Santa Monica Mountains, 1 in Lancaster, 1 in Rowland Heights, 3 in the San Gabriel Mountains and 3 in Quartz Hill.

The County has developed the current floodplain management plan as an up-to-date tool for flood preparedness and flood hazard mitigation. It expands the previous efforts by addressing all of unincorporated Los Angeles County rather than the repetitive loss areas alone. It also addresses the many changes in local development and other conditions since the previous plans were prepared, as well as evolving local, state and federal regulations and programs. Elements and strategies in this plan were selected because they meet various state or federal program requirements as well as the needs of Los Angeles County and the citizens of its unincorporated areas.

A companion document prepared in conjunction with this plan, the *Los Angeles County Repetitive Loss Area Analysis*, provides a detailed assessment of areas in unincorporated Los Angeles County that have experienced repeated flood damage in the past, with recommended actions to mitigate flooding at each specific repetitive loss area.

## 1.4 CRS STEPS FOR FLOODPLAIN MANAGEMENT PLANNING

The first priority for this plan is to benefit the citizens of unincorporated Los Angeles County by providing protection against the hazard posed by potential flooding. In addition, the plan has been developed to follow the guidelines for flood planning presented by FEMA for the CRS program. To earn CRS credit for a floodplain management plan, the community's process for developing the plan must include at least one item from each of 10 steps (see Appendix B for details):

- Planning process steps:
  - Step 1, Organize
  - Step 2, Involve the public
  - Step 3, Coordinate
- Risk assessment steps:
  - Step 4, Assess the hazard
  - Step 5, Assess the problem
- Mitigation strategy steps:
  - Step 6, Set goals
  - Step 7, Review possible activities
  - Step 8, Draft an action plan
- Plan maintenance steps:
  - Step 9, Adopt the plan
  - Step 10, Implement, evaluate and revise.

## 1.5 HOW TO USE THIS PLAN

This floodplain management plan is organized into the following primary parts, which follow the organization of the CRS steps for floodplain planning:

- Part 1—Planning Process and Project Background
- Part 2—Risk Assessment
- Part 3—Mitigation Strategy
- Part 4—Plan Maintenance

Each part includes elements identified in the CRS's 10 steps. Appendices at the end of the plan include information to support the main content of the plan:

- Appendix A—Glossary of acronyms and definitions
- Appendix B—Description of CRS Planning Requirements
- Appendix C—Steering Committee Ground Rules
- Appendix D—Public outreach information, including the survey and summary and documentation of public meetings
- Appendix E—Locations of Critical Facilities and Critical Infrastructure by Watershed
- Appendix F—Mapped FEMA Flood Zones by Watershed
- Appendix G—Los Angeles County Mapped Floodways by Watershed
- Appendix H—Template for progress reports to be completed as this plan is implemented
- Appendix I—Framework for conducting the Program for Public Information over the next year.

# CHAPTER 2.
# PLAN DEVELOPMENT METHODOLOGY

The process followed to develop the *Los Angeles County Comprehensive Floodplain Management Plan* had the following primary objectives:

- Form a planning team
- Define the planning area
- Establish a steering committee
- Coordinate with other agencies
- Review existing programs
- Engage the public in development of the floodplain management plan.

These objectives are discussed in the following sections. A section at the end of this chapter also describes the development of a program for public involvement (PPI). The PPI outlines a strategy for public involvement after the floodplain management plan has been adopted and its recommendations are being implemented. The PPI is separate from the public involvement strategy used to develop the floodplain management plan itself.

## 2.1 FORMATION OF THE PLANNING TEAM

This planning project was initiated and overseen by the Los Angeles County Department of Public Works Watershed Management Division. Los Angeles County hired Tetra Tech, Inc. to assist with development and implementation of the plan. The Tetra Tech project manager reported directly to the Los Angeles County project manager. A planning team was formed to lead the planning effort (CRS Step 1), made up of the following members:

- Eduardo Escobar, P.E.—Civil Engineer
- George De La O, P.E.—Senior Civil Engineer
- Michael Chen—Principal Civil Engineering Assistant
- Jeff Li, P.E.—Senior Civil Engineering Assistant
- Terri Grant, P.E.—Principal Engineer
- Ira Artz, P.E.—Tetra Tech Project Manager
- Rob Flaner—Tetra Tech Hazard Mitigation Program Manager
- Kristen Gelino—Hazard Mitigation Planner
- Sara Townsend—Public Outreach Coordinator

## 2.2 DEFINING THE PLANNING AREA

The planning area was defined as all unincorporated areas of Los Angeles County. Some background information that was analyzed for the plan is available only at a countywide level, without breakdowns for incorporated and unincorporated areas. This information is identified as such where it is presented in the

plan. Information that is specific to unincorporated areas—such as flood hazard modeling results and areas addressed by proposed mitigation actions—is generally indicated as applying to "the planning area."

## 2.3 THE STEERING COMMITTEE

A steering committee was formed to oversee all phases of the planning effort. The members of this committee included key Los Angeles County staff, citizens, and other stakeholders from within the planning area. The planning team assembled a list of candidates representing interests within the planning area that could have recommendations for the plan or be impacted by its recommendations. The Steering Committee was established as the following 13 of those candidates:

- Hu Yi (Chairperson)—Flood Maintenance Division, Los Angeles County Department of Public Works
- Debbie Sharpton (Vice-Chairperson)—Mountains Restoration Trust
- Martin Araiza—Water Resources Division, Los Angeles County Department of Public Works
- John Blalock—Resident, Antelope Valley
- Mark Child— Los Angeles County Department of Regional Planning
- George De La O—Watershed Management Division, Los Angeles County Department of Public Works
- Loni Eazell—Disaster Services Group, Los Angeles County Department of Public Works
- Okorie Ezieme—Altadena Town Council
- Scott Gardner—Los Angeles County Fire Department
- Michael Hart—Malibou Lake Mountain Club
- Frank Lopez—Los Angeles Chamber of Commerce
- Lisa Naslund—Building & Safety Division, Los Angeles County Department of Public Works
- Kendra Pospychalla—American Red Cross, Los Angeles Region

Leadership roles and ground rules were established during the Steering Committee's initial meeting on August 26, 2014. The Steering Committee agreed to meet monthly as needed throughout the course of the plan's development. The planning team facilitated each Steering Committee meeting, which addressed a set of objectives based on an established work plan. The Steering Committee met nine times from August 2014 through April 2016. Meeting agendas, notes and attendance logs are available for review upon request. Appendix C includes the ground rules established by the Steering Committee and a full list of members, including designated alternates. All Steering Committee meetings were open to the public and advertised as such on the floodplain management plan website. The agendas and meeting notes were posted to the floodplain management plan website.

## 2.4 COORDINATION WITH OTHER AGENCIES

Opportunities for involvement in the planning process were provided as follows to neighboring communities, local and regional agencies involved in floodplain management, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (CRS Step 3):

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee.
- **Agency Notification**—The following agencies were invited to participate in the plan development from the beginning and were kept apprised of plan development milestones:
  - California State Department of Water Resources
  - California State Office of Emergency Services
  - City of Agoura Hills
  - City of Arcadia
  - City of Calabasas
  - City of Glendale
  - City of Glendora
  - City of La Canada Flintridge
  - City of La Verne
  - City of Lancaster
  - City of Los Angeles
  - City of Monrovia
  - City of Palmdale
  - City of San Dimas
  - City of Santa Clarita
  - City of Sierra Madre
  - City of Westlake Village
  - FEMA Region IX
  - Kern County
  - Orange County
  - San Bernardino County
  - Ventura County

  These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process.
- Pre-Adoption Review—All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the plan website. Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the Insurance Services Office, FEMA's CRS contractor, for a pre-adoption review to ensure CRS program compliance.

## 2.5 REVIEW OF EXISTING PROGRAMS

The planning effort included review and incorporation as appropriate of existing plans, studies, reports and technical information. Chapter 4 of this plan provides a review of laws and ordinances in effect that can affect mitigation actions, including an assessment of all Los Angeles County regulatory, technical and financial capabilities to implement flood hazard mitigation actions. In addition, the following programs can affect flood hazard mitigation in Los Angeles County:

- Los Angeles County 2035 General Plan
- Los Angeles County Operational Area Emergency Response Plan (prepared by Los Angeles County's Chief Executive Office; Office of Emergency Management)
- Los Angeles County All-Hazard Mitigation Plan
- Los Angeles County Capital Improvement Programs.

## 2.6 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about local needs are considered and addressed. CRS credits are available for providing opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval, as well as for optional public involvement activities (CRS Step 2).

### 2.6.1 Strategy

The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Steering Committee.
- Attempt to reach as many citizens as possible using multiple media.
- Use a survey to determine public perception of flood risk and support of mitigation actions.
- Identify and involve stakeholders
- Develop a Program for Public Information.
- Conduct public meetings to invite the public's input.

#### *Stakeholders and the Steering Committee*

Stakeholders are the individuals, agencies and jurisdictions that have a vested interest in the recommendations of this plan. The effort to include stakeholders in this process included stakeholder participation on the Steering Committee. Stakeholders targeted for this process included:

- Community representatives
- Los Angeles County divisions responsible for activities relevant to floodplain management
- Environmental advocacy groups
- Local disaster preparedness and response agencies
- Owners and operators of businesses within the floodplain
- Repetitive loss area representatives.

CRS Step 2 awards credit for a planning process conducted through a committee that includes members of the public and/or non-governmental stakeholders. The 13-member Steering Committee includes six non-governmental stakeholders (46.2 percent).

#### *Floodplain Management Plan Website*

At the beginning of the development of the current plan, a floodplain management plan section was developed on Los Angeles County's website to keep the public informed about planning activities and to solicit input (see Figure 2-1). The site's address (http://dpw.lacounty.gov/WMD/NFIP/FMP/) was publicized in all press releases, mailings and public meetings. The site provided the public with information on the plan development process, the Steering Committee, a project survey, and drafts of the plan. Los Angeles County will keep the website active after the plan's completion to keep the public informed about mitigation projects and future plan updates.

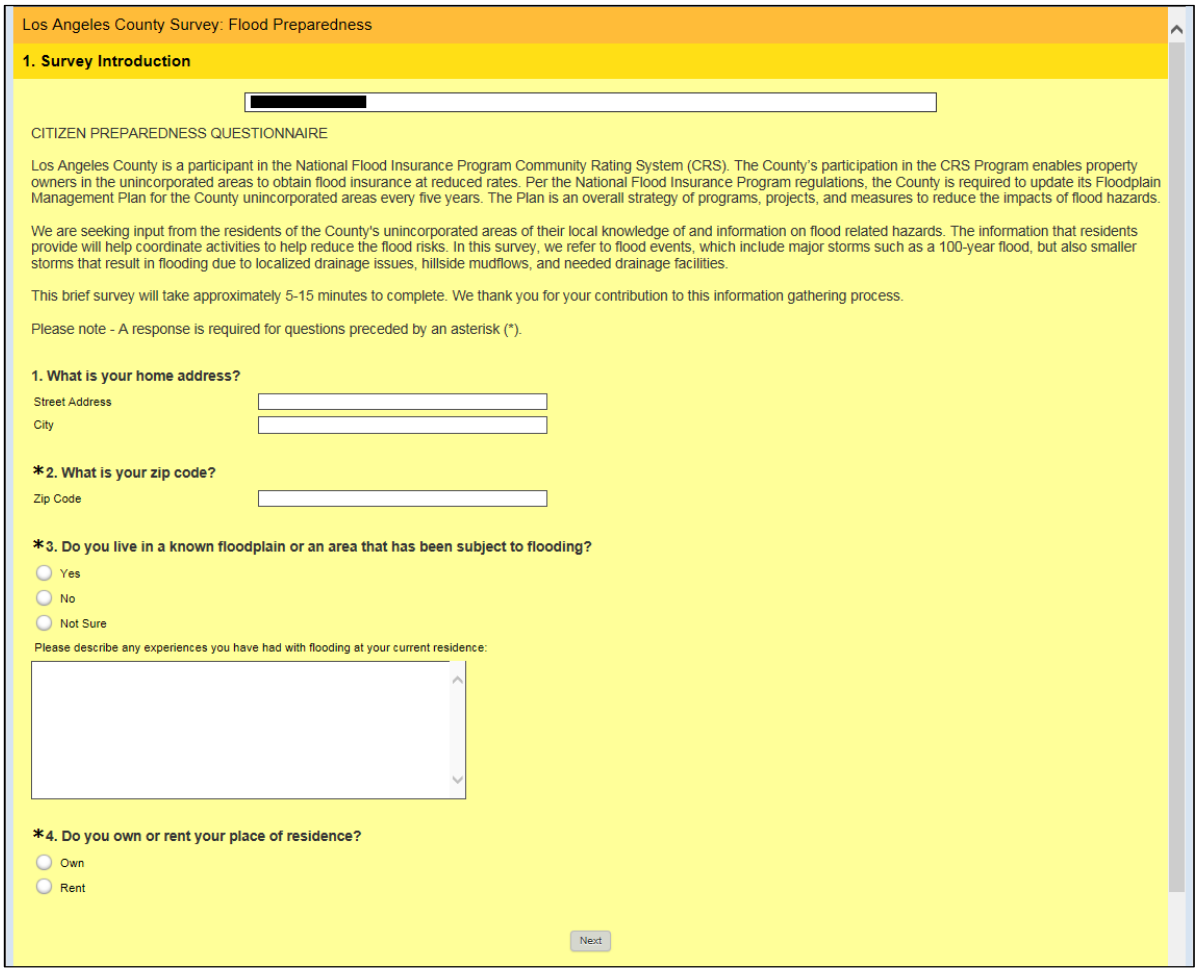

*Figure 2-1. Sample Page from Floodplain Management Plan Web Site*

## *Survey*

A survey (see Figure 2-2) was developed by the planning team with guidance from the Steering Committee. The survey was used to gauge household preparedness for the flood hazard and the level of knowledge of tools and techniques that assist in reducing risk and loss from flooding. This survey was designed to help identify areas vulnerable to floods. The answers to its 33 questions helped guide the Steering Committee in affirming the goals and objectives identified during the planning process and in selecting mitigation initiatives.

Multiple methods were used to solicit survey responses:

- A web-based version of the survey was made available on the plan website.
- Mailings to residents notifying them of public meetings included links to the online survey.
- All attendees at the public open houses were asked to complete a survey, using the web site or hard copies of the survey form available at the open houses.
- A flyer was prepared advertising the survey.
- Individual Steering Committee members contacted organizations to request that they publicize the link to the online survey; the following outlets were contacted in this way:
  - Los Angeles Chamber of Commerce weekly newsletter
  - Neighborhood Watch email lists
- The Los Angeles County Department of Public Works advertised the survey on its Twitter account (see Figure 2-3).


Los Angeles County Survey: Flood Preparedness

1. Survey Introduction

CITIZEN PREPAREDNESS QUESTIONNAIRE

Los Angeles County is a participant in the National Flood Insurance Program Community Rating System (CRS). The County's participation in the CRS Program enables property owners in the unincorporated areas to obtain flood insurance at reduced rates. Per the National Flood Insurance Program regulations, the County is required to update its Floodplain Management Plan for the County unincorporated areas every five years. The Plan is an overall strategy of programs, projects, and measures to reduce the impacts of flood hazards.

We are seeking input from the residents of the County's unincorporated areas of their local knowledge of and information on flood related hazards. The information that residents provide will help coordinate activities to help reduce the flood risks. In this survey, we refer to flood events, which include major storms such as a 100-year flood, but also smaller storms that result in flooding due to localized drainage issues, hillside mudflows, and needed drainage facilities.

This brief survey will take approximately 5-15 minutes to complete. We thank you for your contribution to this information gathering process.

Please note - A response is required for questions preceded by an asterisk (*).

1. What is your home address?

Street Address

City

*2. What is your zip code?

Zip Code

*3. Do you live in a known floodplain or an area that has been subject to flooding?

Yes

No

Not Sure

Please describe any experiences you have had with flooding at your current residence:

*4. Do you own or rent your place of residence?

Own

Rent

Next

*Figure 2-2. Sample Page from Survey Distributed to the Public*

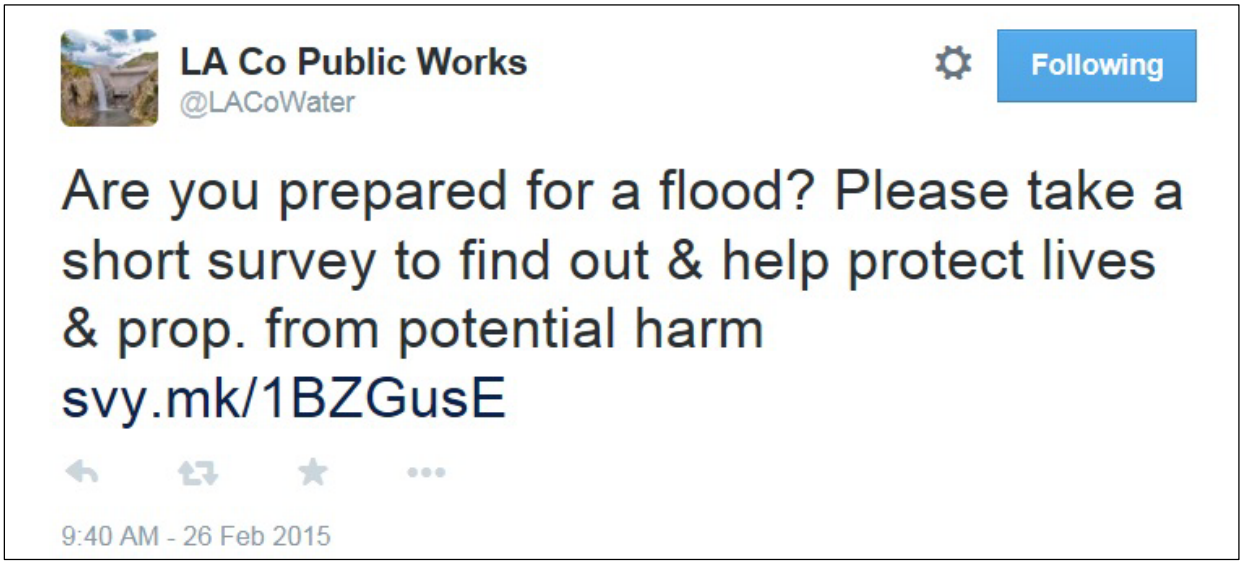



*Figure 2-3. Twitter Notification of Survey from Department of Public Works*

Hard copies of the survey were made available at the public open houses. A web-based version was available on the plan website. Although the number of surveys completed (136) is not sufficient to establish statistical trends, the responses provided valuable feedback to use in the planning process. The complete survey and a summary of its findings can be found in Appendix D.

## Open House Public Meetings

Meaningful public participation was essential for the planning process. Public meetings were held to disseminate information and to solicit input from community members, as summarized in Table 2-1.

**TABLE 2-1.**
**FLOODPLAIN MANAGEMENT PLAN OPEN HOUSE PUBLIC MEETINGS**

| When | Where |
|---|---|
| December 3, 2014, 4:00 pm to 7:00 pm | Agoura: Malibou Lake Mountain Club<br>29033 Lake Vista Drive, Agoura, CA 91301 |
| January 10, 2015, 2:00 pm to 5:00 pm | Altadena: Altadena Community Library<br>600 East Mariposa Street, Altadena, CA 91001 |
| January 24, 2015, 11:00 am to 2:00 pm | Santa Clarita: Canyon Country Jo Anne Darcy Library<br>18601 Soledad Canyon Road, Santa Clarita, CA 91351 |
| February 21, 2015, 12:00 pm to 3:00 pm | Lancaster: Lancaster Public Library<br>601 West Lancaster Boulevard, Lancaster, CA 93534 |
| April 2, 2015, 5:00 pm to 7:00 pm | Lynwood: Lynwood Library<br>11320 Bullis Road, Lynwood, CA 90262 |

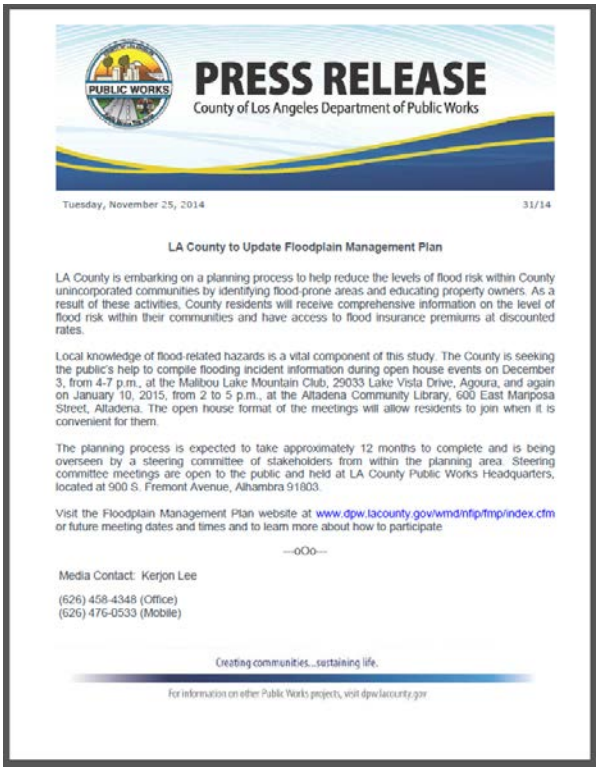
### Open House Meeting Notification

Multiple means were used to provide broad public notice of the open house public meetings:

- Notice of all public meetings was posted on the project website.
- Press releases were distributed to the media announcing meeting times and locations (see Figure 2-4)
- Flyers were developed and distributed throughout the communities (see Figure 2-5).
- Postcards were mailed to properties located in floodplains near the meeting locations (see Figure 2-6). Over the course of the planning process, 2,472 postcards were distributed.

### Open House Meeting Format

The public meeting format allowed attendees to examine maps and handouts and have direct conversations with project staff. Reasons for planning and information generated for the risk assessment were shared with attendees via a PowerPoint presentation. Computer mapping workstations loaded with output from the Hazus modeling allowed citizens to see information on their property, including exposure and damage estimates for flood hazard events (see Figure 2-7). Participating property owners were provided printouts of this information for their properties. This tool was effective in illustrating risk to the public. Planning team members were present to answer questions. Each citizen attending the open houses was asked to complete a survey, and each was given an opportunity to provide written comments to the Steering Committee. Example meeting activities are shown in Figure 2-8 through Figure 2-11



PRESS RELEASE

County of Los Angeles Department of Public Works

Tuesday, November 25, 2014 31/14

**LA County to Update Floodplain Management Plan**

LA County is embarking on a planning process to help reduce the levels of flood risk within County unincorporated communities by identifying flood-prone areas and educating property owners. As a result of these activities, County residents will receive comprehensive information on the level of flood risk within their communities and have access to flood insurance premiums at discounted rates.

Local knowledge of flood-related hazards is a vital component of this study. The County is seeking the public's help to compile flooding incident information during open house events on December 3, from 4-7 p.m., at the Malibou Lake Mountain Club, 29033 Lake Vista Drive, Agoura, and again on January 10, 2015, from 2 to 5 p.m., at the Altadena Community Library, 600 East Mariposa Street, Altadena. The open house format of the meetings will allow residents to join when it is convenient for them.

The planning process is expected to take approximately 12 months to complete and is being overseen by a steering committee of stakeholders from within the planning area. Steering committee meetings are open to the public and held at LA County Public Works Headquarters, located at 900 S. Fremont Avenue, Alhambra 91803.

Visit the Floodplain Management Plan website at www.dpw.lacounty.gov/wmd/nfip/fmp/index.cfm or future meeting dates and times and to learn more about how to participate.

---oOo---

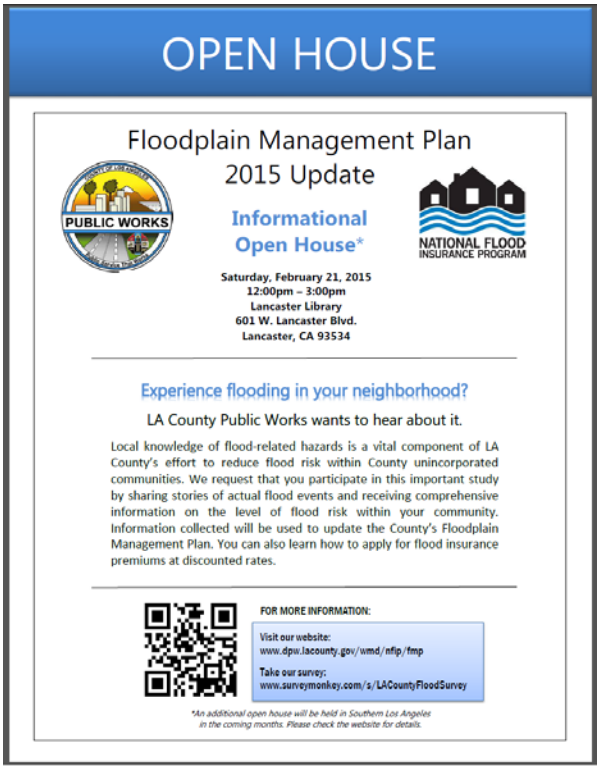
Media Contact: Kerjon Lee

(626) 458-4348 (Office)
(626) 476-0533 (Mobile)

Creating communities...sustaining life.

For information on other Public Works projects, visit dpw.lacounty.gov

Figure 2-4. Press Release Announcing Public Meetings for the Floodplain Management Plan



OPEN HOUSE

Floodplain Management Plan
2015 Update

Informational
Open House*

NATIONAL FLOOD INSURANCE PROGRAM

**Saturday, February 21, 2015**
**12:00pm – 3:00pm**
**Lancaster Library**
**601 W. Lancaster Blvd.**
**Lancaster, CA 93534**

Experience flooding in your neighborhood?

LA County Public Works wants to hear about it.

Local knowledge of flood-related hazards is a vital component of LA County's effort to reduce flood risk within County unincorporated communities. We request that you participate in this important study by sharing stories of actual flood events and receiving comprehensive information on the level of flood risk within your community. Information collected will be used to update the County's Floodplain Management Plan. You can also learn how to apply for flood insurance premiums at discounted rates.

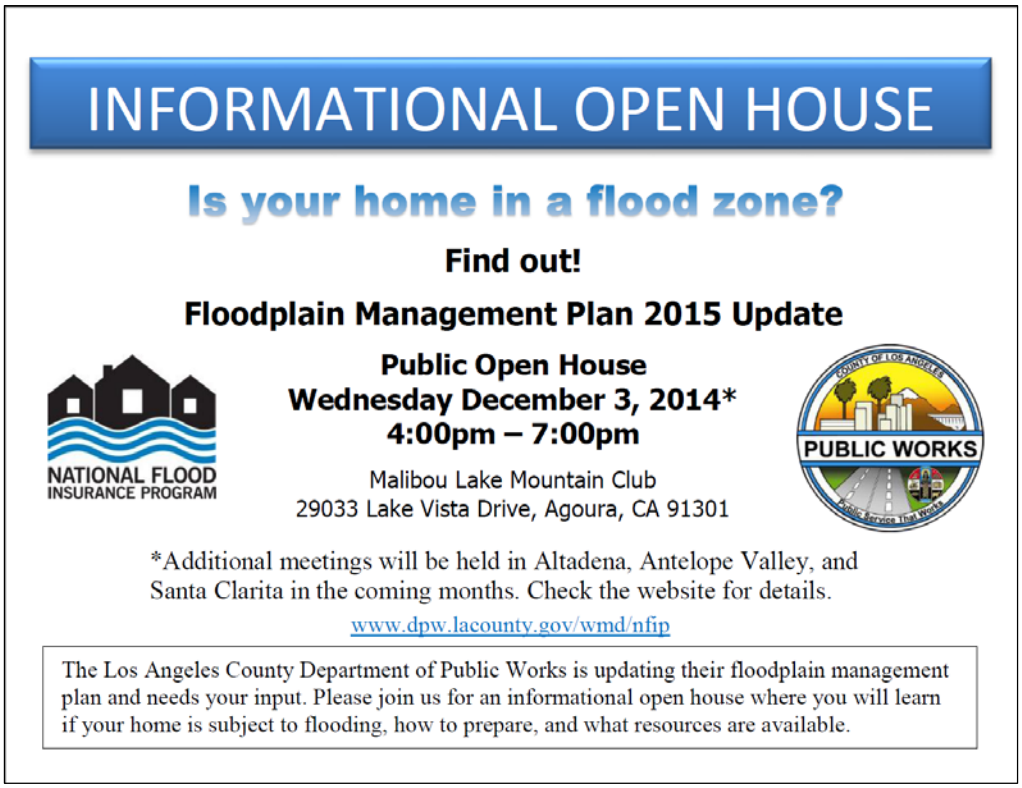
FOR MORE INFORMATION:

Visit our website:
www.dpw.lacounty.gov/wmd/nfip/fmp

Take our survey:
www.surveymonkey.com/s/LACountyFloodSurvey

*An additional open house will be held in Southern Los Angeles in the coming months. Please check the website for details.

Figure 2-5. Flyer Announcing Public Meeting for the Floodplain Management Plan



INFORMATIONAL OPEN HOUSE

**Is your home in a flood zone?**

**Find out!**

**Floodplain Management Plan 2015 Update**

NATIONAL FLOOD INSURANCE PROGRAM

**Public Open House**
**Wednesday December 3, 2014***
**4:00pm – 7:00pm**

Malibou Lake Mountain Club
29033 Lake Vista Drive, Agoura, CA 91301

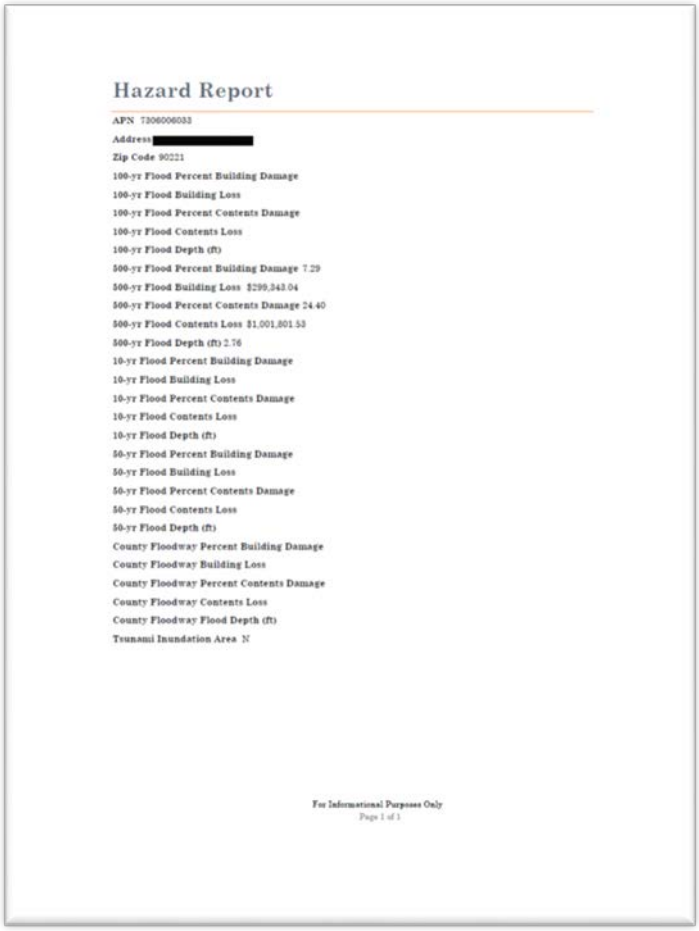
PUBLIC WORKS

*Additional meetings will be held in Altadena, Antelope Valley, and Santa Clarita in the coming months. Check the website for details.

www.dpw.lacounty.gov/wmd/nfip

The Los Angeles County Department of Public Works is updating their floodplain management plan and needs your input. Please join us for an informational open house where you will learn if your home is subject to flooding, how to prepare, and what resources are available.

Figure 2-6. Postcard Announcing Public Meeting for the Floodplain Management Plan



Hazard Report

APN 7306006033

Address [redacted]

Zip Code 90221

100-yr Flood Percent Building Damage

100-yr Flood Building Loss

100-yr Flood Percent Contents Damage

100-yr Flood Contents Loss

100-yr Flood Depth (ft)

500-yr Flood Percent Building Damage 7.29

500-yr Flood Building Loss $299,343.04

500-yr Flood Percent Contents Damage 24.40

500-yr Flood Contents Loss $1,001,801.53

500-yr Flood Depth (ft) 2.76

10-yr Flood Percent Building Damage

10-yr Flood Building Loss

10-yr Flood Percent Contents Damage

10-yr Flood Contents Loss

10-yr Flood Depth (ft)

50-yr Flood Percent Building Damage

50-yr Flood Building Loss

50-yr Flood Percent Contents Damage

50-yr Flood Contents Loss

50-yr Flood Depth (ft)

County Floodway Percent Building Damage

County Floodway Building Loss

County Floodway Percent Contents Damage

County Floodway Contents Loss

County Floodway Flood Depth (ft)

Tsunami Inundation Area N

For Informational Purposes Only

Page 1 of 1

*Figure 2-7. Example Printout from Hazus Workstation*

*Figure 2-8. Hazus Workstation, Malibou Lake Mountain Club Meeting, December 3, 2014*

*Figure 2-9. Display of Flood Hazard Mapping, Altadena Meeting, January 10, 2015*

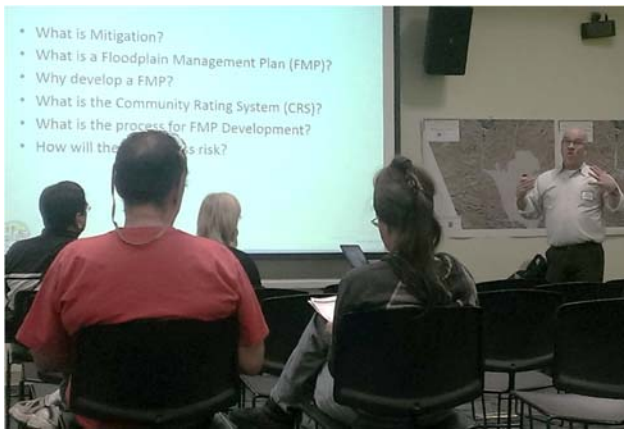



*Figure 2-10. Informational Presentation, Santa Clarita Meeting, January 24, 2015*

*Figure 2-11. Team Member Discussion with a Resident, Santa Clarita Meeting, January 24, 2015*

### *Presentations to Town Councils*

In addition to the public meetings described above, several town councils asked to be briefed on the floodplain management planning process. Table 2-2 lists the presentations to town councils. Town councils in Los Angeles County are advisory boards made up of elected representatives from unincorporated local communities. They are a voice of the community, conveying the needs of its residents to County, state and federal agencies.

**TABLE 2-2.**
**FLOODPLAIN MANAGEMENT PLAN PRESENTATIONS TO TOWN COUNCILS**

| When | Where |
|---|---|
| March 18, 2015, 6:00 pm | Lancaster—Antelope Acres Town Council Meeting: Westside Community Church<br>47707 90th Street West, Lancaster, CA 93536 |
| March 24, 2015, 7:00 pm | Palmdale— Lake Los Angeles Town Council Meeting: Stephen Sorensen Park Gymnasium<br>16801 East Avenue P, Lake Los Angeles, CA 93591 |
| March 25, 2015, 7:00 pm | Lancaster— Association of Rural Town Councils Meeting: Fire Station 129<br>42110 N. 6th Street West, Lancaster, CA 93534 |

### *Presentation of the Draft Plan*

Public meetings to present the draft plan were held on June 14 and 15, 2016. Both meetings ran from 6:30 pm to 7:30 pm. These meetings took place during the published public comment period, which ran from _____, 2016 to _____, 2016. They were advertised via a flyer that was distributed throughout the community, including through mailings to properties located in the floodplain.

## 2.6.2 Public Involvement Results

### *Survey Outreach*

The survey for this plan was completed by 136 respondents. Detailed results are provided in Appendix D. Key results are as follows:

- Over 20 percent of respondents believe they live in a floodplain or area subject to flooding.
- Of all respondents whose addresses could be geo-located for confirmation, 10.8 percent live in a known floodplain.
- 14.9 percent of respondents confirmed that they have flood insurance, 69.4 percent responded that they do not have flood insurance, and 15.7 percent were not sure.
- Most respondents without flood insurance said that they do not have it because they do not need it, as their property has never flooded (41.9 percent) or because their property is at higher elevation (30.1 percent).
- 25 percent of respondents definitively located in the floodplain (two total) said that the presence of a flood hazard at their current home was not disclosed to them by a real estate agent, seller, or landlord. 58.6 percent of all respondents believe such disclosure would influence their decision to buy or rent a home; 20.7 percent were not sure.
- Some residents requested examination of their flood zone risk, stating that they are in an identified flood zone but do not believe themselves to be at risk (either due to property elevation or lack of direct flood experience).
- The flood hazards identified as issues of concern to the most respondents include urban flooding/drainage issues, climate change impacts, and mudflow hazards.
- 10.4 percent of respondents felt either well prepared or very well prepared for a flood event; 40.6 percent indicated feeling somewhat prepared.
- 41.4 percent of residents disagreed or strongly disagreed that flood hazard and risk information is easy to find.
- The most frequently identified sources for previously received flood awareness information were federal, state, and local emergency management (45.6 percent), local news or media (29.8 percent), and personal experience (20.2 percent).
- Respondents' top preferred methods for receiving public education are as follows:
  - Internet (52.1 percent)
  - TV news (47.9 percent)
  - Radio news (43.8 percent)
  - Public awareness campaign, e.g., flood awareness week (32.2 percent)
  - Social media, such as Twitter or Facebook (32.2 percent).
- Respondents' top preferred methods for receiving emergency notifications are as follows:
  - Text message (58.7 percent)
  - Cell phones (44.6 percent)
  - Email (42.1 percent).

- 70.4 percent of respondents agree or strongly agree that local, state and federal government should provide programs promoting citizen action to reduce exposure to flood risks.
- Respondents ranked government-sponsored flood damage reduction projects in the following order of preference.
    1. Retrofitting infrastructure (improving culverts, bridges, and local drainage)
    2. Capital projects (dams, levees, flood walls, and drainage improvements)
    3. Providing better flood risk information to the public
    4. Strengthening codes and regulations to higher regulatory standards
    5. Acquiring vulnerable properties and maintaining them as open space
    6. Assisting vulnerable property owners with securing mitigation funding
    7. Other measures
- 81 percent of respondents support the preservation of natural land containing a flood hazard.

### *Open House Public Meetings and Town Council Presentations*

The concept of mitigation was introduced to the public at public meetings. These gave the Steering Committee and planning team feedback that was used in developing components of the plan. Meeting results are summarized in Table 2-3.

**TABLE 2-3.**
**SUMMARY OF OPEN HOUSE PUBLIC MEETINGS AND TOWN COUNCIL PRESENTATIONS**

| Date | Location | Number of Attendees | Number of Surveys or Comments Received |
|---|---|---|---|
| **Open House Public Meetings** | | | |
| December 3, 2014 | Malibou Lake Mountain Club | 20 | 5 |
| January 10, 2015 | Altadena Community Library | 6 | 0 |
| January 24, 2015 | Canyon Country Jo Anne Darcy Library | 8 | 3 |
| February 21, 2015 | Lancaster Public Library | 10 | 2 |
| April 2, 2015 | Lynwood Library | 4 | 0 |
| June 14, 2016 | Agoura Hills Library Community Room | | |
| June 15, 2016 | Lynwood Library | | |
| **Town Council Presentations** | | | |
| March 18, 2015 | Westside Community Church | 11 | 0 |
| March 24, 2015 | Stephen Sorensen Park Gymnasium | 30 | 0 |
| March 25, 2015 | Fire Station 129 | 19 | 0 |
| **Total** | | **108** | **10** |

The following is a summary of comments received from attendees at the meetings and presentations:

- Concerns were expressed regarding the crossings of washes in the Antelope Valley, where streams flow across roads during storms, preventing cars from passing. On some occasions, vehicles have been swept away. A town council member indicated that there was at least one death when someone tried to cross a wash with too much flow. The town council member specifically identified Avenue O as a problem, where Big Rock Wash splits into two washes. During big storms, residents between the two washes are confined until floodwaters recede. This can also be a problem if emergency vehicles need to access the homes.
- Residents expressed concern about Lake Los Angeles flooding. On Avenue P-8, sediment has partially filled in a natural watercourse that runs through private properties. Some property owners also placed fences across the watercourse. During a storm several years ago, water overflowed the watercourse and flooded several neighboring homes. One resident indicated that several feet of mud on her property resulted in the loss of a horse.
- One resident noted that a repaving of Spunky Canyon Road was resulting in drainage issues.One resident was a Realtor hoping to find a resource for sharing flood information with potential buyers.
- Three attendees who reside in a FEMA-designated AH Zone east of I-605 between Rivera Road and Slauson Avenue expressed concern about required flood insurance costs.
- One resident indicated that she had received a notice requiring an additional payment for flood insurance. She was unable to remember from whom she had received the letter.
- Comments made at the Malibou Lake meeting addressed the following topics:
  - Reevaluation of the FEMA Malibou Lake delineations
  - Sediment issues at Malibou Lake
  - Malibou Lake spillway modifications
  - General concerns about the accuracy of FEMA mapping
  - Management of Westlake Village dam (located upstream of Malibou Lake).
- Various attendees indicated corrections to flood hazard map posters displayed at the meetings, including depth values and creek names.
- A resident who attended the Santa Clarita meeting lives in a FEMA-designated AO Zone and received information about elevation certificates at the meeting. In a follow-up email, he said that after submitting the elevation certificate to his insurance company his rate was reduced from $1,071 to $331.

## 2.7 PREPARING PROGRAM FOR PUBLIC INFORMATION

The public involvement strategy described in the previous section ensured that the public was informed about the development of this floodplain management plan and had opportunities to provide input. In a separate, parallel effort, a public involvement strategy called a “program for public information” (PPI) was developed to be used for ongoing public involvement as the recommendations of the floodplain management plan are being implemented. The PPI will provide a means to enhance the public outreach components of floodplain management and to identify specific outreach activities to meet local needs. A PPI is an ongoing effort to identify, prepare, implement and monitor public information activities tailored to local needs.

A committee of non-governmental and governmental stakeholders was formed to oversee development of the PPI. The steering committee for the floodplain management plan was kept informed of the progress of the PPI committee. The results of the risk assessment and public outreach efforts from the development of the floodplain management plan were used to inform the development of the PPI. The County used the CRS seven-step planning process for development of the PPI:

- Establish a PPI committee
- Assess the community's public information needs
- Formulate messages
- Identify outreach projects to convey the messages
- Examine other public information initiatives
- Prepare the PPI document
- Implement, monitor and evaluate the PPI.

These steps are described in detail in Chapter 14 of this plan.

## 2.8 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 2-4 summarizes important milestones in the development of the plan.

**TABLE 2-4.**
**PLAN DEVELOPMENT MILESTONES**

| Date | Event | Description | Attendance |
|---|---|---|---|
| 2/21/2014 | Initiate consultant procurement | Seek a planning expert to facilitate the process | N/A |
| 4/4/2014 | Select Tetra Tech to facilitate plan development | Facilitation contractor secured | N/A |
| 7/2/2014 | Identify planning team | Formation of the planning team | N/A |
| 8/26/2014 | Steering Committee Meeting #1 (Kick-off Meeting) | • Review purposes for update<br>• Organize Steering Committee<br>• Discuss goal setting<br>• Develop public involvement strategy | 17 |
| 9/23/2014 | Steering Committee Meeting #2 | • Review and approve ground rules<br>• Identify a mission statement<br>• Review and discuss plan goals<br>• Define Phase 1 public involvement | 25 |
| 10/28/2014 | Steering Committee Meeting #3 | • Confirm mission statement and goals<br>• Introduce objective development exercise<br>• Discuss critical facilities definition<br>• Discuss and affirm questionnaire<br>• Develop public meeting framework | 22 |
| 11/18/2014 | Public Outreach strategy | Website set up for posting information related to plan development. | N/A |
| 12/2/2014 | Steering Committee Meeting #4 | • Confirm objectives<br>• Review public meeting arrangements | 27 |
| 12/3/2014 | Public Meeting #1 | Public open house to present plan information to public (Malibou Lake Mountain Club) | 20 |
| 1/10/2015 | Public Meeting #2 | Public open house to present plan information to public (Altadena Community Library) | 6 |
| 1/24/2015 | Public Meeting #3 | Public open house to present plan information to public (Canyon Country Jo Anne Darcy Library) | 8 |
| 1/27/2015 | Steering Committee Meeting #5 | • Review mission statement, goals, and objectives<br>• Review informational open house information<br>• Discuss the plan maintenance strategy<br>• Conduct a brainstorming session on strengths, weaknesses, opportunities and obstacles | 20 |
| 2/21/2015 | Public Meeting #4 | Public open house to present plan information to public (Lancaster Public Library) | 10 |
| 2/24/2015 | Steering Committee Meeting #6 | • Review and discuss the public involvement strategy<br>• Review the mitigation catalog<br>• Discuss the program for public information | 21 |
| 3/17/2015 | Identify PPI Committee | Formation of the PPI Committee (Step 1) | N/A |
| 3/18/2015 | Town Council Presentation #1 | Meeting to present and review plan information to local advisory councils | 11 |

**TABLE 2-4.**
**PLAN DEVELOPMENT MILESTONES**

| Date | Event | Description | Attendance |
|---|---|---|---|
| 3/24/2015 | Steering Committee Meeting #7 | • Review and discuss the public involvement strategy<br>• Discuss the program for public information<br>• Review and discuss the draft action plan | 19 |
| 3/24/2015 | Town Council Presentation #2 | Meeting to present and review plan information to local advisory councils | 30 |
| 3/25/2015 | Town Council Presentation #3 | Meeting to present and review plan information to local advisory councils | 19 |
| 4/2/2015 | Public Meeting #5 | Public open house to present plan information to public (Lynwood Library) | 4 |
| 4/14/2015 | PPI Committee Meeting #1 | • Introduce the Program for Public Information<br>• Discuss and define target areas (Step 2)<br>• Discuss and define target audiences (Step 2) | 7 |
| 4/28/2015 | Steering Committee Meeting #8 | • Review progress on the Program for Public Information<br>• Review and discuss results from the questionnaire<br>• Review and discuss the draft action plan<br>• Discuss next steps for the planning process | 16 |
| 5/21/2015 | PPI Committee Meeting #2 | • Review and revise target areas and audiences (Step 2)<br>• Discuss and define priority topics (Step 3)<br>• Discuss and define messages, audiences and outcomes (Step 3) | 7 |
| 6/10/2015 | PPI Committee Meeting #3 | • Review and revise messages, audiences and outcomes (Step 3)<br>• Discuss and define outreach projects (Step 4)<br>• Discuss and define messages, audiences and outcomes (Step 7) | 7 |
| 4/29/2016 | Draft Plan | Internal review draft provided by planning team to Steering Committee | N/A |
| 5/17/2016 | Steering Committee Meeting #9 | • Review and discuss the draft plan<br>• Discuss next steps for the planning process | 14 |
| 6/_/2016 | Public Comment Period | Initial public comment period of draft plan opens. Draft plan posted on plan website with press release notifying public of plan availability | N/A |
| 6/14/2016 | Public Outreach | Final public meeting on draft plan (Agoura Hills Library) | __ |
| 6/15/2016 | Public Outreach | Final public meeting on draft plan (Lynwood Library) | __ |
| __/__/2016 | Plan Approval | Final draft plan submitted to Insurance Services Office (ISO) for review and approval | N/A |
| __/__/2016 | Adoption | Public notice published advertising the __/__ public hearing by the Board of Supervisors where they will adopt the plan. | N/A |
| __/__/2016 | Adoption | Board of Supervisors adopts plan during public hearing. | __ |
| __/__/2016 | Plan Approval | Final plan approved by ISO | N/A |

# CHAPTER 3.
# LOS ANGELES COUNTY PROFILE

Los Angeles County, on the southwest coast of California, is the most populous county in the state, with a 2014 estimated population of 10,042,000 (26 percent of the total population of California). It is the state's 12th largest county by area, at 4,084 square miles. There are 88 cities in the county; the City of Los Angeles is the largest and is the county seat. The unincorporated portion of the county, which is the planning area for this floodplain management plan, covers 2,638 square miles and is home to over a million people. Figure 3-1 shows the county location and main features.

## 3.1 HISTORICAL OVERVIEW

The following history is summarized from historical information provided on the Los Angeles County website (Los Angeles County, 2014a).

Los Angeles County was one of California's original 27 counties established in 1850. Originally it was 4,340 square miles along the coast between Santa Barbara and San Diego. The county later grew to 34,520 square miles, extending east to the Colorado River. The County was subsequently divided up three times: Kern County received a large slice in 1851; San Bernardino County split off in 1853; and Orange County was established in 1889. Today, with 4,084 square miles, it is slightly smaller than its original size.

The area covered by present-day Los Angeles County was settled by Native Americans for centuries before the first European contact in 1769. In the 1780s, a group of families from Mexico established a new settlement named El Pueblo de la Reyna de Los Angeles (The Town of the Queen of the Angels). Over time, the area became known as the Ciudad de Los Angeles (City of Angels), which was the largest town in Southern California by the 1840s, when the area came under U.S. control through treaties with Mexico. On February 18, 1850, the County of Los Angeles was established, and the City of Los Angeles was named the county seat.

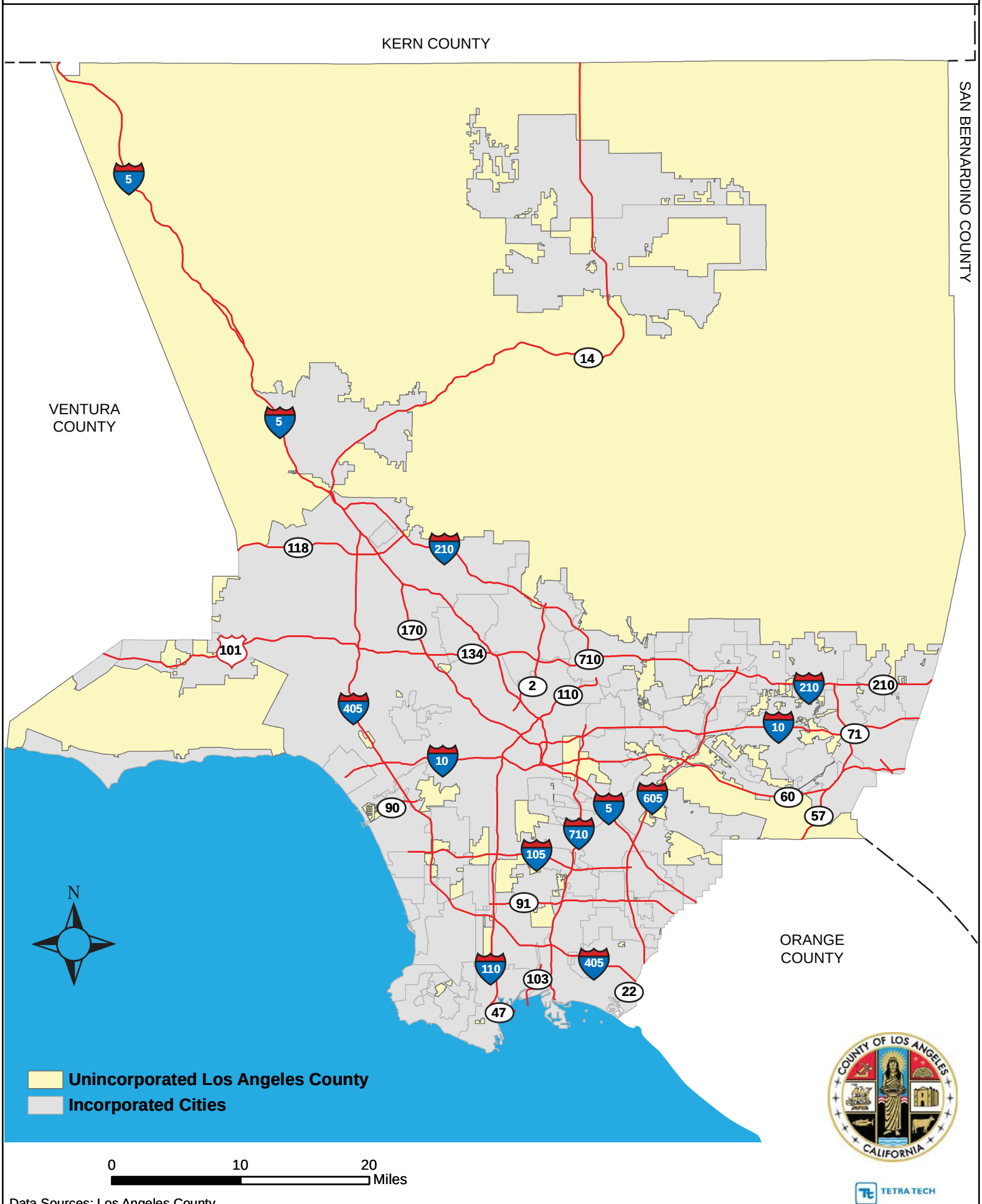
After the Civil War, there was a large immigration into the Los Angeles area from Europe, Asia, and Central and South America, as well as the eastern United States. The Southern Pacific Railroad completed its Los Angeles route in 1880, followed by the Santa Fe Railroad six years later. The railroads set forth a long-term plan for growth. Southern California citrus farming, tourism and the building of towns were promoted to attract investors, and to increase the value of railroad shipments. The Los Angeles population increased from about 11,000 in 1880 to about 60,000 in 1890.

Los Angeles became a center of oil production in the early 20th Century. Drilling activity in the county reached new heights in the 1920s when major finds were made in Whittier, Montebello, Compton, Torrance, Inglewood, Huntington Beach, Santa Fe Springs and Signal Hill.

In the early 1900s, growth in the City of Los Angeles necessitated the annexation of the large San Fernando Valley. By the 1920s, fruit—especially citrus—cultivation was San Fernando's biggest industry. Olives also flourished in the Mediterranean-like climate. Other crops grown in the County included alfalfa, apricots, asparagus, barley, hay, beans, beets, cabbage, citrus, corn, lettuce, melons, peaches, potatoes, pumpkins, squash, tomatoes, and walnuts.

**Figure 3-1.**
**Planning Area**

**Los Angeles County Floodplain Management Plan**



The only local water in Los Angeles was the intermittent Los Angeles River and groundwater replenished by the area's minimal rain. About 250 miles northeast of Los Angeles in Inyo County, a desert region known as the Owens Valley had the Owens River, a permanent stream of fresh water fed by the melted snows of the eastern Sierra Nevada mountains. In 1905, the people of Los Angeles voted for $22.5 million worth of bonds to build an aqueduct from the Owens River. The aqueduct opened November 5, 1913.

By 1930, the motion picture industry was thriving in the county. The 1950s saw the opening of numerous television stations. By the early 1970s, the television and movie industries became interdependent, with much crossover from one medium to the other. Today, the Hollywood film has retained its position as the ultimate entertainment, and television has become the major disseminator of popular culture.

To accommodate the County's growing population, a number of large engineering projects were instituted, including the construction of Hoover Dam, which channeled the Colorado River water to the County and provided hydroelectric power. The area's excellent weather made it an ideal location for aircraft testing and construction, and World War II brought hundreds of new industries to the area, boosting the local economy. By the 1950s, Los Angeles County was a large metropolis. Today more than 10.4 million people call Los Angeles County home, residing in 88 cities and nearly 200 unincorporated areas.

## 3.2 PHYSICAL SETTING

### 3.2.1 Topography

Topography in Los Angeles County consists of a coastal plain extending in from the southern coast, hills in the central county across the north end of the urbanized area, the Santa Monica Mountains to the west, the San Gabriel Mountains crossing the north-central portion of the county, and a high, flat portion of the Mojave desert in the county's northeastern corner. Offshore, the county also includes Santa Catalina Island, about 30 miles south of Long Beach, and San Clemente Island, about 60 miles south of Long Beach.

The Santa Monica Mountains, in western Los Angeles County and southeastern Ventura County, cover 250 square miles, rising out of the Pacific Ocean to a height over 3,000 feet. The mountain range was driven up from the sea over 10 million years ago. Weathering has created rugged landscapes of canyons up to 2,000 feet deep with unique rock formations (Los Angeles County, 2009a).

The San Gabriel Mountains and the surrounding Angeles National Forest encompass nearly 700,000 acres of wilderness on the northern edge of the Los Angeles metropolis. The San Gabriel Mountains have several peaks over 9,000 feet, the highest being Mount San Antonio (locally know as Mount Baldy) at 10,064 feet. The foothills (starting at 1,300 feet) are grassy and barren; the land becomes rockier and forested with oak, pine and cedar at higher elevations. There are clear mountain streams and reservoirs, small lakes, waterfalls, old mines and steep canyons (Los Angeles County, 2009a).

Antelope Valley is the western tip of the Mojave Desert extending into Los Angeles County. It is a high, flat valley surrounded by mountain ranges. The San Gabriel Mountain Range to the south separates the valley from the Los Angeles Basin, and the Tehachapi Mountain Range to the north separates it from Bakersfield and the San Joaquin Valley. Lancaster, one of the cities in the Antelope Valley, has an elevation of 2,500 feet above sea level (Los Angeles County, 2009a).

### 3.2.2 Geology and Soils

The 1903 soil survey of Los Angeles (Mesmer, 1903) identifies 17 soil types in the area, as summarized in Table 3-1.

**TABLE 3-1.**
**IDENTIFIED SOIL TYPES IN THE LOS ANGELES AREA**

| Soil | % of Total Area | Soil | % of Total Area | Soil | % of Total Area |
|---|---|---|---|---|---|
| Placentia sandy loam | 18.1 | Oxnard loam | 5.4 | Maricopa gravelly loam | 1.6 |
| Fresno sand | 15.9 | Fresno fine sand | 4.4 | Galveston clay | 1.3 |
| Santiago silt loam | 10.8 | Maricopa sandy loam | 3.8 | Dune sand | 0.9 |
| Fresno fine sandy loam | 10.6 | Los Angeles sandy loam | 2.5 | River wash | 0.5 |
| San Joaquin black adobe | 10.3 | Fullerton sandy adobe | 1.9 | Peat | 0.3 |
| Oxnard sand | 9.8 | Sierra adobe | 1.9 | | |

Source: Mesmer, 1903

The soil survey described the characteristics of the most common soils in the area as follows:

- Placentia sandy loam—The surface soil of Placentia sandy loam is composed of a light- brown or brown loam with a medium to fine texture. Ordinarily it is comparatively loose and easily cultivated, except in certain localities where it has a tendency to bake or pack. It is underlain by a more compact subsoil that is lighter in color, with a slight reddish cast. In certain places the underlying material packs harder than in others, and is locally known as hardpan. Where the subsoil is exposed in cuts, in the upper 2 or more feet it cracks in irregular lines like adobe. Beneath this stratum the material grades into sand or into a material much like the surface soil.
- Fresno sand—Fresno sand is a light to medium gray sand that is coarse to medium in texture. It is generally loose and in very few instances shows any tendency to clod in cultivation. The soil is generally 6 feet or more in depth. In many cases, however, it is found overlying material of the Fresno fine sandy loam and occasionally, in the lower areas, a silty material.
- Santiago silt loam—Santiago silt loam is light to dark gray silt loam, varying from loose, easily cultivated soil to a heavy texture and a tendency to pack, bake, and crack when dry. The texture generally varies with the color: the light is friable; the dark is heavy. The depth varies from a foot to more than 6 feet, and the surface soil grades into layers of sand, fine sandy loam or silt.
- Fresno fine sandy loam—The surface soil of the Fresno fine sandy loam consists of light to dark gray fine sandy loam, ranging in texture from medium to fine. The soil has an average depth of about 3 feet and is generally underlain by sand, though layers of silt and fine sandy loam constitute the subsoil in places, particularly in lower areas.
- San Joaquin black adobe—The surface soil of the San Joaquin black adobe consists of a black or dark-brown loam or a clay loam that is very adhesive when wet and baking and cracking in irregular checks when dry. As the soil becomes drier, the cracks in places attain the width of an inch or more and extend to a depth of 2 or 3 feet. The soil is easiest to cultivate when first moistened after it has been thoroughly dried. Later it is more plastic and difficult to till. The soil varies in depth from 2 to 4 or more feet and is underlain by a brown-colored phase of the same or a sandier material, by decomposing shale, or, in a few instances, by sand.
- Oxnard sand—Oxnard sand is yellowish-gray, dark-gray, or grayish-brown sand of medium to fine texture. It is of a loose, open character, in places being shifted by the winds. The material extends to a depth of 6 feet and grades into a sand of much the same texture as the soil.

Figure 3-2 shows subsurface geology of the area, mapped rock types and seismic faults and folds.

Source: California Geological Survey, 2010.

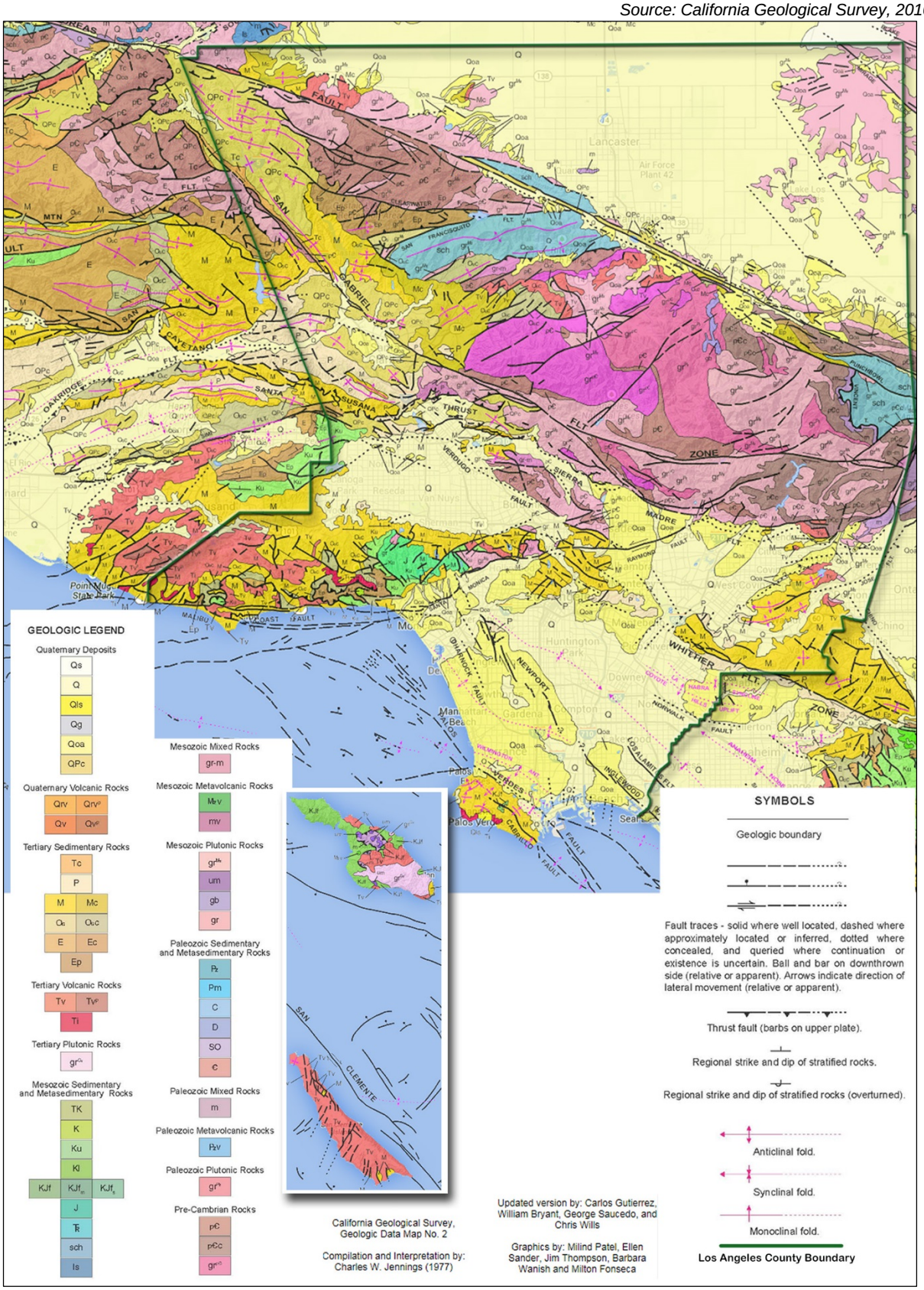



*Figure 3-2. Los Angeles County Geologic Features*

## 3.2.3 Drainage and Watersheds

The Natural Resources Conservation Service (NRCS) designates major watersheds with an eight-digit hydrologic unit code (HUC-8) and subdivides them into smaller watersheds designated with a 10-digit hydrologic unit code (HUC-10). The major and smaller watersheds that lie all or partly within Los Angeles County are listed in Table 3-2 and shown on Figure 3-3 and Figure 3-4. Analysis of the planning area for this floodplain management plan was performed at the smaller watershed scale. Detailed descriptions of these watersheds can be found in Section 6.2 of this document.

**TABLE 3-2.**
**NRCS WATERSHEDS IN UNINCORPORATED LOS ANGELES COUNTY**

| HUC-10 Code | Name |
|---|---|
| **HUC-8 Watershed: Middle Kern/Upper Tehachapi/Grapevine** | |
| 1803000307 | Grapevine Creek |
| **HUC-8 Watershed: Santa Clara River** | |
| 1807010201 | Headwaters Santa Clara River |
| 1807010202 | Bouquet Canyon |
| 1807010203 | Castaic Creek |
| 1807010204 | Upper Santa Clara River |
| 1807010205 | Upper Piru Creek |
| 1807010206 | Lower Piru Creek |
| **HUC-8 Watershed: Calleguas** | |
| 1807010301 | Calleguas Creek |
| **HUC-8 Watershed: Santa Monica Bay** | |
| 1807010401 | Malibu Creek |
| 1807010402 | Ballona Creek |
| 1807010403 | Dominguez Channel |
| 1807010404 | Big Sycamore Canyon-Frontal Santa Monica Bay |
| 1807010405 | Garapito Creek-Frontal Santa Monica Bay |
| 1807010406 | Frontal Santa Monica Bay-San Pedro Bay |
| **HUC-8 Watershed: Los Angeles River** | |
| 1807010501 | Big Tujunga Creek |
| 1807010502 | Upper Los Angeles River |
| 1807010503 | Rio Hondo |
| 1807010504 | Lower Los Angeles River |
| **HUC-8 Watershed: San Gabriel River** | |
| 1807010601 | West Fork San Gabriel River |
| 1807010602 | Upper San Gabriel River |
| 1807010603 | Dalton Wash |
| 1807010604 | San Jose Creek |
| 1807010605 | Lower San Gabriel River |
| 1807010606 | Colorado Lagoon-Frontal Alamitos Bay |
| **HUC-8 Watershed: San Pedro/Channel Islands** | |
| 1807010700 | San Nicholas Island/Santa Catalina Island |
| **HUC-8 Watershed: Santa Ana** | |
| 1807020307 | Chino Creek |
| **HUC-8 Watershed: Antelope-Fremont Valleys** | |
| 1809020609 | Le Montaine Creek-Eller Slough |
| 1809020610 | Big Rock Creek-Big Rock Wash |
| 1809020611 | Little Rock Wash |
| 1809020613 | Sacatara Creek-Kings Canyon |
| 1809020614 | Amargosa Creek |
| 1809020615 | Lake Palmdale-Piute Ponds |
| 1809020616 | Town of Pearblossom |
| 1809020618 | Cottonwood Creek-Tylerhorse Canyon |
| 1809020619 | Mescal Creek-Rocky Buttes |
| 1809020622 | Rogers Lake |
| 1809020623 | Rock Creek-Buckhorn Lake |
| 1809020624 | Rosamond Lake |
| **HUC-8 Watershed: Mojave** | |
| 1809020804 | Sheep Creek-El Mirage Lake |

Notes:
1. HUC-8 watershed names shown are those defined by the NRCS. Alternative names are established in the 2006 Los Angeles County Department of Public Works Hydrology Manual, as described in Section 6.2.
2. HUC-8 Watershed San Pedro/Channel Islands and HUC-10 Watershed San Nicholas Island/Santa Catalina Island are not shown on Figure 3-3 and Figure 3-4 as they are outside the mapped extent of those figures.

**Figure 3-3.**
**Major (HUC-8) Watersheds Lying Partly or Completely Within Los Angeles County**

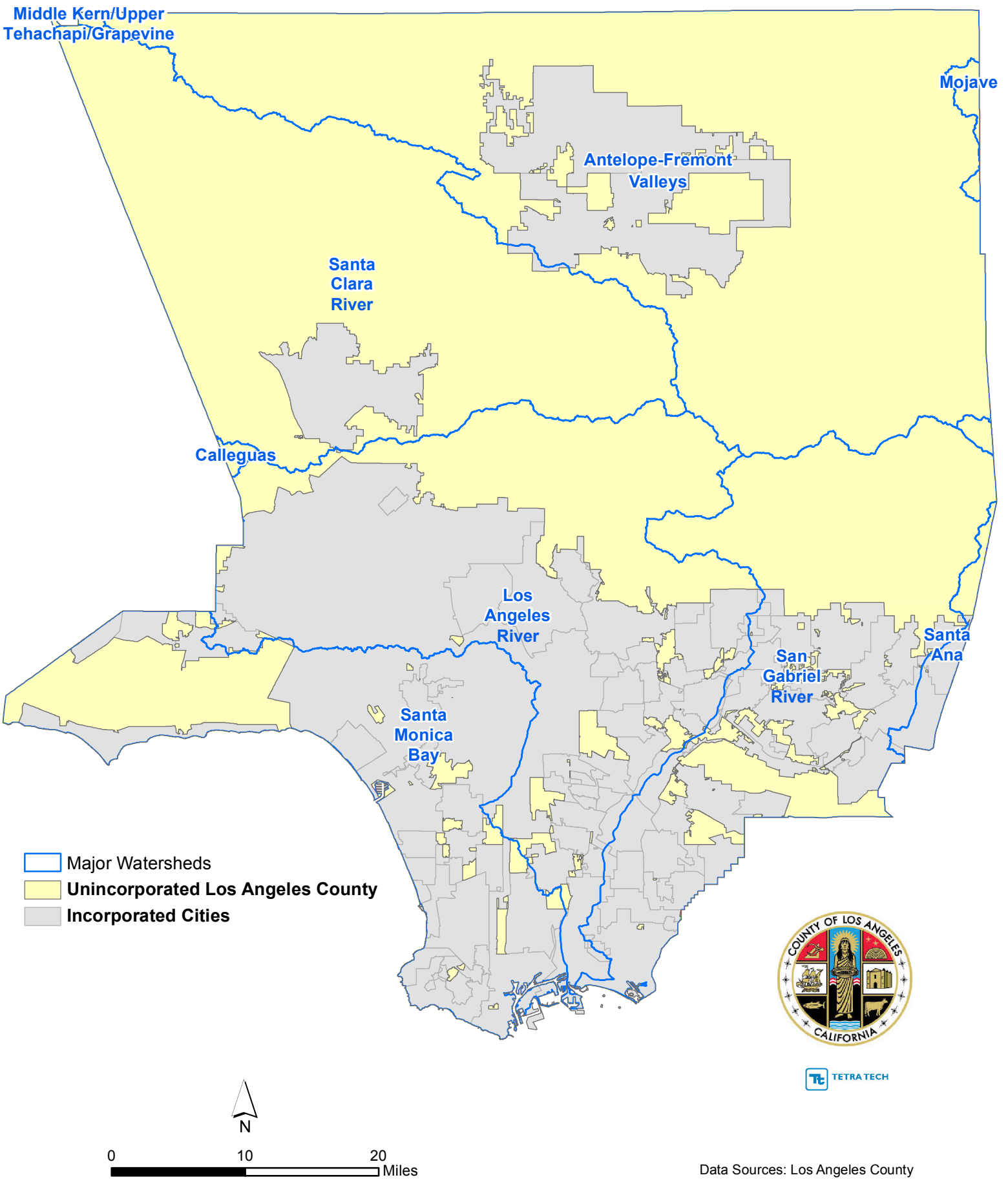
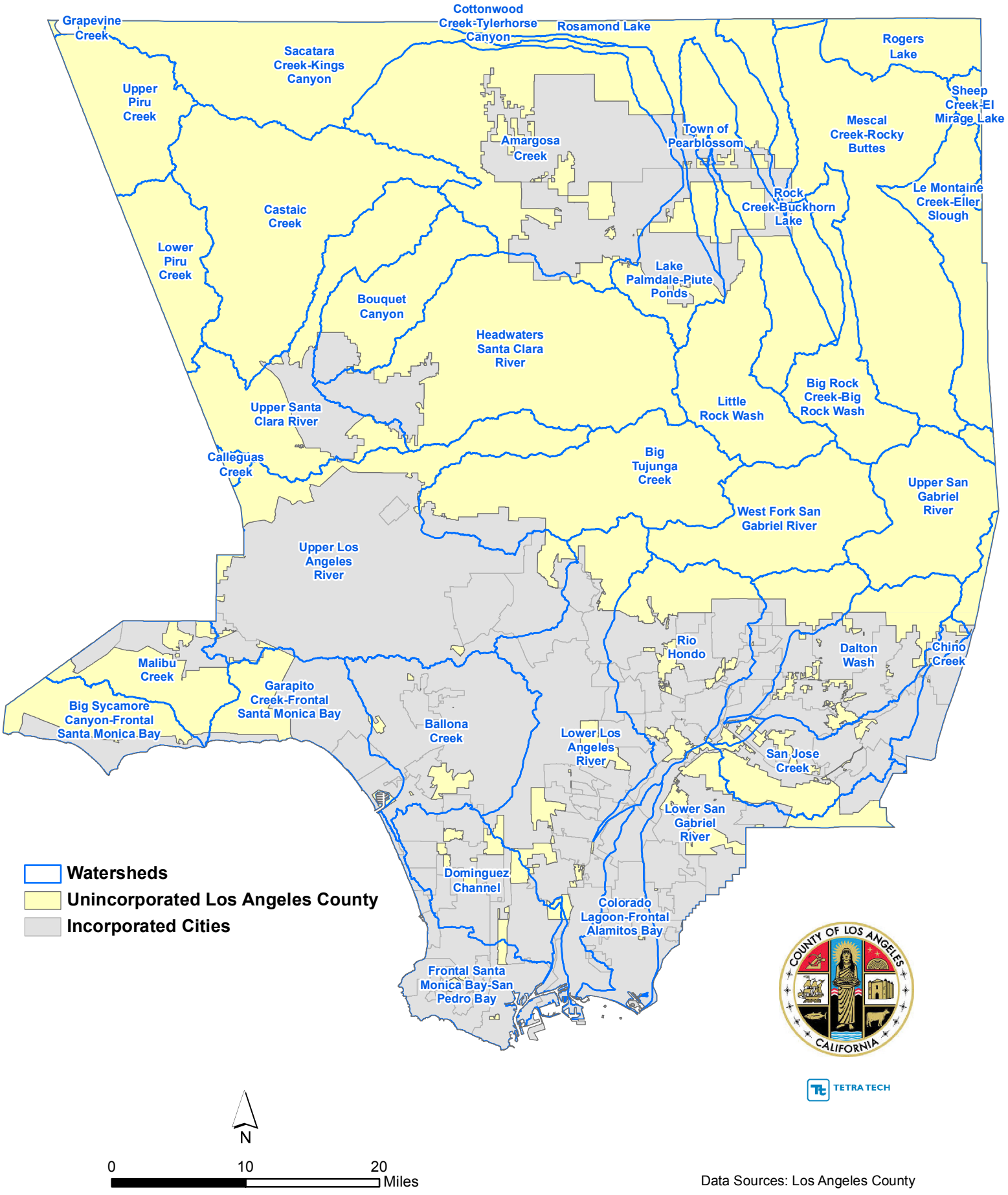


**Figure 3-4.**
**Smaller (HUC-10) Watersheds Within Los Angeles County**




Data Sources: Los Angeles County

### 3.2.4 Climate

In the basins and valleys adjoining the California coast, climate is subject to wide variations within short distances as a result of the influence of topography on the circulation of marine air. The Los Angeles Basin offers many varieties of climate within a few miles. Santa Monica Pier, in the Los Angeles area, has a normal July maximum of around 75ºF, but the average increases to 95ºF at Canoga Park in the San Fernando Valley just 15 miles to the north (WRCC, 2014). Table 3-3 summarizes key climate data for the county at three locations: Los Angeles International Airport on the coast, downtown Los Angeles in the central county, and Lancaster in the Mojave Desert.

**TABLE 3-3.**
**AVERAGE LOS ANGELES COUNTY CLIMATE DATA**

| | L.A. International Airport | Downtown Los Angeles | Lancaster |
|---|---|---|---|
| Average Annual Minimum Temperature | 56.1ºF | 56.6ºF | 46.6ºF |
| Average Annual Maximum Temperature | 70.6ºF | 75.6ºF | 75ºF |
| Average Annual Mean Temperature | 63.3ºF | 66.2ºF | 60.8ºF |
| Average Annual Precipitation (inches) | 13.15 | 15.14 | 7.4 |

Source: California DWR, 2014.

Although the basic air flow above the area is from the west or northwest during most of the year, mountain chains deflect these winds so that, except for the immediate coast, wind direction is more a product of local terrain than of the prevailing circulation. Strong and sometimes damaging winds from the east or southeast occur when there is a strong high-pressure area to the east and an intense low-pressure area approaching from the west. In southern California these winds are called “Santa Ana Winds.” Their air is typically dry, and the winds are strong and gusty, sometimes exceeding 100 mph, particularly near the mouth of canyons oriented along the direction of airflow. These conditions occasionally lead to serious fire suppression problems and often result in the temporary closing of highways to campers, trucks, and light cars.

The Los Angeles Basin is almost completely enclosed by mountains on the north and east. A vertical temperature structure (inversion) in the air along most of coastal California tends to prevent vertical mixing of the air. The geographical configuration and southern location of the Los Angeles Basin permit a fairly regular daily reversal of wind direction—offshore at night and onshore during the day. (WRCC, 2014).

## 3.3 DEVELOPMENT FEATURES

### 3.3.1 Land Use

Los Angeles County is highly urbanized, but it includes large, sparsely developed areas in the Mojave Desert, the Angeles and Los Padres National Forests in the San Gabriel Mountains, and the Santa Monica Mountains National Recreation Area. Over half of the unincorporated areas in the County are considered natural resources, and 39 percent are designated as rural. The County’s land use patterns are greatly influenced and shaped by the surrounding natural features, which include valleys, waterways, coastland mountains, forestland, and desert (Los Angeles County Department of Regional Planning, 2015b).

A network of high-capacity transportation systems traverses Los Angeles County. In the unincorporated areas, these systems include California State Route (SR) 14, SR 138, SR 39, Interstate 5, U.S. Route 2, and SR 23. Due to the accessibility that the transportation network provides, along with County unincorporated areas' proximity to major population centers in the cities of Los Angeles and Malibu, the County projects significant growth in population and employment for the unincorporated areas over the next 20 years (Los Angeles County Department of Regional Planning, 2015b).

To help ensure that regionally unique characteristics are considered in long-term development, the County has specific plans for local unincorporated areas, including the Canyon Park, La Viña, Santa Catalina Island, Marina Del Ray, Northlake, Newhall Ranch, and Universal Studios areas. The County also regulates development in special management areas to prevent loss of life and property and to protect important resources, such as agricultural resources, airport areas, coastal zones, flood zones, historic resources, mineral resources, and military operations (Los Angeles County Department of Regional Planning, 2015b).

The County promotes infill development, sustainable development, and transit-oriented development to preserve land and resources while reducing the costs of public infrastructure and other services. This focus reduces residential exposure to natural hazards, such as wildfires and flooding, through the siting and design of open spaces. The County has noted the locations of higher hazard areas near population centers and growth areas, and it plans to use this information to ensure planning and development processes continue to consider these factors (Los Angeles County Department of Regional Planning, 2015b).

Land use distribution in unincorporated Los Angeles County is summarized in Table 3-4.

**TABLE 3-4.**
**LAND USE DISTRIBUTION IN UNINCORPORATED LOS ANGELES COUNTY**

| Land Use Designation | Area (acres) | Percent of Total |
|---|---|---|
| Agricultural | 11,130.88 | 0.64% |
| Commercial | 23,014.38 | 1.33% |
| Education | 1,845.39 | 0.11% |
| Government | 69,201.79 | 4.00% |
| Industrial | 3,354.81 | 0.19% |
| Religion | 1,811.65 | 0.10% |
| Residential | 194,075.22 | 11.23% |
| Uncategorized | 223,048.08 | 12.90% |
| Vacant | 1,201,319.13 | 69.49% |
| **Total** | **1,728,801.33** | **100.00%** |

## 3.3.2 Critical Facilities and Infrastructure

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These become especially important after a flood or other hazard event. The CRS defines a critical facility as follows:

> A structure or other improvement that, because of its function, size, service area, or uniqueness, has the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if it is destroyed or damaged or if its functionality is impaired. Critical

facilities include health and safety facilities, utilities, government facilities, and hazardous materials facilities.

Through a facilitated process, the Steering Committee established a definition of critical facilities for this floodplain management plan, consistent with the definition used in the Los Angeles County Local All-Hazards Mitigation Plan, that includes but is not limited to the following:

- Facilities critical to government response activities (i.e., life safety and property and environmental protection), which may include local government dispatch centers, schools, shelters, and hospitals.
- Facilities that, if damaged, could cause serious secondary impacts, such as hazardous material facilities.
- Facilities that are critical to utility operations, such as wastewater treatment plants and transformers.

Three sources were used to develop an inventory of facilities meeting these definitions:

- Location Management System GIS data from Los Angeles County's GIS Data Portal
- Facility registry services GIS data downloaded from the U.S. Environmental Protection Agency's website for facilities under EPA's Toxic Release Inventory program (used as source for hazardous material facilities)
- Default entries contained in the Comprehensive Data Management System that is part of FEMA's Hazus software (Hazus version 2.1; used as source for electric power and oil facilities, and for light rail and rail bridges).

Due to the sensitivity of this information, a detailed list is not provided in this plan; the list is on file with the County. Table 3-5 and Table 3-6 provide summaries of the general types of critical facilities and infrastructure in the planning area. General locations are shown on maps provided in Appendix E. The numbers of critical facilities and infrastructure located within mapped floodplains of the planning area are given in Section 7.3.

**TABLE 3-5.**
**COUNTY OF LOS ANGELES CRITICAL FACILITIES**

| | Medical & Health Service | Government Function | Protective Function | Schools | Hazardous Materials | **Total** |
|---|---|---|---|---|---|---|
| Amargosa Creek | 0 | 0 | 3 | 13 | 0 | **16** |
| Ballona Creek | 2 | 0 | 3 | 9 | 0 | **14** |
| Big Rock Creek-Big Rock Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 2 | 1 | 0 | **3** |
| Big Tujunga Creek | 0 | 0 | 1 | 1 | 0 | **2** |
| Bouquet Canyon | 0 | 0 | 1 | 0 | 0 | **1** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 0 | 0 | 2 | 6 | 6 | **14** |
| Chino Creek | 0 | 0 | 0 | 1 | 0 | **1** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | **0** |

**TABLE 3-5.**
**COUNTY OF LOS ANGELES CRITICAL FACILITIES**

| | Medical & Health Service | Government Function | Protective Function | Schools | Hazardous Materials | **Total** |
|---|---|---|---|---|---|---|
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 14 | 0 | **14** |
| Dominguez Channel | 1 | 1 | 4 | 34 | 52 | **92** |
| Frontal Santa Monica Bay-San Pedro Bay | 2 | 0 | 1 | 6 | 7 | **16** |
| Garapito Creek-Frontal Santa Monica Bay | 0 | 0 | 3 | 3 | 0 | **6** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 0 | 0 | 2 | 8 | 3 | **13** |
| Lake Palmdale-Piute Ponds | 0 | 0 | 0 | 0 | 0 | **0** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 0 | **0** |
| Little Rock Wash | 0 | 0 | 1 | 2 | 0 | **3** |
| Lower Los Angeles River | 9 | 14 | 8 | 100 | 44 | **175** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 0 | 3 | 3 | 58 | 7 | **71** |
| Malibu Creek | 0 | 0 | 2 | 3 | 0 | **5** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 1 | 6 | 0 | **7** |
| Rio Hondo | 2 | 1 | 3 | 28 | 1 | **35** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Sacatara Creek-Kings Canyon | 0 | 0 | 0 | 1 | 0 | **1** |
| San Jose Creek | 0 | 2 | 2 | 58 | 10 | **72** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 1 | 0 | **1** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 2 | 0 | **2** |
| Town of Pearblossom | 0 | 0 | 1 | 9 | 0 | **10** |
| Upper Los Angeles River | 0 | 2 | 5 | 8 | 1 | **16** |
| Upper Piru Creek | 0 | 0 | 1 | 1 | 0 | **2** |
| Upper San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 1 | 0 | 5 | 5 | 0 | **11** |
| West Fork San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **17** | **23** | **54** | **378** | **131** | **603** |

Note: Facility counts shown are for the entire planning area. Counts within mapped floodplains are listed in Table 7-6 and Table 7-7. See Table 5-1 for data sources.

**TABLE 3-6.**
**COUNTY OF LOS ANGELES CRITICAL INFRASTRUCTURE**

| | Water Storage | Wastewater | Power | Communications | Bridges | Transportation | Dams | **Total** |
|---|---|---|---|---|---|---|---|---|
| Amargosa Creek | 0 | 1 | 0 | 2 | 36 | 1 | 3 | **43** |
| Ballona Creek | 0 | 0 | 1 | 1 | 20 | 0 | 0 | **22** |
| Big Rock Creek-Big Rock Wash | 0 | 0 | 0 | 0 | 5 | 1 | 0 | **6** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 0 | 2 | 6 | 2 | 0 | **10** |
| Big Tujunga Creek | 0 | 0 | 0 | 0 | 17 | 1 | 1 | **19** |
| Bouquet Canyon | 0 | 0 | 0 | 0 | 1 | 0 | 2 | **3** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 0 | 0 | 0 | 0 | 38 | 1 | 2 | **41** |
| Chino Creek | 0 | 0 | 0 | 4 | 2 | 1 | 0 | **7** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 19 | 0 | 3 | **22** |
| Dominguez Channel | 0 | 0 | 2 | 2 | 83 | 1 | 0 | **88** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 0 | 0 | 0 | 17 | 1 | 0 | **18** |
| Garapito Creek-Frontal Santa Monica Bay | 0 | 0 | 0 | 1 | 16 | 0 | 1 | **18** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 5 | 0 | 0 | **5** |
| Headwaters Santa Clara River | 0 | 0 | 0 | 6 | 60 | 3 | 0 | **69** |
| Lake Palmdale-Piute Ponds | 0 | 1 | 0 | 0 | 34 | 1 | 1 | **37** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 2 | 1 | 0 | **3** |
| Little Rock Wash | 0 | 0 | 0 | 0 | 9 | 1 | 1 | **11** |
| Lower Los Angeles River | 2 | 0 | 1 | 2 | 164 | 13 | 0 | **182** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 4 | 0 | 1 | **5** |
| Lower San Gabriel River | 1 | 2 | 1 | 1 | 73 | 0 | 2 | **80** |
| Malibu Creek | 0 | 1 | 0 | 0 | 21 | 5 | 2 | **29** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 0 | 1 | 5 | 2 | 0 | **8** |
| Rio Hondo | 0 | 1 | 0 | 17 | 31 | 0 | 1 | **50** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 0 | 0 | 0 | 0 | 2 | 0 | 0 | **2** |
| Sacatara Creek-Kings Canyon | 1 | 0 | 0 | 2 | 5 | 0 | 0 | **8** |
| San Jose Creek | 1 | 0 | 0 | 1 | 34 | 0 | 0 | **36** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 6 | 0 | 3 | 2 | **11** |

**TABLE 3-6.**
**COUNTY OF LOS ANGELES CRITICAL INFRASTRUCTURE**

| | Water Storage | Wastewater | Power | Communications | Bridges | Transportation | Dams | **Total** |
|---|---|---|---|---|---|---|---|---|
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 1 | 0 | 0 | 0 | **1** |
| Town of Pearblossom | 1 | 0 | 0 | 2 | 6 | 0 | 1 | **10** |
| Upper Los Angeles River | 0 | 0 | 0 | 1 | 84 | 0 | 2 | **87** |
| Upper Piru Creek | 0 | 0 | 1 | 1 | 41 | 1 | 0 | **44** |
| Upper San Gabriel River | 0 | 0 | 0 | 0 | 5 | 0 | 0 | **5** |
| Upper Santa Clara River | 0 | 1 | 1 | 0 | 36 | 0 | 1 | **39** |
| West Fork San Gabriel River | 0 | 0 | 0 | 16 | 8 | 2 | 1 | **27** |
| **Total** | **6** | **7** | **7** | **69** | **889** | **41** | **27** | **1046** |

Note: Facility counts shown are for the entire planning area. Counts within mapped floodplains are listed in Table 7-8 and Table 7-9. See Table 5-1 for data sources. See Table 5-1 for data sources.

## 3.4 DEMOGRAPHICS

Some populations are at greater risk from hazard events such as floods because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly (especially older single men), the disabled, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a flood event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would help to extend focused public outreach and education to these most vulnerable citizens.

### 3.4.1 Population Characteristics

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. The California Department of Finance estimated Los Angeles County's population at 10,041,797 as of January 1, 2014: 1,046,557 in unincorporated areas and 8,995,240 in incorporated areas (California Department of Finance, 2014).

Population changes are useful socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population signifies economic decline. Figure 3-5 shows annual population changes from 1991 to 2014 for unincorporated Los Angeles County, the County as a whole, and the State of California (California Department of Finance, 2007, 2012 and 2014).

Source: California Department of Finance, 2007, 2012 and 2014

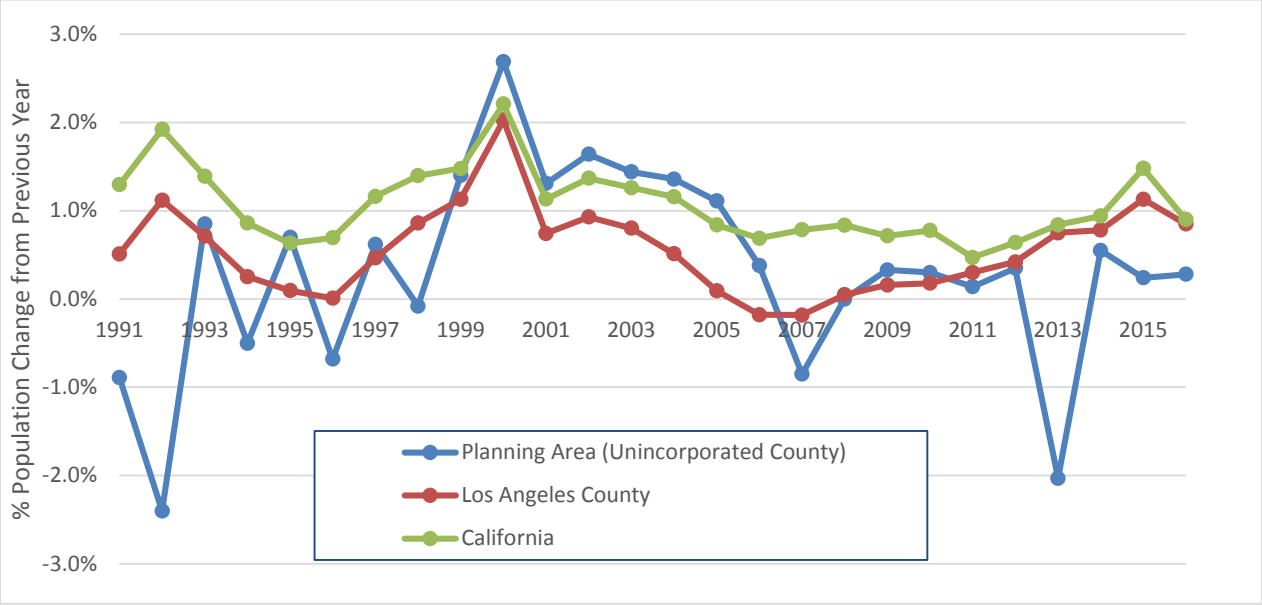



*Figure 3-5. California and Los Angeles County Population Growth*

The population of the unincorporated area drops in years when annexations move population from unincorporated to incorporated areas; however, in years when such declines did not occur, the population growth rate in the unincorporated county was generally higher than the countywide and statewide growth rates through the mid-2000s. Unincorporated area growth has been lower than the state and countywide rates in more recent years.

The Los Angeles County General Plan (Los Angeles County, 2015) forecasts that, by 2035, total County population will increase to 11,353,000 and unincorporated-area population will increase to 1,399,500. These projections represent a 16-percent increase from 2008 for the total County and a 33-percent increase for the unincorporated area.

## 3.4.2 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards such as flooding. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in floods than other types of housing. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

In the most recent 3-year estimates (2011 – 2013) from the U.S. Census Bureau's American Community Survey, per capita income in Los Angeles County was $27,288 and the median household income was $54,244. It is estimated that 13.2 percent of households receive an income between $100,000 and $149,999 per year and 12.1 percent of household incomes are above $150,000 annually. The Census Bureau estimates that 18.8 percent of the population in the County lives below the poverty level (U.S. Census, 2013b).

### 3.4.3 Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events such as floods and are more likely to suffer health-related consequences. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from the flood hazard.

The overall age distribution for Los Angeles County is illustrated in Figure 3-6. Based on the most recent 3-year estimates from the U.S. Census Bureau's American Community Survey (2011 – 2013), 11.6 percent of the County's population is 65 or older. According to the Census data, 38 percent of the over-65 population has disabilities of some kind and 13.4 percent have incomes below the poverty line. The county's population includes 19.4 percent who are 14 or younger. Among children under 18, 26.7 percent are below the poverty line. (U.S. Census, 2013a, 2013b and 2013c)

*Source: U.S. Census, 2013c*

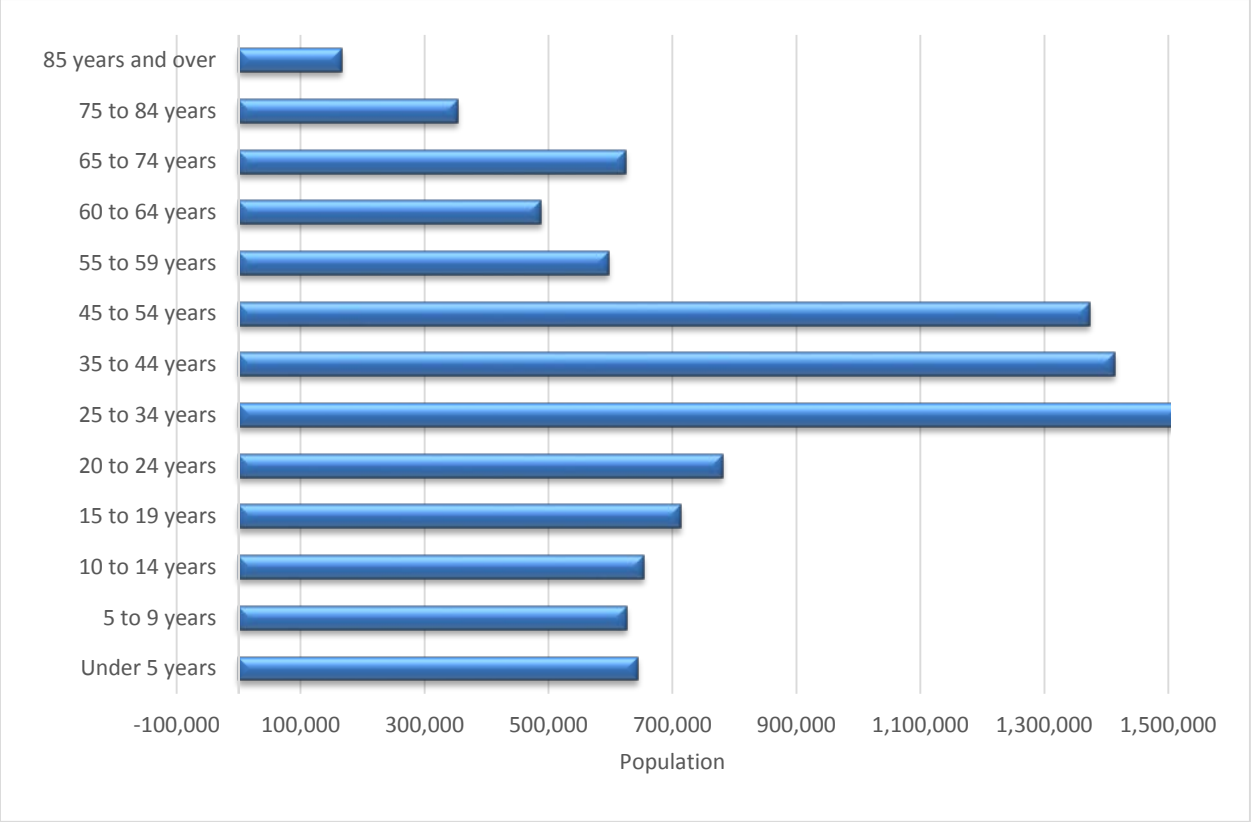



*Figure 3-6. Los Angeles County Age Distribution*

### 3.4.4 Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to the most recent 3-year estimates from the U.S. Census Bureau's American Community Survey (2011 – 2013), the racial composition of Los Angeles County is 53.7 percent white. The largest identified minority populations are Asian at 13.9 percent and Black or African American at 8.3 percent; 19.4 percent of the population identifies as "some other race." Figure 3-7 shows the racial distribution in the County. The County's population is 48.1 percent Hispanic. (U.S. Census, 2013c)

*Source: U.S. Census, 2013c*

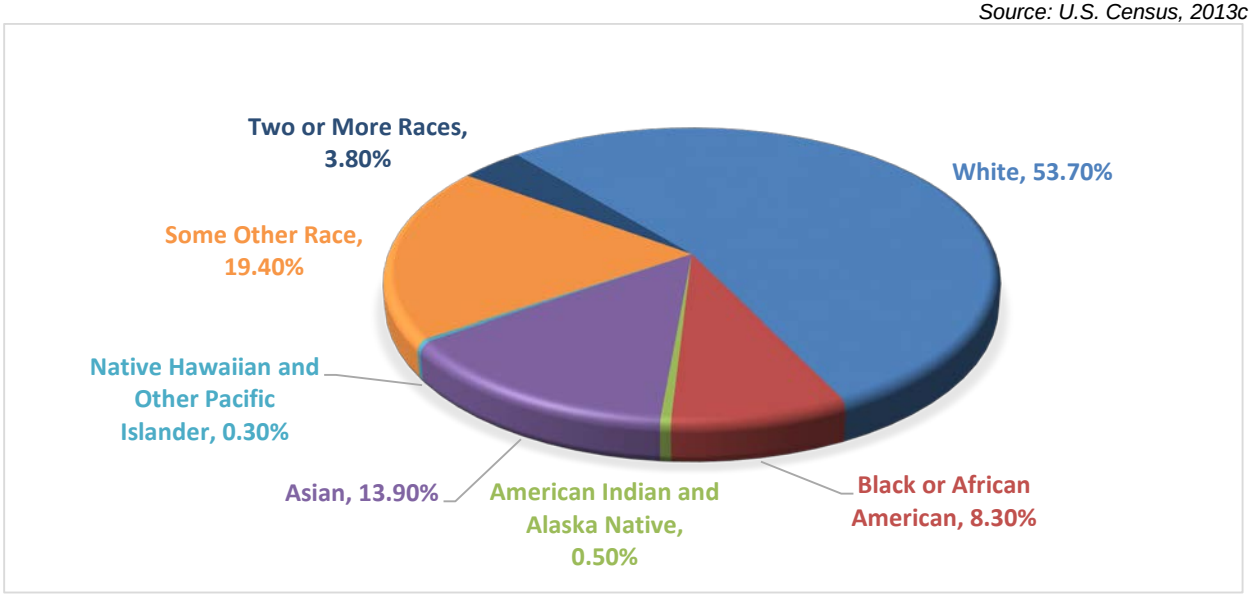



*Figure 3-7. Los Angeles County Race Distribution*

Los Angeles County has a 34.9-percent foreign-born population. Census data indicate that more than half of the population—56.9 percent—speak a language other than English at home, including 39.4 percent of the total population who speak Spanish at home; another 10.8 percent speak an Asian or Pacific Islander language at home. The census estimates that 25.8 percent of the residents speak English "less than very well." (U.S. Census, 2013a).

## 3.5 ECONOMY

### 3.5.1 Industry, Businesses and Institutions

Los Angeles County's economy is strongly based in the education/health care/social service industry (21 percent of employment), followed by professional/scientific/management/administrative (12 percent) and retail trade (11 percent). Natural resource industries (<1 percent), and public administration (3 percent) are the industries making up the smallest sources of the local economy. Figure 3-8 shows the breakdown of industry types in the County. (U.S. Census, 2013b)

Source: U.S. Census, 2013b

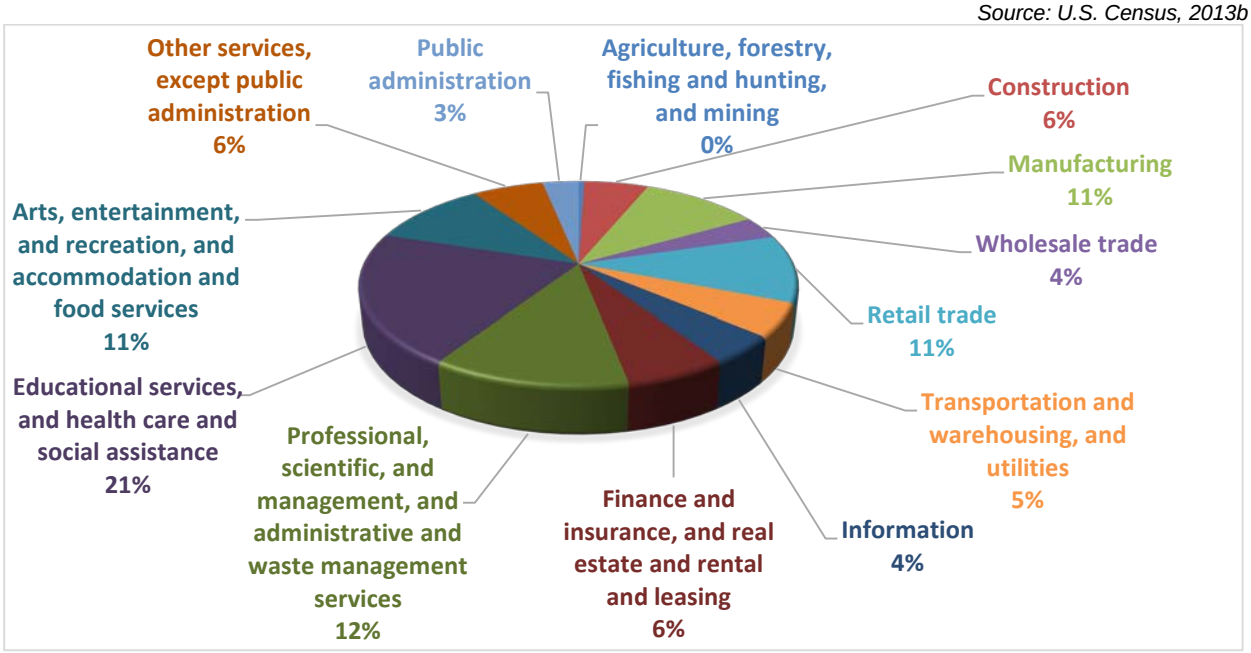



*Figure 3-8. Industry in Los Angeles County*

Available online data sources identify the following large employers in Los Angeles County (EDD, 2014a; LA Almanac, 2014; Statisticbrain.com, 2014):

- Government organizations are among the largest individual employers: Los Angeles County, Los Angeles Unified Schools, the City of Los Angeles, the federal government and the State of California.
- Several universities are major employers, including the University of California Los Angeles, the University of Southern California and the California Institute of Technology.
- Large health-care providers include Kaiser Permanente, Cedars-Sinai Medical Center, Providence Health and Services and Adventist Health.
- Large defense contractors with many employees in the county include Northrup Grumman Corporation, the Boeing Company, Raytheon Company and Lockheed Martin Corporation.
- Major employers in retail include Kroger, Target, Home Depot, Von's and Costco.
- Banks with many employees in the county include Bank of America and Wells Fargo
- Walt Disney Company, Warner Bros. Entertainment Inc. and Sony Pictures Entertainment are significant employers in the entertainment industry.

## 3.5.2 Employment Trends and Occupations

According to the 2011-2013 3-year American Community Survey, 64.6 percent of the Los Angeles County population 16 years old or older is in the labor force, including 57.8 percent of women in that age range and 71.7 percent of men (U.S. Census, 2013b).

Figure 3-9 compares California's and Los Angeles County's unemployment trends from 1990 through 2013, based on data from the U.S. Bureau of Labor Statistics (BLS, 2014) and the California Employment Development Department (EDD, 2014b). Los Angeles County's unemployment rate was lowest in 2006 at

4.8 percent. The rate peaked at 12.6 percent in 2010, and has declined since then. The county unemployment rate has generally been slightly higher than the statewide rate.

Figure 3-10 shows Census Bureau estimates of employment distribution by occupation category (U.S. Census, 2013b). Management, business, science and arts occupations make up 35 percent of the jobs in the County. Sales and office occupations make up 25 percent of the local working population. The U.S. Census estimates that 72.6 percent of workers in the County commute alone (by car, truck or van) to work, and mean travel time to work is 29.7 minutes (U.S. Census, 2013b).

*Sources: BLS, 2014 and EDD, 2014b*

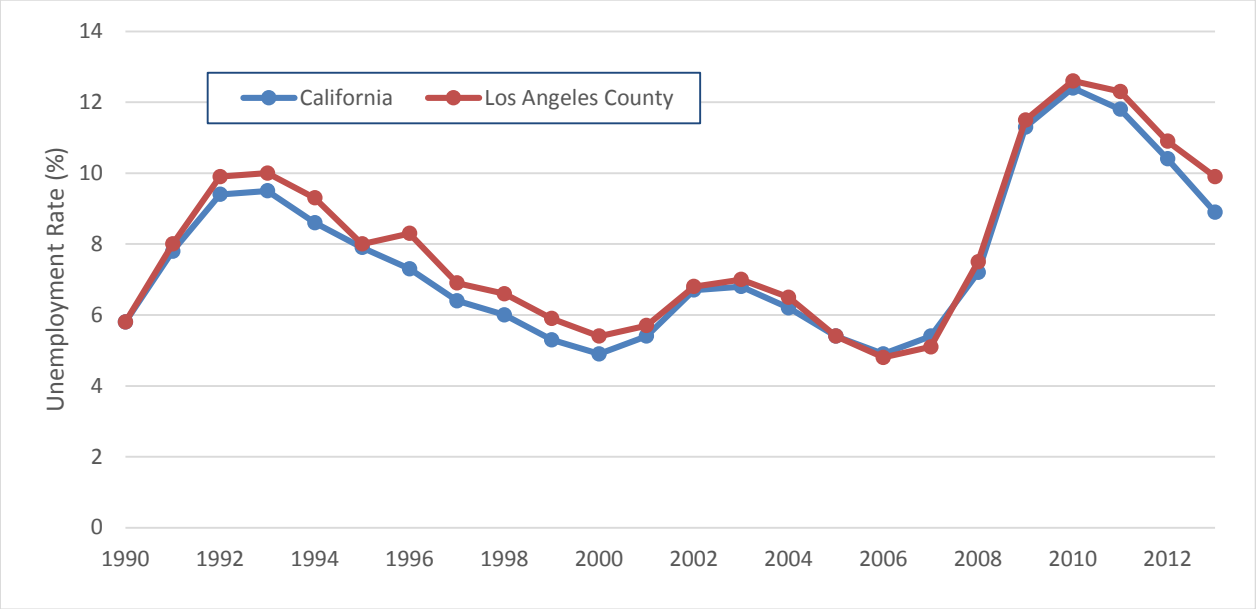



*Figure 3-9. California and Los Angeles County Unemployment Rate*

*Source: U.S. Census, 2013b*

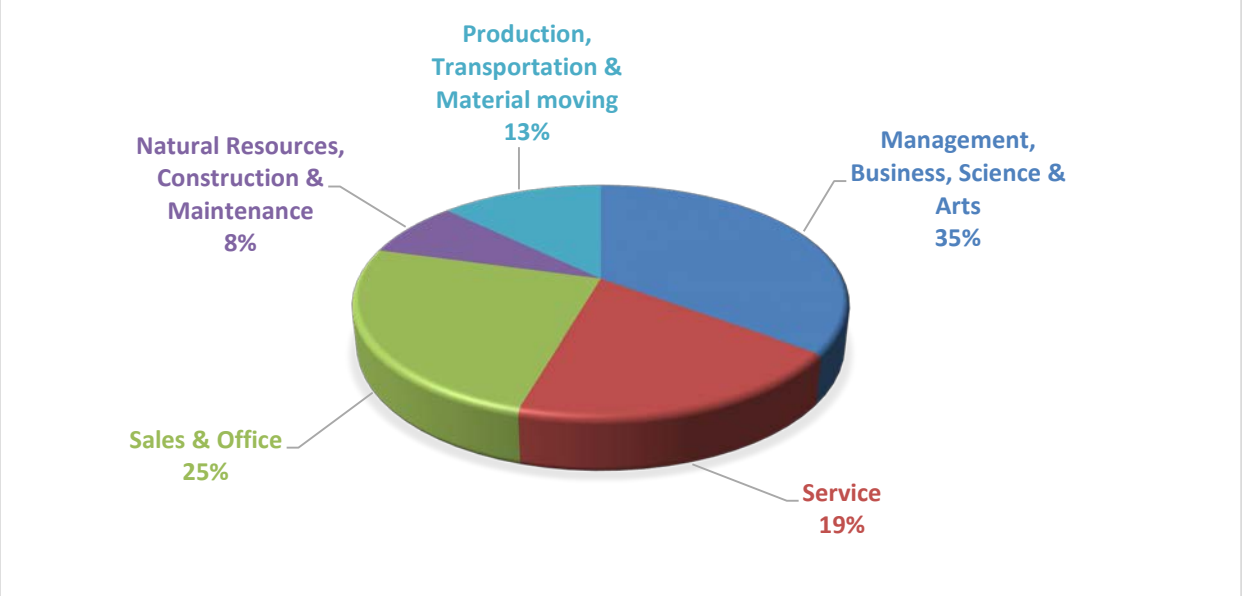



*Figure 3-10. Occupations in Los Angeles County*

# CHAPTER 4.
# RELEVANT PROGRAMS AND REGULATIONS

The CRS 10-step planning process provides credit for a planning process that includes a review of existing studies, reports, and technical information and of the community's needs, goals, and plans for the area (Step 3a). Where information from the existing studies and reports is used in the plan, the source should be referenced. The review needs to cover community needs and goals, past flood studies, disaster damage reports, natural area plans, and other documents that will provide information for the planning process.

This chapter identifies existing laws, ordinances and plans at the federal, state and local level that can support or impact mitigation initiatives identified in this plan. The information provided is used to support the capabilities assessment presented in Section 4.4. Each program identified in this chapter represents a capability that the County has to implement actions identified in Chapter 11 of this plan. These are ongoing programs leveraged by the County to promote flood resiliency within the planning area.

Federal, state, and local agencies share and coordinate responsibilities for flood protection in Los Angeles County. The two main federal agencies are the U.S. Army Corps of Engineers, which implements federal flood protection policies, and FEMA. The California Department of Water Resources (DWR) is responsible for managing the state's waterways. The Los Angeles County Department of Public Works and the Los Angeles County Flood Control District work to reduce flood risk in Los Angeles County. Development of this plan included a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process. Pertinent federal, state and local laws are described below.

## 4.1 FEDERAL

### 4.1.1 National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood (called the 100-year flood or base flood) and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a flood-prone area, participating jurisdictions must, at a minimum, ensure that the project meets the following criteria (44 CFR Part 60, Section 60.3):

- Be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy,
- Be constructed with materials resistant to flood damage
- Be constructed by methods and practices that minimize flood damage

- Be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Additional criteria apply depending on the availability of information about the flood hazard.

Los Angeles County participates in the NFIP and has adopted regulations that meet the NFIP requirements. The County entered the NFIP in 1980, and the first Los Angeles County FIRM was issued December 2, 1980. Structures permitted or built before then are called "pre-FIRM" structures, and structures built afterwards are called "post-FIRM." The insurance rate is different for the two types of structures. The effective date for the current FIRM is September 26, 2008. Los Angeles County is currently in good standing with the provisions of the NFIP as monitored by FEMA Region IX and the California Department of Water Resources. Table 4-5 (at the end of this chapter) summarizes the NFIP capability of Los Angeles County.

## 4.1.2 The Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions to meet the CRS goals of reducing flood losses, facilitating accurate insurance rating and promoting awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 9 community would receive a 5 percent premium discount, a Class 8 community would receive a 10 percent premium discount, and so on, until reaching a 45 percent premium discount for a Class 1 community. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) As of May 2014, out of 1,296 communities in the U.S. participating in the CRS program, only 88 were rated Class 5 and only 12 were rated higher (see Figure 4-1).

*Source: FEMA, 2014a*

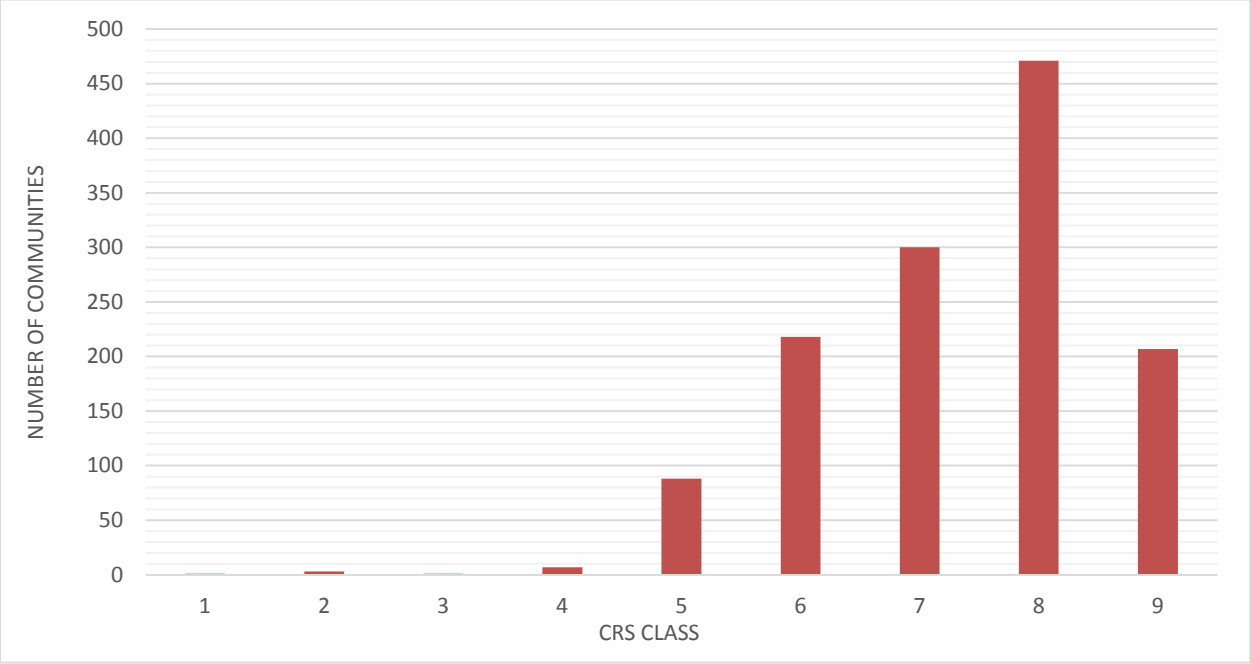



*Figure 4-1. CRS Communities by Class Nationwide as of May 2014*

The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Los Angeles County has participated in the CRS program since 1990. Los Angeles County has a Class 7 rating (out of 10), so citizens who live in a 100-year floodplain in unincorporated areas of the county can receive a 15-percent discount on their flood insurance; outside the 100-year floodplain they receive a 5-percent discount. This equates to a savings ranging from $66 to $475 per policy, for a total countywide premium savings of almost $350,000 (California DWR, 2013). To maintain or improve its rating, the Los Angeles County goes through an annual recertification and a re-verification every five years. This plan has been developed to help the County maintain or enhance its CRS classification in the future.

### 4.1.3 Disaster Mitigation Act of 2000

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for state, local and Indian tribal governments as a condition of mitigation grant assistance. The DMA replaced previous federal mitigation planning provisions with new requirements that emphasize the need for planning entities to coordinate mitigation planning and implementation efforts. The DMA established a new requirement for local mitigation plans and authorized up to 7 percent of Hazard Mitigation Grant Program funds to be available for development of state, local, and Indian tribal mitigation plans.

Los Angeles County, in conjunction with its many emergency services partners, has prepared a Local All-Hazards Mitigation Plan that sets strategies for coping with the natural and man-made hazards faced by residents. The plan is a compilation of information from County departments correlated with known and projected hazards that face southern California. It was formally adopted by the Los Angeles County Board of Supervisors for use in the development of specific hazard mitigation proposals that have a high cost-benefit ratio. The plan complies with requirements of FEMA and the Governor's Office of Emergency Services and was approved by both agencies in 2014. It has a 5-year performance period through 2019.

### 4.1.4 Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

In some parts of the country, including the Pacific Northwest and the Sacramento-San Joaquin Delta area, court rulings have found that floodplain management measures can be in conflict with the goals of the endangered species act. Those rulings have required FEMA and local governments to engage in a consultation process with federal wildlife agencies (Section 7 of the ESA) as they work to develop certain floodplain management programs, plans and projects. No such rulings currently affect the Los Angeles area, but floodplain managers should nonetheless be aware of any potential activities that could fall under the ESA.

### 4.1.5 The Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach. Sections 4.2.8 and 4.3.2 describe the State's and County's response to the Clean Water Act.

### 4.1.6 National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving floods and other hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In other instances, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency-responder disciplines. These instances necessitate coordination across this spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, terrorist activities, and other human-caused disasters) regardless of size or complexity.

Los Angeles County has adopted an emergency response plan that is fully NIMS compliant. The County adopted the County of Los Angeles Operational Area Emergency Response Plan in March 2012. The Governor's Office of Emergency Services approved it as NIMS compliant on August 31, 2011.

### 4.1.7 Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. The most recent amendments became effective in January 2009 (P.L. 110-325). Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have any necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or visual alerts. Two stand-alone technical documents have been issued for shelter operators to meet the needs of people with disabilities. These documents address physical accessibility as well as medical needs and service animals.

The ADA also intersects with disaster preparedness programs in regards to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

## 4.2 STATE

### 4.2.1 California General Planning Law

California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The general plan expresses the community's goals, visions, and policies relative to future land uses, both public and private. The general plan is mandated and prescribed by state law (Cal. Gov. Code §65300 et seq.), and forms the basis for most local government land use decision-making. The plan must consist of an integrated and internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. County actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan.

The Los Angeles County Department of Regional Planning has developed and maintains a General Plan under the provisions of California's general planning law. The Los Angeles County 2035 General Plan provides a policy framework for how and where the unincorporated County will grow through 2035, while recognizing the County's diversity of cultures, abundant natural resources, and status as an international economic center. The Los Angeles County 2035 General Plan accommodates new housing and jobs within unincorporated areas in anticipation of population growth in the County and the region.

### 4.2.2 California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970, shortly after the federal government passed the National Environmental Policy Act, to institute a statewide policy of environmental protection. CEQA requires state and local agencies in California to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. CEQA makes environmental protection a mandatory part of every California state and local agency's decision making process.

CEQA establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. For any project under CEQA's jurisdiction with potentially significant environmental impacts, agencies must identify mitigation measures and alternatives by preparing an environmental impact report and may approve only projects with no feasible mitigation measures or environmentally superior alternatives.

This updated floodplain management plan does not require CEQA environmental review. It constitutes a feasibility and planning study for possible future actions, which the County has not approved, adopted or funded, and therefore is exempt from CEQA under Section 15262 of the CEQA Guidelines. However, future mitigation actions implemented as recommended by this plan may be subject to CEQA review.

### 4.2.3 AB 162: Flood Planning, Chapter 369, Statutes of 2007

This California State Assembly Bill passed in 2007 requires cities and counties to address flood-related matters in the land use, conservation, and safety and housing elements of their general plans. The land use element must identify and annually review the areas covered by the general plan that are subject to flooding as identified in floodplain mapping by either FEMA or the California DWR. The conservation element of the general plan must identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for the purposes of groundwater recharge and stormwater management. The safety element must identify information regarding flood hazards including (California Legislature, 2015):

- Flood hazard zones
- Maps published by FEMA, California DWR, the U.S. Army Corps of Engineers, the Central Valley Flood Protection Board, the Governor's Office of Emergency Services, etc.
- Historical data on flooding
- Existing and planned development in flood hazard zones.

The general plan must establish goals, policies and objectives to protect from unreasonable flooding risks including:

- Avoiding or minimizing the risks of flooding new development
- Evaluating whether new development should be located in flood hazard zones
- Identifying construction methods to minimize damage.

AB 162 establishes goals, policies and objectives to protect from unreasonable flooding risks. It establishes procedures for the determination of available land suitable for urban development, which may exclude lands where FEMA or California DWR has determined that the flood management infrastructure is not adequate to avoid the risk of flooding.

### 4.2.4 SB 379: Land Use, General Plan, Safety Element

This California Senate Bill establishes provisions that require the safety element in local general plans to be reviewed and updated to address climate adaptation and resiliency strategies. The safety element must include a vulnerability assessment, adaptation goals, policies and objectives, and implementation measures. A safety element update to comply with the law is due at the time of a jurisdiction's first local hazard mitigation plan adoption after January 1, 2017, or if no such FEMA plan has been adopted, by January 1, 2022. The bill also references specific sources of useful climate information to consult, such as Cal-Adapt.

### 4.2.5 California State Building Code

California Code of Regulations Title 24 (CCR Title 24), also known as the California Building Standards Code, is a compilation of building standards from three sources:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes

- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes adopted to address particular California concerns.

The state Building Standards Commission is authorized by California Building Standards Law (Health and Safety Code Sections 18901 through 18949.6) to administer the processes related to the adoption, approval, publication, and implementation of California's building codes. These building codes serve as the basis for the design and construction of buildings in California. The national model code standards adopted into Title 24 apply to all occupancies in California except for modifications adopted by state agencies and local governing bodies. Since 1989, the Building Standards Commission has published new editions of Title 24 every three years.

## 4.2.6 Standardized Emergency Management System

CCR Title 19 establishes the Standardized Emergency Management System to standardize the response to emergencies involving multiple jurisdictions. The Standardized Emergency Management System is intended to be flexible and adaptable to the needs of all emergency responders in California. It requires emergency response agencies to use basic principles and components of emergency management. Local governments must use the system in order to be eligible for state funding of response-related personnel costs under CCR Title 19 (Sections 2920, 2925 and 2930). Individual agencies' roles and responsibilities contained in existing laws or the state emergency plan are not superseded by these regulations.

Los Angeles County has adopted an emergency response plan that is fully NIMS compliant. The County adopted the County of Los Angeles Operational Area Emergency Response Plan in March 2012. The Governor's Office of Emergency Services approved it as NIMS compliant on August 31, 2011.

## 4.2.7 California State Hazard Mitigation Plan

Under the DMA, California must adopt a federally approved state multi-hazard mitigation plan in order to be eligible for certain disaster assistance and mitigation funding. The intent of the California State Hazard Mitigation Plan is to reduce or prevent injury and damage from hazards in the state through the following:

- Documenting statewide hazard mitigation planning in California
- Describing strategies and priorities for future mitigation activities
- Facilitating the integration of local and tribal hazard mitigation planning activities into statewide efforts
- Meeting state and federal statutory and regulatory requirements.

The plan is an annex to the State Emergency Plan, and it identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. It also establishes hazard mitigation goals and objectives. The plan will be reviewed and updated annually to reflect changing conditions and new information, especially information on local planning activities.

Local hazard mitigation plans developed in response to the Disaster Mitigation Act in the State of California are to be consistent with the provisions of the approved State Hazard Mitigation Plan. The 2014 County of Los Angeles All Hazards Mitigation plan was determined to be consistent with the state plan by the Governor's Office of Emergency Services during its review and approval of the plan in 2013.

### 4.2.8 Governor's Executive Order S-13-08

Governor's Executive Order S-13-08 enhances the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events. There are four key actions in the executive order:

- Initiate California's first statewide climate change adaptation strategy to assess expected climate change impacts, identify where California is most vulnerable, and recommend adaptation policies by early 2009. This effort will improve coordination within state government so that better planning can more effectively address climate impacts on human health, the environment, the state's water supply and the economy.
- Request that the National Academy of Science establish an expert panel to report on sea level rise impacts in California, to inform state planning and development efforts.
- Issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects.
- Initiate a report on critical infrastructure projects vulnerable to sea level rise.

### 4.2.9 Los Angeles Regional Water Quality Control Board

The Los Angeles Regional Water Quality Control Board protects ground and surface water quality in the Los Angeles region. It is one of nine regional boards statewide under the California Environmental Protection Agency. The board conducts the following activities to protect ground and surface waters under its jurisdiction (California State Water Resources Control Board, 2015):

- Address region-wide and specific water quality concerns through updates of the Water Quality Control Plan (Basin Plan) for the Los Angeles Region.
- Prepare, monitor compliance with, and enforce waste discharge requirements.
- Implement and enforce local stormwater control efforts.
- Regulate the cleanup of contaminated sites that have polluted groundwater or surface water or have the potential to do so.
- Enforce water quality laws, regulations, and waste discharge requirements.
- Coordinate with other public agencies and groups that are concerned with water quality.
- Inform and involve the public on water quality issues.

### 4.2.10 California Civil Code 1102

Article 1102 of the California Civil Code establishes requirements for disclosure of information as part of real estate transactions. It applies to any transfer of real property or residential stock cooperative with one to four dwelling units, by sale, exchange, installment land sale contract, lease with an option to purchase, other option to purchase, or ground lease coupled with improvements. The code imposes disclosure duties on the seller, the seller's agent, or both. Provisions of this code require disclosure of information regarding the proximity of the subject property to areas of natural hazards, including flood, wildfire and earthquake.

# 4.3 LOCAL

## 4.3.1 General Plan

The Los Angeles County 2035 General Plan, adopted in October 2015, is the latest update to the County of Los Angeles general plan. It provides a policy framework for how and where the unincorporated County will grow through 2035. It accommodates new housing and jobs within the unincorporated areas in anticipation of population growth in the County and the broader region. The General Plan includes the following elements (Los Angeles County Department of Regional Planning, 2015b):

- Land Use Element
- Mobility Element
- Air Quality Element
- Conservation and Natural Resources Element
- Parks and Recreation Element
- Noise Element
- Safety Element
- Public Services and Facilities Element
- Economic Development Element
- Housing Element.

General Plan elements that are particularly applicable to implementation of the floodplain management plan are the Conservation and Natural Resources Element, which guides the long-term conservation of natural resources and preservation of available open space areas, and the Safety Element, which reduces the potential risk of death, injuries, and economic damage resulting from natural and human-caused hazards.

### *Conservation and Natural Resources Element*

#### *Watershed Management*

The Conservation and Natural Resources Element of the General Plan addresses watershed management, noting that it is an effective and comprehensive way to address water resource challenges. Watershed management integrates habitat enrichment and recreation availability with water supply, flood protection, and clean runoff (Los Angeles County, 2015).

Because a watershed encompasses many jurisdictions, water supply, water quality, flood protection and natural resource issues are best managed at a regional or multiple-agency level. The County works within its jurisdiction to improve the health of rivers, streams and lesser tributaries to enhance overall water resources, runoff quality and wildlife habitat. However, watershed integration requires the County to also participate with other stakeholders to manage the function and health of watersheds. Collaboration with local stakeholders and jurisdictions and with educational and professional institutions is needed to develop and implement watershed plans to protect and augment local water supplies, maintain flood protection standards, provide assistance in the event of flooding, encourage recreational opportunities, conserve habitats of native species, and improve the quality of water that flows to rivers, lakes, and the ocean.

#### *Significant Ecological Areas and Coastal Resource Areas*

The Conservation and Natural Resources Element of the General Plan establishes the Significant Ecological Area (SEA) designation for land that contains irreplaceable biological resources. Coastal Resource Areas (CRAs) are located within the coastal zone and include biological resources equal in significance to SEAs. The General Plan identifies 21 SEAs and 9 CRAs. Two CRAs are linked to SEAs that are not entirely within CRAs (the Santa Monica Mountains Coastal Zone and Palos Verde Coastline) (Los Angeles County, 2015):

- Significant Ecological Areas
  - Cruzan Mesa Vernal Pools
  - East San Gabriel Valley
  - Griffith Park
  - Harbor Lake Regional Park
  - Joshua Tree Woodlands
  - Madrona Marsh Preserve
  - Palos Verdes Peninsula and Coastline
  - Puente Hills
  - Rio Hondo College Wildlife Sanctuary
  - San Andreas
  - San Dimas Canyon / San Antonio Wash
  - San Gabriel Canyon
  - Santa Clara River
  - Santa Felicia
  - Santa Monica Mountains
  - Santa Susana Mountains / Simi Hills
  - Tujunga Valley / Hansen Dam
  - Valley Oaks Savannah
  - Verdugo Mountains
- Coastal Resource Areas
  - El Segundo Dunes
  - Malibu Coastline
  - Palos Verdes Coastline (ocean and shoreline portions)
  - Point Dume
  - Santa Catalina Island
  - Coastal Zone of the Santa Monica Mountains
  - Terminal Island (Pier 400)

The objective of the SEA Program is to conserve genetic and physical diversity by designating biological resource areas that are capable of sustaining themselves into the future. However, SEAs are not wilderness preserves. Much of the land in SEAs is privately is held, used for public recreation, or abuts developed areas. The SEA program must therefore balance the overall objective of resource preservation against other critical public needs. The General Plan goals and policies are intended to ensure that privately held lands within the SEAs retain the right of reasonable use, while avoiding activities and developments that are incompatible with the long-term survival of the SEAs (Los Angeles County, 2015).

### *Safety Element*

Flooding is among the natural hazards addressed in the Safety Element of the General Plan. The element presents goals and policies for uses in flood hazard zones, as well as tsunami hazard areas and potential dam failure inundation areas. It also addresses the potential impact on flooding of sea level rise associated with climate change (Los Angeles County, 2015).

## 4.3.2 Community Plans

The Los Angeles County General Plan (2015) serves as the foundation for community-based plans, such as area plans, community plans, and coastal land use plans. Area plans focus on land use and policy issues that are specific to the planning area. Community plans cover smaller geographic areas within the planning

area and address neighborhood and/or community-level policy issues. Coastal land use plans are components of local coastal programs; they regulate land use and establish policies to guide development in the coastal zone. The following is a list of community-based plans in Los Angeles County:

- Altadena Community Plan
- Antelope Valley Area Plan
- East Los Angeles Community Plan
- Hacienda Heights Community Plan
- Marina del Rey Local Coastal Land Use Plan
- Malibu Local Coastal Land Use Plan
- Rowland Heights Community Plan
- Santa Monica Mountains North Area Plan
- Santa Catalina Island Local Coastal Land Use Plan
- Santa Clarita Valley Area Plan
- Twin Lakes Community Plan
- Walnut Park Neighborhood Plan
- West Athens-Westmont Community Plan.

### 4.3.3 Watershed Management Program

Municipalities and community stakeholders throughout Los Angeles County developed a total of 19 collaborative Watershed Management Programs and Enhanced Watershed Management Programs for the county's six watersheds—Dominguez Channel, Los Angeles River, Los Cerritos Channel, San Gabriel River, Santa Monica Bay and Upper Santa Clara River. Each Watershed Management Group meets regularly to implement its plan. The draft plans were submitted to the Los Angeles Regional Water Quality Control Board by June 30, 2015.

Each plan identifies programs and projects to improve water quality, promote water conservation, enhance recreational opportunities, manage flood risk, improve aesthetics, and support public education. Each includes water quality priorities, watershed control measures, the scheduling of projects, and monitoring, assessment and adaptive management for projects. The plans rely heavily on three approaches:

- **Regional Multi-Benefit Projects**—Regional multi-benefit projects retain, divert or treat stormwater and non-stormwater from subwatershed areas, while also providing water conservation, flood, recreation, habitat and other benefits.
- **Green Street Projects**—Green street projects improve streets, sidewalks or other paved areas using permeable materials and drought-tolerant plants to capture, clean or infiltrate rain water. Green infrastructure projects help to clean surface water bodies, recharge groundwater, beautify neighborhoods, and cool communities by increasing the amount of vegetation.
- **Low Impact Development**—Low impact development consists of site design approaches and best management practices that address runoff and pollution at the source. These practices can effectively remove nutrients, bacteria, and metals while reducing the volume and intensity of stormwater flows.

### 4.3.4 Greater Los Angeles County Region Integrated Regional Water Management Plan

The 2013 Integrated Regional Water Management (IRWM) Plan Update defines the direction for collaborative planning to achieve sustainable management of water resources in the Greater Los Angeles County Region. The Plan identifies solutions to achieve the following objectives over the 25-year planning horizon:

- Reduce the region's reliance on imported water
- Comply with water quality regulations by improving the quality of urban runoff, stormwater and wastewater
- Protect, restore and enhance natural processes and habitats
- Increase watershed-friendly recreational space for all communities
- Reduce flood risk in flood-prone areas by increasing protection or decreasing needs using integrated flood management approaches
- Adapt to and mitigate against climate change vulnerabilities.

Since 2006, the Greater Los Angeles County Region has supported projects that achieve these objectives, including 52 projects that were awarded over $100 million of IRWM implementation grant funding.

### 4.3.5 Los Angeles County Flood Control District

The Los Angeles County Flood Control Act was adopted by the State Legislature in 1915 after a regional flood took a heavy toll on lives and property. The act established the Los Angeles County Flood Control District and empowered it to provide flood protection, water conservation, recreation and aesthetic enhancement within its boundaries. The Flood Control District is governed, as a separate entity, by the County of Los Angeles Board of Supervisors. In 1984, the Flood Control District entered into an operational agreement transferring planning and operational activities to the Los Angeles County Department of Public Works.

Within the Greater Los Angeles County area, the Flood Control District and the U.S. Army Corps of Engineers share responsibilities for managing flood risk. The Flood Control District is the primary agency able to address large regional drainage needs. It uses available funds to operate and maintain flood control facilities and systems that cross various cities. In years of heavy rainfall, the flood control system has largely prevented serious flooding that affected the Los Angeles area many years ago.

The Flood Control District boundaries encompass 2,752 square miles, six major watersheds and 85 cities. Its municipal flood protection and water conservation system is one of the largest in the world. It includes 14 major dams and reservoirs, 487 miles of open channels, 162 debris dams, 2,919 miles of underground storm drain and more that 80,000 catch basins. Planning efforts to rehabilitate flood control facilities also consider other potential beneficial uses of those facilities, such as environmental restoration, enhancement of water quality, and recreation.

### 4.3.6 Antelope Valley Comprehensive Plan and Amendments

Los Angeles County originally developed a comprehensive plan for the Antelope Valley, an unincorporated section of the County, in 1987. The Antelope Valley differs from other parts of the County because it lacks an ocean drainage outlet. It also lacks defined natural channels below the foothills, as well as an adequate flood control system, resulting in unpredictable and varying flood risk across the valley floor. The plan explores flood control and water conservation measures to reduce the negative effects of regional private development and to better address local flood hazard needs. It seeks to provide a cohesive approach to drainage, stormwater management, and flood risk mitigation. The plan evaluates the fee structures available to finance drainage solutions (Los Angeles County Department of Public Works, 1987). Two amendments to the original plan update costs and drainage fees to continue implementing recommended improvements (Los Angeles County Department of Public Works, 1991 and 2006).

### 4.3.7 Antelope Valley Integrated Regional Water Management Plan

The Antelope Valley Integrated Regional Water Management (IRWM) group developed a water resource management plan in 2007. The 2007 plan was updated in 2013 to reflect new state integrated planning requirements, include more detailed and updated content, and solicit future project funding opportunities. The 2013 Antelope Valley IRWM Plan explores key issues, including uncertain and variable water supply, water demand exceeding supply, water quality and flood management, environmental resources, water management and land use, and climate change. It identifies and prioritizes a series of projects to address key concerns in the region, particularly those related to water supply (Antelope Valley Integrated Regional Water Management Group, 2013).

### 4.3.8 Upper Santa Clara River Watershed Integrated Regional Water Management Plan

The Upper Santa Clara River Watershed Integrated Regional Water Management group developed a water resource management plan that was last updated in 2014. The 2014 Upper Santa Clara River Watershed IRWM Plan examines current and future water-related needs, identifies regional objectives for water-related resource management, develops strategies to address identified needs, and evaluates projects to meet the regional objectives. It integrates planning and implementation and facilitates regional cooperation, with the goals of reducing water demand, improving operational efficiency, increasing water supply, improving water quality, and promoting resource stewardship over the long term (Los Angeles County, 2015a).

### 4.3.9 Sediment Management Strategic Plan

The Los Angeles County Flood Control District developed a Sediment Management Strategic Plan in response to challenges in managing sediment. These challenges included recent wildfires that led to an increased inflow of sediment and debris and increased pressure on the capacity of sediment placement sites. This plan provides an overview of sediment management issues and evaluates various projects. It is guided by the following objectives:

- Maintaining flood risk management and water conservation
- Recognizing opportunities for increased environmental stewardship
- Reducing social impacts related to sediment management
- Identifying ways to use sediment as a resource
- Ensuring that the Flood Control District is fiscally responsible in its decision-making.

The plan is designed to be effective from 2012 to 2032 (Los Angeles County Department of Public Works, 2012).

### 4.3.10 Local Coastal Programs

The County of Los Angeles Local Coastal Programs (LCPs) comply with the 1976 Coastal Act, enacted by the California Legislature, which requires coastal cities and counties to establish coastal resource conservation and development programs. The LCPs consist of planning and regulatory measures that manage short-term and long-term development in the coastal zone. Each LCP includes a land use plan and implementation action plan. LCPs must consider the unique factors of the coastal community, as well as regional and state concerns. The County of Los Angeles has LCPs for three unincorporated areas: the Santa Monica Mountains, Marina Del Rey, and Santa Catalina Island.

### 4.3.11 Los Angeles County Low Impact Development Ordinance

In November 2012, the Los Angeles Regional Water Quality Control Board adopted a Municipal Separate Storm Sewer System (MS4) Permit to regulate stormwater and non-stormwater discharges in the Los Angeles region. The 2012 MS4 Permit included low impact development (LID) requirements for certain projects to reduce the discharge of stormwater and associated pollutants into receiving water bodies and to control hydromodification. In November 2013, Los Angeles County amended its LID Ordinance in response to the 2012 MS4 Permit. The LID Ordinance applies to certain new development and re-development projects and is intended to accomplish the following:

- Lessen adverse impacts of stormwater and urban runoff from development on natural drainage systems, receiving waters and other water bodies.
- Minimize pollutant loadings from impervious surfaces by requiring certain projects to incorporate appropriate best management practices and other LID strategies.
- Minimize erosion and other hydrologic impacts on natural drainage systems by requiring appropriate hydromodification controls.

### 4.3.12 Los Angeles County Operational Area Emergency Response Plan

The Los Angeles County Operational Area Emergency Response Plan (ERP) provides details for coordinated response to large-scale emergency situations in the County, whether natural, man-made, or technological. The ERP focuses on potentially catastrophic disasters that require more than normal response measures. It reviews capabilities in prevention, protection, response, recovery, and mitigation. It contains information about continuity of government plans and provides annexes for specific situations, including tsunamis, oil spills, and terrorism (Los Angeles County, 2012).

### 4.3.13 Topanga Creek Watershed Management Plan

In 2002, the Topanga Creek Watershed Committee updated the 1996 Topanga Creek Watershed Management Study with new preventive planning strategies and best management practices. These projects and practices were developed to maintain and enhance the watershed's current physical, chemical, biological, economic, and social characteristics, including its diversity in land use (i.e., residential, business development, infrastructure, wilderness recreation, and biological habitat). The plan also seeks to protect life and property from vulnerability to natural hazards such as stormwater runoff, floods, earthquakes, and wildfires (Topanga Creek Watershed Committee, 2002).

### 4.3.14 Rio Hondo Watershed Management Plan

The Rio Hondo Watershed Management Plan provides goals and strategies to all affected municipalities and conservation organizations as a way to improve water quality, health, habitat and recreational opportunities for the Rio Hondo watershed. The Rio Hondo watershed is a sub-watershed of the Los Angeles River watershed and is linked to the San Gabriel River watershed as a result of both natural hydrologic processes and human intervention. The watershed contains both rural and urban areas, with the San Gabriel Mountains and Angeles National Forest defining the upper reaches and the more urban and developed San Gabriel Valley below the foothills. The watershed encompasses 22 cities and six unincorporated communities in Los Angeles County (San Gabriel Valley Council of Governments, 2004).

## 4.3.15 Gateway Watershed Management Program

The Gateway Watershed Management Authority is a coalition of 25 cities and government entities that manage regional water planning needs for the Gateway Cities region. The Gateway Watershed Management Authority developed an integrated regional water management plan in 2013. Although the plan primarily focuses on needs for cities in this region, it includes a few unincorporated County areas. Recommendations developed for this plan include coordinating regional water management efforts, continued maintenance of projects and grant opportunities, addressing MS4 permit watershed monitoring and reporting, and developing a funding and finance plan to implement projects (Gateway Management Authority, 2013).

## 4.3.16 Los Angeles River Master Plan and Corridor Highlights

The Los Angeles River watershed covers 834 square miles and extends from the Santa Monica Mountains to the Simi Hills and from the Santa Susana Mountains to the San Gabriel Mountains. The Los Angeles River is a valuable resource for the County, as well as a major source of flooding. The County developed the Los Angeles River Master Plan in 1996 to seek ways to utilize the natural assets of the Los Angeles basin for economic, recreational, and environmental benefits while maintaining the waterway as a flood protection resource. The plan highlights water conservation as a major concern, noting that 30 to 40 percent of the County's water supply comes from local sources. It also recommends multi-use and multi-benefit projects, which not only strengthen flood control measures but also educate citizens, create environmental habitats, or increase recreational opportunities (Los Angeles Department of Public Works, 1996).

In 2005, the County released the Master Plan and Corridor Highlights document, which provides information about Master Plan projects implemented since the Master Plan's adoption and those planned for future construction. Many of the projects are structural, but highlights also include natural resource preservation and education and outreach projects. Where sufficient data was available, the report documents specific benefits as well as implementation and location information (Los Angeles Department of Public Works, 2005).

## 4.3.17 Los Angeles County Annual Hydrologic Reports

Los Angeles County releases an annual report containing hydrologic data relevant to the County; the most recent report covers October 2013 through September 2014. The report is organized into eight major sections providing background and statistics on the following areas:

- **Los Angeles County—**County's topography, geology, and land use
- **Runoff**—Mean daily and peak annual runoff flow rates for active stream gaging stations
- **Flood Control District**—Flood events summaries
- **Reservoirs**—Summary of annual inflow, outflow, and storage data for County dams and reservoirs
- **Precipitation**—Daily and annual rainfall data from County rain gage stations
- **Erosion control**—Debris basin design data, production summary, and production history
- **Evaporation**—Data for the County's active evaporation stations
- **Water conservation**—Groundwater recharge facility data and historical well data

These reports are a valuable resource for County personnel evaluating water management and needs (Los Angeles County Department of Public Works, 2015a).

## 4.3.18 Los Angeles County Drainage Area Project

The Los Angeles County Drainage Area (LACDA) Project is a multi-use project to reduce flood overflows by increasing the carrying capacity of major County waterways, including the lower Los Angeles River, Rio Hondo, and lower portion of Compton Creek. The project is designed to simultaneously increase recreational opportunities and local aesthetics through improvements, such as a bike trail, equestrian trail, and landscaping. The LACDA project includes the elevation of 21 miles of existing levees; the modification of 24 railroad, traffic, utility, and pedestrian bridges; and connections between trails and eight park areas (Los Angeles County Department of Public Works, 2015c). The LACDA Project is further described in Chapter 6 of this plan.

## 4.3.19 Trash Best Management Practices

The 2004 *Technical Report of Trash Best Management Practices* identifies necessary measures to meet trash total maximum daily load goals for the Los Angeles River and Ballona Creek. Recommendations include trash and runoff source-control best management practices as the top preference. Also recommended are structural projects for high-trash generation areas, such as drain system retrofits, channel-cleaning contracts, and replacement of impervious surfaces (Los Angeles County Department of Public Works, 2004). Keeping flood control facilities, including catch basins, free from trash and debris helps prevent localized street flooding.

## 4.3.20 Los Angeles County Response to ADA

The Los Angeles County Operational Emergency Response Plan Access and Functional Needs Annex defines the term "individuals with disabilities and access and functional needs" as populations whose members may have additional needs before, during and after an incident in functional areas including but not limited to the following:

- Maintaining independence
- Communication
- Transportation
- Supervision
- Medical care.

These populations may include any of the following:

- Individuals with mobility and transportation impairments
- Individuals with vision, hearing and dual sensory impairment
- Individuals with health, behavioral and mental health needs
- Individuals with intellectual and developmental disabilities
- Individuals who live in institutionalized settings
- Elderly and children
- Culturally diverse populations
- Individuals with limited English proficiency or non-English speakers
- Individuals with socio-economic barriers, including the homeless population.

### *Reasonable Accommodations Ordinance*

The ordinance, which was adopted by the Board of Supervisors on November 28, 2011, creates an administrative procedure for persons with disabilities to request reasonable accommodation from land use and zoning standards or procedures, when those standards or procedures are a barrier to equal housing access, pursuant to state and federal Fair Housing laws. The ordinance applies to all the unincorporated areas of Los Angeles County.

### *Plan Action Implementation*

The ADA protocol will be applied when implementing any actions in this plan that could impact individuals with disabilities and access and functional needs. This will involve measures such as review by the Los Angeles County Access and Functional Needs Committee or whatever protocol has been established by the County at the time of project implementation.

## 4.4 CAPABILITY ASSESSMENT

The planning team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of an agency's mission, programs and policies, and evaluates its capacity to carry them out.

Table 4-1 summarizes the legal and regulatory capability of Los Angeles County. This table describes the legal authorities available to the county and/or enabling legislation at the state level affecting planning and land management tools that can support floodplain management action items. Each of these capabilities represents an ongoing program that supports Los Angeles County's commitment to floodplain resilience. Any gap in capability identified in this table should be considered as an action by the County in the action plan component of this plan. The table identifies the following information for each program:

- **Local Authority**: Does the County have the authority to implement the identified capability through policy or formal adoption?
- **State of Federal Prohibitions**: Are there are any regulations that may impact the implementation of an identified capability that are enforced or administered by another agency (e.g., a state agency or special purpose district)?
- **Other Regulatory Authority**: Are there are any regulations that may impact the implementation of a capability that are enforced or administered by another agency (e.g., a state agency or special purpose district)? This can also be referred to as delegated authority.
- **State Mandated**—Do state laws or other requirements enable or require the listed item to be implemented at the local level?

Table 4-2 summarizes the administrative and technical capability of Los Angeles County. This table inventories the staff resources available to Los Angeles County to help with flood hazard mitigation planning and the implementation of specific mitigation actions.

Table 4-3 summarizes fiscal capabilities of Los Angeles County. It identifies what financial resources (other than grants) are available to the County to support the implementation of floodplain management actions.

**TABLE 4-1.**
**LOS ANGELES COUNTY LEGAL AND REGULATORY CAPABILITY**

| | Local Authority | State or Federal Prohibitions | Other Regulatory Authority | State Mandated |
|---|---|---|---|---|
| **Codes, Ordinances & Requirements** | | | | |
| Building Code | Yes | No | No | Yes |
| ***Comment:*** County of Los Angeles County Code, Title 26 – Building Code | | | | |
| Zoning Code | Yes | No | No | Yes |
| ***Comment:*** County of Los Angeles County Code, Title 22 – Planning and Zoning | | | | |
| Subdivisions | Yes | No | No | No |
| ***Comment:*** County of Los Angeles County Code, Title 21 – Subdivision Code | | | | |
| Post-Disaster Recovery | Yes | No | No | No |
| ***Comment:*** County of Los Angeles County Code, Title 2 – Administration, Division 3 – Departments and Other Administrative Bodies, Chapter 2.68 – Emergency Services, Part 6 – Director of Recovery Operations | | | | |
| Flood Damage Prevention Ordinance | Yes | No | No | No |
| ***Comment:*** County of Los Angeles County Code:<br>Title 26, Chapter 1, Section 110 – Prohibited Uses of Building Sites<br>Title 11, Division 3, Chapter 11.60 – Floodways and Water Surface Elevations<br>Title 21, Chapter 21.44.320 – Land subject to flood hazard, inundation, or geological hazard<br>Title 21, Chapter 21.44.330 – Flood-hazard area, floodway or natural watercourse designation<br>Title 20, Division 5, Chapter 20.94 – Channels<br>Title 22, Division 1, Chapter 22.52, Part 5 – Flood Control | | | | |
| Low-Impact Development Standards | Yes | No | No | Yes |
| ***Comment:*** County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.84 Low Impact Development Standards | | | | |
| Real Estate Disclosure | No | No | No | Yes |
| ***Comment:*** State of California Natural Hazards Disclosure Act, effective June 1, 1998 (California Civil Code Section 1103.2) | | | | |
| Growth Management | No | No | Yes | Yes |
| ***Comment:*** County of Los Angeles County Code, Title 22 – Planning and Zoning, Chapter 22.46 – Specific Plans. Specific Plans are available for Santa Catalina Island, Marina Del Rey, Universal Studios, and East Los Angeles Third Street. | | | | |
| Site Plan Review | Yes | No | No | No |
| ***Comment:*** County of Los Angeles County Code, Title 26 – Building Code, Chapter 1 – Administration, Inspections. | | | | |
| Special Purpose (flood management, critical areas) | — | — | — | — |
| ***Comment:*** County of Los Angeles County Code, Title 11 – Health and Safety, Division 2 – General Hazards, Chapter 11.52 – Water Hazards.<br>County of Los Angeles County Code, Title 11 – Health and Safety, Division 3 – Miscellaneous Regulations, Chapter 11.60 – Floodways and Water Surface Elevations.<br>County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.80 – Stormwater and Runoff Pollution Control<br>Angeles County Code, Title 12 – Environmental Protection, Chapter 12.20 – Depositing Petroleum Products on Beaches or into Pacific Ocean<br>County of Los Angeles County Code, Title 20 – Utilities, Division 5 – Flood Control District Property and Facilities<br>County of Los Angeles County Code, Flood Control District Code, Chapter 21 – Stormwater and Runoff Pollution Control<br>County of Los Angeles County Code, Title 31 – County Green Building Standards Code | | | | |

**TABLE 4-1.**
**LOS ANGELES COUNTY LEGAL AND REGULATORY CAPABILITY**

| | Local Authority | State or Federal Prohibitions | Other Regulatory Authority | State Mandated |
|---|---|---|---|---|
| **Planning Documents** | | | | |
| General Plan | Yes | No | No | Yes |
| ***Comment:*** Los Angeles County 2035 General Plan, October 2015. Draft plan includes several major policies, specifically, expanding transit-oriented districts, promoting mixed-use, expanding significant ecological areas, creating employment protection districts, protecting agricultural resources, and ensuring zoning consistency with amendments to existing County ordinances. Available online | | | | |
| Capital Improvement Plan | Yes | No | No | No |
| ***Comment:*** The Los Angeles County Department of Public Works develops and implements capital projects, and manages those projects implemented by a project consultant. The 2035 General Plan Implementation Program identifies a goal project of the Department of Regional Planning and the Department of Public Works jointly securing funding and setting priorities to prepare capital improvement plans for the County's 11 planning areas. Some current community plans have capital improvements listed, but level of detail varies based on community and plan age. | | | | |
| Economic Development Plan | Yes | No | No | No |
| ***Comment:*** Los Angeles County Strategic Plan for Economic Development, 2016 2035 General Plan, Chapter 14 – Economic Development Element. Available online | | | | |
| Floodplain or Basin Plan | Yes | No | No | No |
| ***Comment:*** Los Angeles County Floodplain Management Plan, 2010. Available online. | | | | |
| Stormwater Plan | Yes | No | Yes | Yes |
| ***Comment:*** Low Impact Development Standards Manual, February 2014 | | | | |
| Watershed Management Plan | Yes | No | Yes | No |
| ***Comment:*** Enhanced Watershed Management Programs in progress and to be submitted for approval to the Los Angeles Regional Water Quality Control Board by June 28, 2015. These plans will include the County's five watersheds: Ballona Creek, Dominguez Channel, Marina Del Ray, Santa Monica Bay, and Upper Los Angeles River. All available online. Other unincorporated community watershed management plans: Topanga Creek, Upper Santa Clara River, Rio Hondo and Gateway Cities Region | | | | |
| Habitat Conservation Plan | No | No | No | No |
| ***Comment:*** 2035 General Plan, Chapter 9 – Conservation and Natural Resources Element, Significant Ecological Areas. Available online | | | | |
| Shoreline Management Plan | Yes | No | No | Yes |
| ***Comment:*** Los Angeles County Stormwater Monitoring Reports, Section 1.1.1.4 – Shoreline Monitoring (released annually and with most recent report of 2014-2015) Local Coastal Programs (LCP) • Santa Monica Mountains LCP, adopted on August 26, 2014, and certified on October 10, 2014 • Marina Del Rey LCP, adopted in 1996, and amended and certified in 2012 • Santa Catalina Island LCP, adopted on March 15, 1983, and certified on November 17, 1983 All available online | | | | |
| Emergency Response Plan | Yes | No | No | Yes |
| ***Comment:*** Los Angeles County Operational Area Emergency Response Plan (ERP), 2012. Available online | | | | |
| Post-Disaster Recovery Plan | Yes | No | No | No |
| ***Comment:*** Recovery Annex to the ERP ERP, Section 2.7: Recovery Considerations also reviews County Recovery Procedures | | | | |
| Sediment Management Plan | Yes | No | No | No |
| ***Comment:*** Sediment Management Strategic Plan, 2012-2032. Available online | | | | |

**TABLE 4-1.**
**LOS ANGELES COUNTY LEGAL AND REGULATORY CAPABILITY**

| | Local Authority | State or Federal Prohibitions | Other Regulatory Authority | State Mandated |
|---|---|---|---|---|
| Continuity of Operations Plan | Yes | No | No | Yes |
| ***Comment:*** All Los Angeles County departments and/or divisions must develop, exercise, and maintain plans for business continuity functions and processing resources. Each department and/or division must develop a plan for its business operations that can sufficiently support the service requirements of other operations and functions involved in the incident. Plans must address the full range of resources including data processing, data communications links, personnel, personal computers, terminals, workspace, voice communication, and documents. Additionally, Chapter 3 of the ERP includes Continuity of Government information. | | | | |
| Water Resource Management Plan | Yes | No | Yes | Yes |
| ***Comment:*** Greater Los Angeles County Region Integrated Regional Water Management Plan, 2013, Antelope Valley Integrated Regional Water Management Plan, 2013, Upper Santa Clara River Watershed Integrated Regional Water Management Plan, 2014 | | | | |
| Best Management Practices | — | — | — | — |
| ***Comment:*** Technical Report of Trash Best Management Practices, 2004 These best management practices were identified and evaluated to provide effective alternatives to meet the goals of the trash total maximum daily load for Los Angeles River and Ballona Creek. | | | | |

**TABLE 4-2.**
**ADMINISTRATIVE AND TECHNICAL CAPABILITY**

| Staff/Personnel Resources | Available? | Department/Agency/Position |
|---|---|---|
| Planners or engineers with knowledge of land development and land management practices | Yes | Los Angeles County Department of Public Works (Public Works) Land Development Division; Los Angeles County Department of Regional Planning |
| Engineers or professionals trained in building or infrastructure construction practices | Yes | Public Works Geotechnical and Materials Engineering Division; Public Works Building and Safety Division |
| Planners or engineers with an understanding of flooding hazards | Yes | Public Works Geotechnical and Materials Engineering Division; Public Works Water Resources Division and associated subdivisions |
| Staff with training in benefit/cost analysis | Yes | Public Works multiple divisions, including the Watershed Management Division |
| Floodplain manager | Yes | Public Works Watershed Management Division |
| Surveyors | Yes | Public Works Survey/Mapping and Property Management (Land Records) Division |
| Personnel skilled or trained in GIS applications | Yes | Public Works Survey/Mapping and Property Management (Land Records) Division; Public Works GIS Managers |
| Scientists familiar with flooding hazards in local area | Yes | Public Works Water Resources Division and associated subdivisions |
| Emergency manager | Yes | Public Works Disaster Services Group; Los Angeles County Office of Emergency Management |
| Grant writers | Yes | Public Works Watershed Management Division, Water Resources Division, and Programs Development Division; Los Angeles County Office of Emergency Management |

**TABLE 4-3.**
**FISCAL CAPABILITY**

| Financial Resources | Accessible or Eligible to Use? |
|---|---|
| Community Development Block Grants | Yes |
| Capital Improvements Project Funding (Flood Control District) | Yes |
| Authority to Levy Taxes for Specific Purposes | Yes |
| Incur Debt through General Obligation Bonds | Yes |
| Incur Debt through Special Tax Bonds | Yes |
| State Sponsored Grant Programs | Yes |
| Development Impact Fees for Homebuyers or Developers | Yes |

Table 4-4 summarizes community based classification programs that rate facets of a community's floodplain management capability. The Community Rating System (CRS) is described in Section 4.1.2. The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a community and how the community enforces them, with emphasis on mitigation of losses from natural hazards. The StormReady and TsunamiReady programs are administered by the National Oceanic and Atmospheric Administration (NOAA). StormReady helps arm communities with communication and safety skills needed to save lives and property before, during and after an event. It helps community leaders and emergency managers strengthen local safety programs.

**TABLE 4-4.**
**COMMUNITY CLASSIFICATIONS**

| | Participating? | Classification | Date Classified |
|---|---|---|---|
| Community Rating System | Yes | 7 | 05/1/2011 |
| Building Code Effectiveness Grading Schedule | Yes | 3/3 | 2010 |
| StormReady | No | N/A | N/A |
| TsunamiReady | No | N/A | N/A |

Table 4-5 summarizes the County's participation in national flood-related programs. These programs rank the County's capabilities to implement flood hazard reduction programs such as building code enforcement and flood warning and response activities.

**TABLE 4-5.**
**NATIONAL FLOOD INSURANCE PROGRAM COMPLIANCE**

| | |
|---|---|
| What department is responsible for floodplain management in your community? | Los Angeles County DPW Watershed Management Division |
| Who is your community's floodplain administrator? | Los Angeles County DPW Watershed Management Division |
| Do you have any certified floodplain managers on staff in your community? | There is one certified floodplain manager on staff at Los Angeles County DPW Watershed Management Division |
| What is the date of adoption of your flood damage prevention ordinance? | County of Los Angeles County Code:<br>• Title 26, Chapter 1, Section 110 – Prohibited Uses of Building Sites, last amended by ordinance 2013-0048 § 2, effective 2013<br>• Title 11, Division 3, Chapter 11.60 – Floodways and Water Surface Elevations, last amended by ordinance 2011-0039 § 2, effective 2011<br>• Title 21, Chapter 21.44.320 – Land subject to flood hazard, inundation, or geological hazard, last amended by ordinance 11665 § 38, effective 1978<br>• Title 21, Chapter 21.44.330 – Flood-hazard area, floodway or natural watercourse designation, last amended by ordinance 11665 § 39, effective 1978<br>• Title 20, Division 5, Chapter 20.94 – Channels, last amended by ordinance 86-0032 § 1, effective 1986; Title 22, Division 1, Chapter 22.52, Part 5 – Flood Control, last amended by ordinance 1494 Ch. 7 Art. 5 § 705.1, effective 1927 |
| When was the most recent Community Assistance Visit or Community Assistance Contact? | Last Community Assistance Visit: September 21, 2010<br>Community Assistance Visit Report: November 3, 2010<br>Community Assistance Visit Closed: November 3, 2010<br>Issues: None |
| To the best of your knowledge, does your community have any outstanding NFIP compliance violations that need to be addressed? If so, please state what they are. | No issues that would render Los Angeles County out of full compliance with the provisions of the NFIP were identified during the last Community Assistance Visit. |
| Do your flood hazard maps adequately address the flood risk within your community? | Flood hazard mapping has been identified as an issue that needs to be addressed by this planning process. See Section 6.14 lists mapping issues, which are addressed by Mitigation Action #33 (Chapter 11). |
| Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed? | Los Angeles County DPW Watershed Management Division staff actively participate in programs of the California Floodplain Management Association as well as other trainings offered by the state and FEMA where feasible. County staff welcomes opportunities for training on floodplain management programs and principles. |
| Does your community participate in the Community Rating System (CRS)? If so, is your community seeking to improve its CRS Classification? If not, is your community interested in joining the CRS program? | Los Angeles County has participated in the CRS since 10/1/1991 and is currently rated a CRS Class 7 |

# PART 2 —
# RISK ASSESSMENT

# CHAPTER 5.
# RISK ASSESSMENT METHODOLOGY

## 5.1 PURPOSE OF RISK ASSESSMENT

This part of the floodplain management plan evaluates the risk of the flood hazard in the planning area (CRS Step 5). Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards such as flooding. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Exposure identification—Determine the extent of people, property, environment and economy exposed to the effects of the natural hazard.
- Vulnerability evaluation—Estimate potential damage from the natural hazard and associated costs.

The risk assessment describes the flooding hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk:

- Identify and profile the flooding hazard (CRS Step 4); the following information is given:
  - Principal sources of flooding in the planning area
  - Major past flood events
  - Geographic areas most affected by floods
  - Estimated flood event frequency
  - Estimates of flood severity
  - Warning time likely to be available for response
  - Existing flood protection programs and projects
  - Secondary hazards associated with the flood hazard
  - Potential impacts of climate change on flooding
  - Expected future trends that could affect the flood hazard
  - Scenario of potential worst-case flood event
  - Key issues related to floodplain management in the planning area.
- Determine exposure to the flood hazard—Exposure was determined by overlaying flood maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to flood events.
- Assess the vulnerability of exposed facilities—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each flood event and assessing structures, facilities, and systems that are exposed.
- Evaluate repetitive loss properties—The County is preparing a separate Repetitive Loss Area Analysis in accordance with Section 512.b of the 2013 CRS Coordinators Manual. This document will be a companion document to this Comprehensive Floodplain Management Plan.

## 5.2 RISK ASSESSMENT APPROACH

### 5.2.1 FEMA's Hazus-MH Software

In 1997, FEMA developed the standardized Hazards U.S. (Hazus) model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology, Hazus-MH, with new models for estimating potential losses from hurricanes and floods. The use of Hazus-MH for hazard mitigation planning offers numerous advantages:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates FEMA review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a floodplain management plan throughout its implementation.

Hazus-MH is a GIS-based software program that includes extensive inventory data, such as demographics, building stock, critical facilities, transportation facilities and utilities. It uses multiple models to estimate potential losses from natural disasters. The program maps hazard areas and estimates damage and economic losses for buildings and infrastructure.

To estimate damage that would result from a flood, Hazus uses pre-defined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, users can generate dollar-value estimates of damage that will result from any given flood event.

Hazus-MH provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information:

- Level 1—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the modeled area.
- Level 2—More accurate estimates of losses require more detailed information about the modeled area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- Level 3—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the modeled area. Level 3 involves establishing new damage curves, which is not necessary for flood hazard analyses, because those damage functions are well established

To assess the flood hazard for this plan, a Level 2, user-defined analysis was performed for both general building stock and critical facilities.

## 5.2.2 Sources of Data Used in Hazus Modeling

GIS building and assessor data (replacement cost values and detailed structure information) were loaded into Hazus-MH, along with structure dates of construction.

An updated inventory was used in place of the Hazus-MH defaults for essential facilities, transportation and utilities in the floodplain. Current County of Los Angeles digital Flood Insurance Rate Maps were used to delineate flood hazard areas and estimate potential losses from the 10-, 50-, 100- and 500-year floods. The Los Angeles County Department of Public Works floodways were also used. Using the digital floodplain boundaries and digital elevation model data based on LIDAR (a type of elevation measurement using laser), flood depth grids were generated and integrated into the model.

Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in RS Means Square Foot Costs (RS Means, 2014). It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (e.g., multi-family residential, commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. For single-family residential, the construction class and number of stories also factor into determining the square foot costs.

Table 5-1 provides Hazus model data documentation for this project.

## 5.2.3 Flood Depth Grid Generation

An important input to Hazus for modeling flood damage is a flood depth grid, which defines the depth of floodwater at points covering the flooded area for any given flood event. For this plan, depth grids were prepared for multiple flood scenarios (10-, 50-, 100- and 500-year flood events) where mapping and detailed flood studies were available. The following methods were used to create the flood depth grid, depending on the floodplain mapping data available:

- **HEC-GeoRAS—**The most detailed flood mapping datasets were combined in a model called HEC-GeoRAS. This type of data was typically available for FEMA-mapped "AE" flood zones (100-year flood zones determined by detailed methods). Flood flow paths and cross sections modeled in HEC-GeoRAS were exported to the HEC-RAS hydraulic software, which calculated water surface elevations relative to the ground surface. These water surfaces were exported back into HEC-GeoRAS and intersected with the existing ground to calculate flood depth grids. This technique was the most accurate of those available for the mapping effort.
- **Base Flood Elevation Reconstruction—**This technique used datasets that included base (100-year) flood elevations for a floodway or floodplain but had no other data available. These could be FEMA AE flood zones or A flood zones (100-year flood zones determined by approximate methods) or zones mapped by local districts. GIS tools were used to create a water surface based on the water surface value given for a specific base flood. This water surface was intersected with the existing ground surface to create output flood depth grids.

**TABLE 5-1.**
**HAZUS MODEL DATA DOCUMENTATION**

| Data | Source | Date | Format |
|---|---|---|---|
| Property parcel data | Los Angeles County parcel data, downloaded from County's GIS website | 2014 | Digital (GIS) format |
| Building information such as area, occupancy, date of construction, stories, land use and foundation type (used to estimate finished floor elevations) | Los Angeles County property data provided by the Los Angeles County Department of Public Works | 2014 | Digital (text) format |
| Building replacement cost | RS Means | 2014 | Paper format. Updated RS Means values imported into Hazus |
| Population data | U.S. Census Bureau | 2010 | Digital (GIS and tabular) format |
| Flood hazard data | FEMA, Los Angeles County | 7/2014 | Digital (GIS) format |
| Critical facilities and infrastructure | Location Management System GIS data from Los Angeles County's GIS Data Portal | 2014 | Digital (GIS) format |
| Hazardous material facilities | U.S. Environmental Protection Agency website Toxic Release Inventory data | 2014 | Digital (GIS) format |

- **Flood Zone Direct Calculation—**This technique was used for flood zone datasets that provided only a water depth or water surface elevation. This includes AO, AH, VE, and similar FEMA zones. If a depth was given for one of these zones, a depth grid was created directly out of that zone boundary. If a static water surface elevation was given, a water surface grid was created out of that zone and intersected with the ground surface to create flood depth grids.
- **Unnumbered A Zones—**A discrepancy was identified in FEMA flood mapping of Unnumbered A Zones. The contour interpolation methodology recommended by FEMA for creating depth-grids (Publication #265) generated abnormally high flood depths in many of these zones. It was determined that this was due to two factors: spatial alignment errors on FEMA mapping, and resolution differences between the water surface projection and the digital elevation model. These errors have been identified as an issue to be addressed by this plan.

  The results were determined to be unacceptable, so an alternative methodology was used for Unnumbered A Zones. Because the minimum regulatory standard for new development in Unnumbered A Zones is at least 2 feet above highest adjacent grade (44 CFR Section 60.3), a 2-foot depth grid was assumed for all Unnumbered A Zones. This may underestimate flood risk in some cases and overestimate it in others. However, this approach generates more creditable results on average than the original methodology attempted for these zones. The regulatory basis for this approach further justifies its use.

- **Flood zone interpolation**—This technique was used for the County floodways data. The floodway boundaries were intersected with the ground surface, with the assumption that the elevation along that boundary marked the water surface elevation edge. The boundary was interpolated to 3D and it was converted to a water surface grid. This grid was then intersected with the ground surface within the boundary to create flood depth grids.

### 5.2.4 Mapping

Hazus generates maps of flood hazard areas, which are included in this plan as a general indication of unincorporated Los Angeles County areas exposed to the flood hazard. Mapping in this plan does not provide enough accuracy to assess the flood hazard risk to individual properties, but such detailed mapping has been developed and is maintained by Los Angeles County. FEMA flood zone information can be accessed by property at http://dpw.lacounty.gov/wmd/floodzone/.

### 5.2.5 Limitations

Loss estimates, exposure assessments and vulnerability evaluations rely on the best available data and methodologies. However, results are subject to uncertainties associated with the following factors:

- Incomplete scientific knowledge about flood hazards and their effects on the built environment
- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent and severity of the flood hazard
- Mitigation actions already employed
- The amount of advance notice residents have to prepare for a flood event
- FEMA adheres to a protocol for map revision. Understanding that floodplains are dynamic and constantly changing, FEMA attempts to keep its maps current by adhering to this protocol. It should be understood that at any point in time a current map may not reflect current conditions.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. The results do not predict precise results and should be used only to understand relative risk.

Results are particularly imprecise for modeling that used the flood zone interpolation technique. That technique assumed that FEMA flood boundaries for the affected zones are accurate, but subsequent assessments found that floodwater surface elevations at some boundaries are unrealistically high. The flood damage estimated using those elevations is therefore likely much greater than would actually occur.

# CHAPTER 6.
# LOS ANGELES COUNTY FLOOD HAZARD PROFILE

## 6.1 GENERAL CONCEPTS

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

**DEFINITIONS**

**Flood**—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

**Floodplain**—The land area along the sides of a river that becomes inundated with water during a flood.

**100-Year Floodplain**—The area flooded by a flood that has a 1-percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

### 6.1.1 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

### 6.1.2 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

### 6.1.3 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in biological quantity and diversity. Wetting of the floodplain soil releases a surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders—particularly birds—move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture.

Riparian zone species have significant differences from those that grow outside of floodplains. For instance, riparian trees tend to be very tolerant of root disturbance and tend to be very quick-growing compared to non-riparian trees.

## 6.2 WATERSHEDS

Of the 10 HUC-8 watersheds partly or completely within Los Angeles County (see Section 3.2.3) only five include significant area within the County (see Figure 3-3). Four of these drain to the ocean and the fifth drains to dry lakes in the desert. The following watershed descriptions are excerpts from the Los Angeles County Department of Public Works January 2006 Hydrology Manual. The descriptions use the watershed names from the Hydrology Manual which differ slightly from the NRCS HUC-8 naming as indicated

### 6.2.1 Los Angeles River

The Los Angeles River Watershed covers over 830 square miles. It includes the western portion of the San Gabriel Mountains, the Santa Susana Mountains, the Verdugo Hills, and the northern slope of the Santa Monica Mountains. The river flows from the headwaters in the western San Fernando Valley and outlets in San Pedro Bay near Long Beach. It crosses the San Fernando Valley and the central portion of the Los Angeles Basin. The watershed terrain consists of mountains, foothills, valleys, and the coastal plain.

The Los Angeles River and many of its tributaries have been the subject of extensive engineering work to reduce flooding impacts. Prior to development, the Los Angeles River system was typical of other streams in the southwest. Its channel was broad and often shifted location within the floodplain due to high sediment loads. The stream location within the coastal plain has varied greatly over the years. Between 1815 and 1825, the river changed course completely. Breaking its banks in what is now downtown Los Angeles, the river followed the course of Ballona Creek, reaching the ocean at a location 20 miles from its current outlet.

Numerous flood control facilities were constructed in the early 20th century, as development began to take place on this wide floodplain. The concrete sections of the Los Angeles River were constructed between

the late 1930s and the 1950s. Channel improvements and extensive watershed development decrease times of concentration and increase runoff flow rates and volumes.

The Los Angeles County Flood Control District constructed three major dams during this period: Pacoima, Big Tujunga and Devil's Gate. The dams were built to reduce downstream flow rates and conserve water for groundwater recharge. Several dams were constructed in the Rio Hondo drainage area, including Eaton Wash, Sierra Madre, Santa Anita and Sawpit. The U.S. Army Corps of Engineers operates four major dams in the watershed to assist in flood control: Hansen, Lopez, Sepulveda and Whittier Narrows.

The parts of the San Gabriel Mountains tributary to the Los Angeles River contain some of the most prolific sediment-producing streams in the world. Intense rainfall, coupled with highly erodible sediment, produces damaging debris discharges. Numerous debris basins have been constructed along the foothills of the San Gabriel Mountains to remove sediment from the flow.

The Los Angeles River Watershed has a diverse land use pattern. The upper portions of the watershed are covered by Angeles National Forest and other rural areas. The remainder of the watershed is highly developed. The watershed has large areas of commercial, residential, and industrial development. Few parks or natural areas exist in the lower watershed. The major tributaries of the Los Angeles River are Burbank Western Channel, Pacoima Wash, Tujunga Wash, and Verdugo Wash in the San Fernando Valley and Arroyo Seco, Compton Creek, and Rio Hondo in the Los Angeles Basin. Much of this tributary network has also been lined with concrete for flood control.

### 6.2.2 San Gabriel River

The San Gabriel River Watershed drains 640 square miles in the eastern portion of the county. The river drains the San Gabriel Mountains to the north and is bounded by the Los Angeles River Watershed and Santa Ana River Watersheds. The watershed outlets to the Pacific Ocean between Long Beach and Seal Beach after passing through the Alamitos Bay estuary. Tributaries to the San Gabriel River include Walnut Creek, San Jose Creek, and Coyote Creek.

The upper portions of the watershed are almost entirely within the Angeles National Forest and are nearly untouched by development. The mountains in this area are extremely rugged, with steep V-shaped canyons. The vegetation is dominated by chaparral and coastal sage scrub with patches of oak woodlands. Conifers are dominant at higher elevations. The streambeds in the area contain sycamore and alder woodlands.

The lower part of the watershed, below the mouth of the San Gabriel Canyon, is mostly developed, with commercial, residential and industrial uses. The developed area in the San Gabriel Valley and Los Angeles Basin makes up 26 percent of the total watershed area. Similar to the Los Angeles River, the San Gabriel River once occupied a wide floodplain and shifted course to accommodate large flows and sediment loads. Development of the floodplain required changing the character of the river dramatically since periodic inundation of the floodplain was not compatible with the new land uses.

Several major dams and debris basins impound floodwaters and prevent debris flows originating in the San Gabriel Mountains. These include Cogswell Dam, San Gabriel Dam, Morris Dam, Big Dalton Dam, San Dimas Dam, Live Oak Dam, and Thompson Creek Dam. Many of these facilities were constructed in the 1930s and have prevented significant damage from large flood events. Major flood events occurred in 1938, 1969, 1978, 1983, 1998, and 2005. The U.S. Army Corps of Engineers operates the Santa Fe Dam and Whittier Narrows Dam in the watershed to assist in flood control.

The San Gabriel River has been channelized below Santa Fe Dam to aid in flood prevention. The channel invert was left unlined for much of its length between Santa Fe Dam and Florence Avenue in Downey. The

unlined bottom promotes infiltration of floodwaters released from upstream dams. Los Angeles County Public Works installed rubber dams to further utilize the river bottom for groundwater recharge.

The most significant spreading ground facilities in the county are in the San Gabriel River watershed. Storm runoff is diverted into the spreading facilities and allowed to recharge groundwater. Major spreading grounds are located at the mouth of San Gabriel Canyon and in the Montebello area downstream of the Whittier Narrows Dam.

### 6.2.3 Santa Clara River

The Santa Clara River originates in the northern slopes of the San Gabriel Mountains at Pacifico Mountain and travels west into Ventura County, discharging into the Pacific Ocean near the City of Ventura. The river runs approximately 100 miles from the headwaters near Acton to the ocean. The river drains an area of approximately 1,600 square miles.

The upper portion of the river within the County of Los Angeles has a watershed area of 644 square miles. Ninety percent of this area is mountainous with steep canyons; the remaining 10 percent is alluvial valleys. The area is mostly undeveloped, with a large portion in the Angeles National Forest. There are some mixed-use developed areas in or near the City of Santa Clarita. The watershed is currently experiencing an accelerated rate of development in areas adjacent to the river.

Major tributaries in the County's portion of the Santa Clara River watershed include Castaic Creek, San Francisquito Canyon, Bouquet Canyon, Sand Canyon, Mint Canyon, and the South Fork of the Santa Clara River. The Santa Clara River and its tributaries are ephemeral streams characterized by alluvial soils. Discharge occurs quickly during rainfall events and diminishes quickly after rainfall has ceased. As in other county watersheds, the mountain and foothill areas are susceptible to debris-laden flows during intense rainfall, especially when the watershed is recovering from fire.

The river remains in a generally natural state, with some modification related to floodplain development. The expected population increase will continue to produce floodplain encroachment, requiring additional bank protection, channelization, and channel crossings. The expected population increase, as well as increased imperviousness, will impact the hydrologic characteristics of the river and the sediment balance.

### 6.2.4 Coastal (HUC-8 Watershed Santa Monica Bay)

The Coastal Watershed consists of a number of individual watersheds that outlet into Santa Monica and San Pedro Bays. These watersheds range from undeveloped to highly urbanized and are grouped together due to their relatively small sizes. These include the following:

- The Malibu Creek Watershed covers 109 square miles at the western end of the County of Los Angeles and extends into Ventura County. Most of the watershed is undeveloped public land. There is sporadic but increasing development throughout the area. The most extensive development is along US Highway 101. The northern portion is hilly and the southern portion, near the ocean, is rugged mountain terrain. Malibu Creek drains into the Pacific Ocean near the Malibu Civic Center.
- Topanga Creek drains 18 square miles in the central Santa Monica Mountains. The watershed is primarily rural with widely scattered residential and commercial development. The creek flows unobstructed along its course and empties into the Santa Monica Bay in an unincorporated portion of the county east of Malibu.

- Ballona Creek is a flood control channel that drains the western Los Angeles basin. The watershed area is bounded by the Santa Monica Mountains on the north and the Baldwin Hills on the south. It extends east nearly to downtown Los Angeles. The total watershed area is roughly 130 square miles. The area is primarily developed but includes undeveloped areas on the south slope of the Santa Monica Mountains. The land use is 64-percent residential, 8-percent commercial, 4-percent industrial, and 17-percent open space. The major tributaries to Ballona Creek are Centinela Creek, Sepulveda Canyon Channel and Benedict Canyon Channel. The watershed drains into Santa Monica Bay at Marina del Rey.
- The Dominguez Watershed covers 133 square miles in the southern portion of the county. The watershed extends from near the Los Angeles International Airport to the Los Angeles Harbor. The area is almost completely developed, with regions of residential, commercial, and industrial land use. Storm drains and the flood control channel network define the watershed rather than natural drainage features.

Many other smaller watersheds in the Coastal Watershed drain developed and undeveloped areas directly to the Pacific Ocean.

### 6.2.5 Antelope Valley (HUC-8 Watershed Antelope-Fremont Valleys)

The Antelope Valley encompasses approximately 1,200 square miles in the northern portion of the County of Los Angeles. The valley is bounded on the north by the Tehachapi Mountains and on the south by the Sierra Pelona and the San Gabriel Mountains. Numerous streams from the mountains and foothills flow across the valley floor. The valley lacks defined drainage channels outside of the foothills and is subject to unpredictable drainage patterns.

Nearly all the surface water runoff from the Los Angeles portion of the Antelope Valley accumulates on Rosamond Dry Lake near the Kern County Line. A small portion is tributary to other dry lakes in the area. This 20-square-mile playa is dry during most of the year but is likely to be flooded during prolonged periods of winter precipitation. Surface runoff and discharges from groundwater remain on the dry lake until removed by infiltration and evaporation. Anecdotal evidence indicates that at times the playa may be underwater for up to five months at a time, as occurred during the winter of 1965-66.

The valley contains the developed areas of Lancaster and Palmdale. The remainder of the valley is sparsely developed. However, the valley is one of the most rapidly developing areas in the county. Rapid development is likely to continue for some time. This development will significantly alter the hydrologic characteristics of the basin.

## 6.3 FLOODING TYPES IN LOS ANGELES COUNTY

In southern California, most flooding is the result of heavy precipitation over periods of one or two days. The short streams and steep watersheds emptying onto lowlands that may be heavily populated produce large volumes of water within short periods and damage is often severe. The problem is sometimes compounded by the denuding of large areas of watershed by fire during the previous season (WRCC, 2014). However, there is no single type of flood in Los Angeles County or single area most susceptible to the flood risk. Many types of flooding occur and many areas of the county are affected, for a range of reasons. The following sections describe the primary flood types and flood hazard areas in the County.

### 6.3.1 FEMA Special Flood Hazard Areas

Special Flood Hazard Areas are defined in the September 26, 2008 Digital Flood Insurance Rate Map (DFIRM) for Los Angeles County. These areas include the following:

- **Areas of Shallow Flooding—**Shallow flooding occurs in flat areas when there are depressions in the ground that collect ponds of water, areas of sloping land and areas of sheet flow where flood depths range from 1 to 3 feet.
- **Regulated Floodways—**The regulated floodway consists of a stream channel plus the portion of the overbanks that must be kept free from encroachment in order to convey the 100-year event without increasing flood levels.
- **Alluvial Fan Flooding—**An alluvial fan is a sedimentary deposit at a point where ground surface slope changes suddenly, such as the base of a mountain front, escarpment, or valley side. Sediments at these locations are deposited in the shape of a fan. Alluvial fan flooding occurs on the surface of these deposits and is characterized by uncertain flow paths.
- **Coastal Areas—**SFHAs along coasts are subject to inundation by the 100-year flood with the additional hazards associated with storm waves. FEMA's *Coastal Construction Manual* (FEMA, 2011) designates hazard areas along coasts as follows:
  - The coastal high hazard area is Zone V (including Zones VE, V1-30, and V). This zone extends from offshore to the inland limit of a primary frontal dune along an open coast and includes any other area that is subject to high-velocity wave action from storms or seismic sources. The boundary of Zone V is generally based on wave heights (3 feet or greater) or wave run-up depths (3 feet or greater). Zone V can also be mapped based on the wave overtopping rate (when waves run up and over a dune or barrier).
  - Zone A or AE consists of portions of the SFHA that are not within the coastal high hazard area. These zones include both coastal and non-coastal SFHAs. Regulatory requirements of the NFIP for buildings in Zone A are the same for both coastal and riverine flooding hazards. Zone AE in coastal areas is divided by the limit of moderate wave action (LiMWA), which is the landward limit of a 1.5-foot wave (FEMA, 2011).
  - The area between the LiMWA and the Zone V limit is the Coastal A-Zone or the Moderate Wave Action Area. This area is subject to wave heights between 1.5 and 3 feet during the base flood. The area between the LiMWA and the landward limit of Zone A is the Minimal Wave Action Area, and is subject to wave heights less than 1.5 feet during the base flood.

  Figure 6-1 shows coastal hazard zones and the effects of energy dissipation and regeneration of a wave as it moves inland. Wave elevations are decreased by obstructions such as vegetation and rising ground elevation (FEMA, 2011).

### 6.3.2 Flash Flooding

A flash flood is a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a defined flood level. Flash floods typically begin within six hours of the precipitation event that causes them (NWS, 2009). Flash flooding is characterized by a quick rise and fall of water level. Flash floods generally result from intense storms dropping large amounts of rain within a short period of time onto watersheds that cannot absorb or slow the flow. Natural terrain and vegetation help to reduce the potential for flash floods, but flash flooding can occur when vegetation is lost due to wildfires and the ground becomes impervious due to the extreme heat. Such events usually include deposition of large amounts of sediment transported from the denatured hillsides.

Source: FEMA, 2011

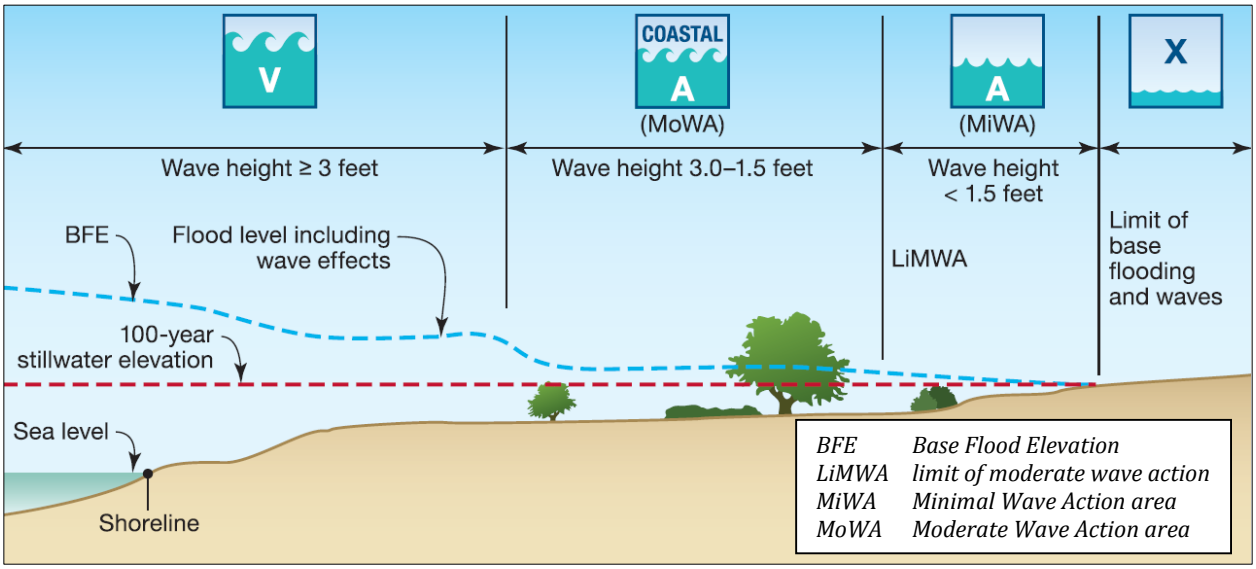



*Figure 6-1. Coastal Hazard Zones*

## 6.3.3 Non-SFHA Urban Drainage Flooding

Local drainage issues and high groundwater levels can lead to stormwater flooding. Many portions of Los Angeles County are subject to this type of flooding, making urban drainage and stormwater mitigation measures particularly important.

Heavy precipitation can produce local flooding in areas outside delineated floodplains or recognizable channels if local conditions cannot accommodate the precipitation through a combination of infiltration and surface runoff. Such flooding generally occurs in areas with flat gradients. Impervious areas associated with urbanization speed the accumulation of floodwaters. Shallow street flooding can occur unless channels have been improved to account for increased flows (FEMA 1997).

High groundwater levels can cause problems even where there is no surface flooding. Basements are susceptible to high groundwater levels. High groundwater is seasonal in some areas; elsewhere, it occurs only after a long periods of above-average precipitation (FEMA 1997).

Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent flooding on streets and other urban areas. They make use of pipes, roadside ditches, channels and roadways to convey water away from an urban area to surrounding streams. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Since drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area (FEMA 2008).

## 6.3.4 Non-SFHA Coastal Flooding

Coastal floods are the submersion of land areas along the ocean coast and other inland waters caused by seawater over and above normal tide action. Coastal flooding occurs along the coasts of oceans, bays, estuaries, coastal rivers and large lakes, regardless of whether they are within an SFHA. Coastal flooding can result in weakened or destroyed coastal structures. Several forces are associated with coastal flooding:

- *Hydrostatic forces* against a structure are created by standing or slowly moving water. Flooding can cause vertical hydrostatic forces, or flotation. These types of forces are one of the main causes of flood damage.
- *Hydrodynamic forces* on buildings are created when coastal floodwaters move at high velocities. These high-velocity flows can destroy solid walls and dislodge buildings with inadequate foundations. High-velocity flows can also move large quantities of sediment and debris that can cause additional damage. In coastal areas, high-velocity flows are typically associated with one or more of the following:
  - Storm surge and wave run-up flowing landward through breaks in sand dunes or across low-lying areas
  - Tsunamis
  - Outflow of floodwaters driven into bay or upland areas
  - Strong currents parallel to the shoreline, driven by waves produced from a storm.

  High-velocity flows can be created or exacerbated by the presence of manmade or natural obstructions along the shoreline and by weak points formed by roads and access paths that cross dunes, bridges or canals, channels, or drainage features.
- *Waves* can affect coastal buildings in the form of breaking waves, wave run-up, wave reflection and deflection, or wave uplift. The most severe damage is caused by breaking waves. The force created by these types of waves breaking against a vertical surface is often at least 10 times higher than the force created by high winds during a coastal storm.
- *Flood-borne debris* produced by coastal flooding events and storms typically includes decks, steps, ramps, breakaway wall panels, portions of or entire houses, heating oil and propane tanks, cars, boats, decks and pilings from piers, fences, erosion control structures, and many other types of smaller objects. Debris from floods can destroy unreinforced masonry walls, light wood-frame construction, and small-diameter posts and piles (FEMA 2011).

Most coastal flooding in California is due to a combination of winter storms, severe storms, rising sea levels, tidal action, currents and waves, and high winds (Los Angeles County, 2014b). Coastal flooding has many of the same problems identified for riverine flooding, as well as additional problems such as storm surge, beach erosion, loss or submergence of wetlands and other coastal ecosystems, saltwater intrusion, high water tables, loss of coastal structures (sea walls, piers, bulkheads, bridges or buildings), and loss of coastal recreation areas, beaches, sand dunes, parks and open space (FEMA, 2011).

### *Storm Surge Areas*

Storm surges inundate coastal floodplains by dune overwash, tidal rise in inland bays and harbors, and backwater flooding through coastal river mouths. Strong winds can increase tide levels and water-surface elevations. Storm systems generate large waves that run up and flood coastal beaches. The combined effects are storm surges that affect the beach, dunes, and adjacent low-lying floodplains. Shallow, offshore depths can cause storm-driven waves and tides to pile up against the shoreline and inside bays. Based on an area's topography, a storm surge may inundate only a small area or coastal lands extending a mile or more inland from the shoreline.

Storm surge can cause significant property damage both by the momentum of waves crashing into property and by eroding, undermining, and weakening structural foundations. This second form also contributes to additional coastal erosion and the destruction of roadways. The maximum potential for storm surge depends on a number of locational and event factors, including storm intensity, forward speed of the storm, size of

the storm, the storm's angle of approach to the coast, central pressure, the width and slope of the continental shelf, and the shape and characteristics of coastal features.

### *Coastal Erosion Areas*

Coastal erosion is one of the primary hazards leading to loss of lives or damage to property in coastal areas. Coastal shorelines change constantly in response to wind, waves, tides, sea-level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system. Coastal erosion resulting from flooding is typically seen when extreme rainfall scours and erodes dunes and when inland floodwaters return through the dunes and beach face into the ocean (FEMA 1996). Such erosion can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitat.

Some methods used in the past to stop or reduce coastal erosion actually exacerbated the problem. Shore protection structures such as seawalls and revetments often are built to stabilize the upland property, but they can subject down-drift beaches to increased erosion. Typically they eliminate natural wave run-up and sand deposition processes and can increase reflected wave action and currents at the water line. Increased wave action can cause localized scour in front of structures and prevent settlement of suspended sediment (FEMA 1996). While hardened structures typically prove to be beneficial in reducing upland property damage, the rate of coastal erosion nearby typically increases. This impacts natural habitats, spawning grounds, recreational activity areas, and public access (Frizzera, 2009). Beaches, dunes, barrier beaches, salt marshes and estuaries can slowly disappear as the sediment sources that feed and sustain them are eliminated.

To counteract the negative impact of hard structures, alternative forms of shoreline stabilization that provide more natural forms of protection can be used. These include beach nourishment and dune restoration, as well as notching existing groins to reestablish a flow of sediment to previously sand-starved areas beaches.

### *Tsunami Hazard Areas*

Earthquakes, landslides on the ocean floor, and volcanic activity all have the potential to create large sea waves that can inundate coastal areas. The California coast has experienced about 80 tsunamis over the past 150 years, and four of these have caused fatalities. The travel time for a locally generated tsunami, from initiation at the source to arrival at coastal communities, can be 5 to 30 minutes.

The likelihood of catastrophic inundation of low-lying coastal areas as a result of a tsunami is low. However, the risk of losing vital commerce associated with the ports of Los Angeles and Long Beach warrants adequate risk reduction measures from tsunamis. The ports of Los Angeles and Long Beach have completed a tsunami hazard assessment to guide disaster planning and mitigate damage from a potential tsunami at their facilities. In addition, the Los Angeles County All-Hazard Mitigation Plan includes risk reduction measures for the coastal areas (Los Angeles County, 2015).

## 6.3.5 Dam Failure

A dam is an artificial barrier that can store water, wastewater, or liquid-borne materials for many reasons, such as flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, pollution control, or combinations of these purposes. Man-made dams can be classified according to the type of construction material used, the methods used in construction, the slope or cross-section of the dam, the way the dam resists the forces of water pressure behind it, or the means used for controlling seepage. Materials used to build dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, plastic, rubber, or combinations of these (Association of State Dam Safety Officials 2013).

More than a third of all dams in the U.S. are 50 or more years old. Approximately 14,000 of those dams pose a significant hazard to life and property if failure occurs. There are about 2,000 unsafe dams in the United States, located in almost every state. Dam failures can occur as a result of structural failures, such as progressive erosion of an embankment or overtopping and breaching by a severe flood. Failure of a dam can cause severe downstream flooding, depending on the magnitude of the failure. Floods caused by dam failures have caused loss of life and property damage (FEMA 1996).

Dam failures can result from one or a combination of the following reasons (FEMA 2013a):

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Earthquakes
- Inadequate maintenance and upkeep.

Dam failures typically occur when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-filled waters that rush downstream, damaging or destroying anything in its path (FEMA 1996). According to the 2010 California State Hazard Mitigation Plan, there have been nine dam failures in the state since 1950, some of which occurred in Los Angeles County. Overtopping caused two of the failures, and the others were caused by seepage or leaks. The historical record indicates that California has had about 45 failures of non-federal dams. The failures occurred for a variety of reasons, the most common being overtopping. Other reasons include shortcomings in the dams or an inadequate assessment of surrounding geomorphologic characteristics.

In Los Angeles County, dams hold billions of gallons of water in reservoirs. Seismic activity can compromise these dams, resulting in catastrophic flooding. Inundation caused by a catastrophic dam or aqueduct failure can devastate large areas and threaten residences and businesses (Los Angeles County, 2015). According to the California Division of Safety of Dams, there are 100 dams in Los Angeles County. Table 6-1 lists dams identified as high hazard by the Division of Safety of Dams. The high hazard classification does not mean that a dam has a high probability of failure; it is based on the downstream impacts on people, property, economy and environment if the dam were to fail. The listed dams have inundation areas within the unincorporated areas of the County, although some of them are located outside of the County. The County has inundation maps for all of the dams listed in the table; the maps are omitted from this plan for security purposes.

The Division of Safety of Dams of the California Department of Water Resources has jurisdiction over large dams throughout the state and enforces safety requirements and annual inspections. Dam owners submit inundation maps to California's Office of Emergency Services that represent the best estimate of where water would flow if a dam failed completely and suddenly with a full reservoir (Los Angeles County, 2015).

**TABLE 6-1.**
**HIGH HAZARD[a] DAMS IN LOS ANGELES COUNTY**

| Name | Water Course | Owner | Year Built | Crest Length (feet) | Height (feet) | Storage Capacity (acre-feet) | Drainage area (sq. mi.) |
|---|---|---|---|---|---|---|---|
| 10th and Western | Off stream | City of Glendale | 1924 | 725 | 28 | 46 | 1.03 |
| Big Tujunga | Big Tujunga Creek | Los Angeles County | 1931 | 505 | 220 | 5,750 | 81.7 |
| Bouquet Canyon | Bouquet Creek | City of Los Angeles | 1934 | 1180 | 190 | 36.505 | 13.6 |
| Castaic | Castaic Creek | CA Department of Water Resources | 1973 | 5200 | 340 | 323,700 | 153.7 |
| Century | Malibu Creek | CA Dept. Of Parks and Recreation | 1913 | 149 | 44 | 70 | 68.1 |
| Cogswell | W Fork San Gabriel River | Los Angeles County Public Works | 1935 | 585 | 266 | 8969 | 38.4 |
| Devils Gate | Arroyo Seco | Los Angeles County | 1920 | 252 | 108 | 2,600 | 29.7 |
| Diederich Res | Off stream | City of Glendale | 1950 | 100 | 60 | 174 | 0 |
| Dry Canyon | Dry Canyon Creek | City of Los Angeles | 1912 | 780 | 66 | 1140 | 4.5 |
| Eagle Rock | Off Stream | City of Los Angeles | 1953 | 495 | 113 | 254 | 0 |
| Eaton Wash Debris Basin | Eaton Wash | Los Angeles County Public Works | 1936 | 1545 | 63 | 721 | 9.47 |
| Elysian | Trib. to Los Angeles River | City of Los Angeles | 1943 | 480 | 71 | 167 | 0.08 |
| Encino | Encino Creek | City of Los Angeles | 1924 | 1,850 | 168 | 9789 | 1.4 |
| Fairmont | Antelope Valley | City of Los Angeles | 1912 | 4300 | 121 | 7507 | 2.64 |
| Fairmont #2 | Trib. to Antelope Valley Creek | City of Los Angeles | 1982 | 4437 | 24 | 493 | 0.08 |
| Garvey reservoir | Trib. to Rio Hondo | Metropolitan Water District | 1954 | 5164 | 160 | 1610 | 0 |
| Glen Oaks 968 | Off Stream | City of Glendale | 1949 | 220 | 62 | 28 | 0 |
| Green Verdugo | Trib. Tujunga Wash | City of Los Angeles | 1953 | 452 | 118 | 99 | 0.04 |
| Greystone | Off Stream | City of Beverley Hills | 1970 | 1140 | 75 | 60 | 0 |
| Hansen Rec Lake | Off Stream | City of Los Angeles | 1999 | 3600 | 50 | 85 | 0.01 |
| Harold Reservoir | Trib. to Antelope Valley | Palmdale Water District | 1891 | 2800 | 30 | 3870 | 4.63 |
| Laguna Reg. Basin | Laguna Wash | Los Angeles County | 1970 | 380 | 43 | 310 | 5.55 |
| Live Oak | Live Oak Creek | Los Angeles County Public Works | 1922 | 303 | 76 | 239 | 2.3 |
| Lopez | Arroyo Grande Creek | San Luis Obispo County | 1969 | 1120 | 166 | 52,500 | 70 |
| Los Angeles Res | San Fernando Creek | City of Los Angeles | 1977 | 3415 | 130 | 10,000 | 9 |
| Lower Franklin #2 | Franklin Canyon | City of Los Angeles | 1982 | 410 | 49 | 920 | 1.12 |
| Malibou Lake Club | Malibu Creek | Private Entity | 1923 | 190 | 44 | 500 | 64 |
| Morris | San Gabriel River | Los Angeles County Public Works | 1935 | 750 | 245 | 27,500 | 210 |
| Morris S. Jones | Trib. to Pit River | Pasadena Dept. of Water and Power | 1952 | 1470 | 49 | 153.3 | -- |
| Mulholland | Weid Canyon | City of Los Angeles | 1924 | 933 | 195 | 4,036 | 1 |
| Pacoima | Pacoima Creek | Los Angeles County | 1929 | 640 | 365 | 3,777 | 27.8 |
| Palos Verdes res | Trib. La Harbor | Metropolitan Water District | 1939 | 2150 | 82 | 1,100 | 1 |

**TABLE 6-1.**
**HIGH HAZARD[a] DAMS IN LOS ANGELES COUNTY**

| Name | Water Course | Owner | Year Built | Crest Length (feet) | Height (feet) | Storage Capacity (acre-feet) | Drainage area (sq. mi.) |
|---|---|---|---|---|---|---|---|
| Potrero | Triunfo Canyon Creek | Private Entity | 1960 | 730 | 40 | 791 | 28.9 |
| Prado Dam | Santa Ana River | Federal-Corps | 1941 | 2280 | 106 | 295,581 | 2255 |
| Puddingstone | Walnut Creek | Los Angeles County Public Works | 1928 | 2698 | 147 | 16,341 | 33.1 |
| Pyramid | Piru Creek | CA Department of Water Resources | 1973 | 1080 | 386 | 178,700 | 295 |
| Riviera Res. | Off Stream | City of Santa Monica | 1962 | 1280 | 40 | 76 | 0 |
| San Antonio Dam | San Antonio Creek | Federal-Corps | 1956 | 3850 | 160 | 11,880 | 27 |
| San Gabriel #1 | San Gabriel River | Los Angeles County Public Works | 1938 | 1520 | 320 | 44,183 | 205 |
| Santa Anita Debris Basin | Santa Anita Wash | Los Angeles County Public Works | 1960 | 955 | 56 | 116 | 12.5 |
| Santa Fe Dam | San Gabriel River | Federal-Corps | 1949 | 23,800 | 92 | 45,409 | 236 |
| Santa Ynez Canyon | Trib. to Santa Ynez Canyon | City of Los Angeles | 1968 | 455 | 157 | 356 | 0.23 |
| Sawpit | Sawpit Creek | Los Angeles County Public Works | 1927 | 527 | 150 | 406 | 3.27 |
| Sepulveda | Los Angeles River | Corps of Engineers | 1941 | 15,270 | 57 | -- | -- |
| Sherwood | | | | | | | |
| Silver Lake | Trib. Ballona Creek | City of Los Angeles | 1906 | 760 | 43 | 2,020 | 0.12 |
| Stone Canyon | Stone Canyon Creek | City of Los Angeles | 1924 | 1150 | 188 | 10,372 | 1.4 |
| Thompson Creek | Thompson Creek | Los Angeles County Public Works | 1928 | 1500 | 66 | 543 | 3.46 |
| Upper Franklin | Franklin Canyon | Federal | 1915 | 260 | 40 | 150 | -- |
| Westlake Reservoir | Tree Springs Creek | Las Virgenes Municipal Water District | 1972 | 1400 | 158 | 9200 | 0.9 |
| Whittier Narrows Dam | San Gabriel River | Federal-Corps | 1957 | 16,960 | 56 | 66,702 | 554 |

a. Downstream Hazard Class 1A: > 300 lives at risk. This refers to the potential effect in the case of a dam failure. It does not indicate a high probability of such failure.

Source: California DWR, 2015.

## 6.3.6 Levee Failure

Levees are a basic means of providing flood protection along waterways in regions where development exists or is planned, and in agricultural areas. Levees confine floodwaters to the main river channel or protect inland areas from high tides. Failure of a levee can lead to inundation of surrounding areas.

The causes of levee failures are structural failures, foundation failures of underlying soils, and overtopping by flood flows, tides and waves. Contributing factors include poor construction materials, erosion by current and wave action, seepage through or under the levee, burrowing rodents, and improper repairs. Lack of

adequate and regular maintenance to correct these problems also contributes to levee failure. Most failures are composites of several of these factors.

FEMA accredits levees as providing adequate risk reduction if levee certification and an adopted operation and maintenance plan are adequate. The criteria for which a levee can be accredited are specified in 44 CFR Section 65.10, (https://www.fema.gov/media-library/assets/documents/10713). Section 65.10 provides the minimum design, operation and maintenance standards levee systems must meet in order to be recognized as providing protection from the base flood on a Flood Insurance Rate Map. In order for a levee to be accredited, the owner must provide data and documentation to demonstrate that the levee complies with these requirements.

An area impacted by an accredited levee is shown as a moderate-risk area and labeled Zone X on a FIRM. This accreditation affects insurance and building requirements. The NFIP does not require flood insurance for areas protected by accredited levees, although FEMA recommends the purchase of flood insurance in these areas due to the risk of flooding from levee failure or overtopping. If a levee is not accredited, the area it protects will still be mapped as a high-risk area (an SFHA), and the federal mandatory purchase of flood insurance applies (FEMA, 2012).

Even with levee certification and FEMA accreditation, there is a flood risk associated with levees. While levees are designed to reduce risk, even properly maintained levees can fail or be overtopped by large flood events. Levees reduce risk, they do not eliminate it.

In Los Angeles County, there are over 200 miles of levees that provide protection against floods of 25-year or greater magnitude. Most of these levees are in cities; fewer than 10 percent are in the unincorporated County. Figure 6-2 and Figure 6-3 show the levees with greater than 25-year protection that would flood developed areas of the County should they be overtopped (mapping of levees with 25-year or great protection is required under Step 4 of Activity 510 of the 2013 CRS Coordinator's Manual). These maps indicate levees that have been accredited by FEMA, and therefore do not represent a flood hazard. The County has received accreditation on 89 percent of the levees for which FEMA certification was required. The following County levees are not accredited by FEMA:

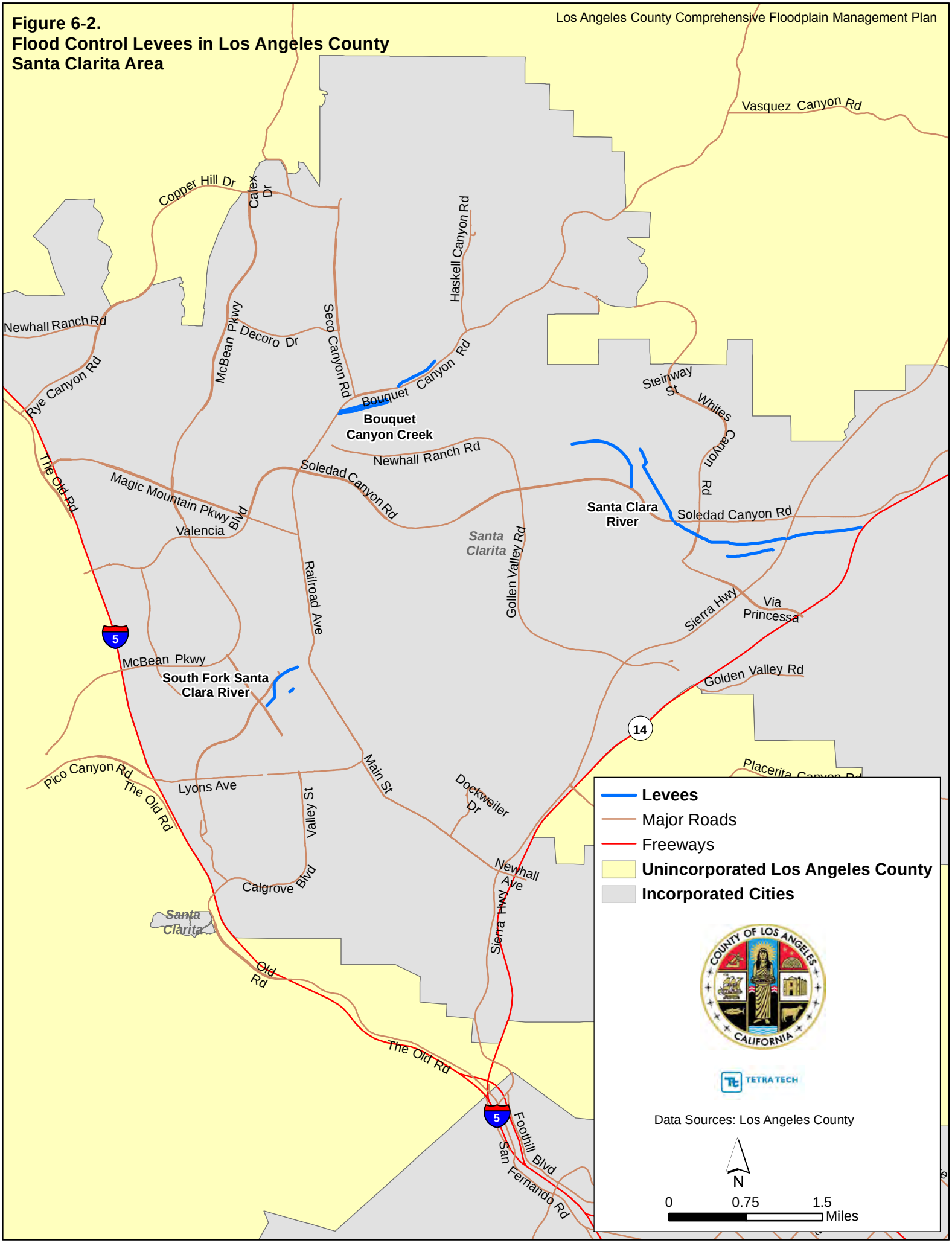
- Dominguez Channel Levee
- Compton Creek Levee
- Bouquet Canyon Creek Levees (ID Nos. 13 and 15)
- Santa Clara River Levees Nos. 4, 7, 10, and
- South Fork Santa Clara River Levee No. 26.

### 6.3.7 Geologic Hazard Areas

Flooding is associated with geologic hazards in two ways:

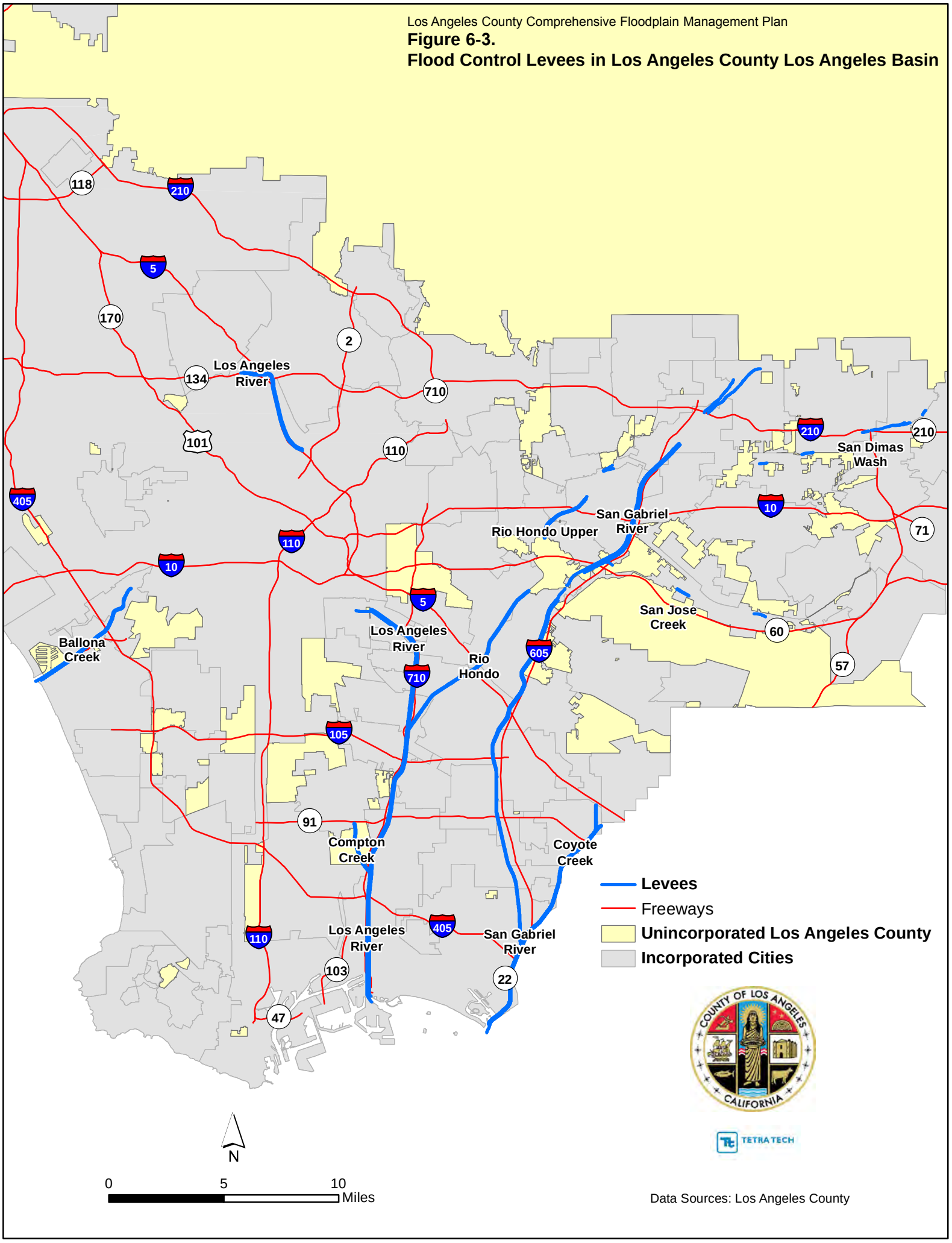
- **Subsidence Areas—**Human activities such as underground mining, groundwater or oil withdrawal, or soil drainage can cause the ground to subside. This may occur gradually, resulting in greater flood potential due to lower land elevation, or suddenly, resulting in sinkholes and collapses that may damage buildings, roads and utilities.
- **Landslide Areas—**Floods, earthquakes and volcanic eruptions can trigger landslides. The landslide risk can be exacerbated by human activities such as mining or the cut-and-fill construction of highways, buildings and railroads.

**Figure 6-2.**
**Flood Control Levees in Los Angeles County**
**Santa Clarita Area**



Los Angeles County Comprehensive Floodplain Management Plan

**Figure 6-3.**
**Flood Control Levees in Los Angeles County Los Angeles Basin**




Data Sources: Los Angeles County

## 6.4 PRINCIPAL FLOODING SOURCES IN LOS ANGELES COUNTY

Flooding in southern California, including the County of Los Angeles, is most frequently the result of coastal storms or heavy rains resulting in one to several days of precipitation. Although flooding resulting from heavy precipitation can occur anywhere in the County, certain areas are more vulnerable than others. This section provides information regarding flood-prone areas in unincorporated areas of the County.

### 6.4.1 Water Bodies

The FEMA Flood Insurance Study for Los Angeles County divides the unincorporated areas into four sub-areas: Antelope Valley, Santa Clarita Valley, Malibu, and the Los Angeles basin. The Los Angeles basin holds the largest amount of unincorporated area.

The main bodies of water (and sources of flooding) in these areas are as follows:

- Ballona Creek
- Los Angeles River
- Malibu Creek
- Pacific Ocean
- Rio Hondo River
- San Gabriel River and its tributaries
- Santa Clara River
- Topanga Canyon

Other sources of potential flooding, as identified in the Flood Insurance Study, include the following:

- Acton Canyon
- Agua Dulce Canyon
- Amargosa Creek
- Anaverde Creek
- Big Rock Creek
- Bouquet Canyon
- Castaic Creek
- Cheseboro Creek
- Cold Creek
- Dark Canyon
- Dry Canyon
- Elizabeth Canyon
- Escondido Canyon
- Garapito Canyon
- Gorman Creek
- Halsey Canyon
- Haskell Canyon
- Iron Canyon
- Las Flores Canyon
- Las Virgenes Creek
- Liberty Canyon
- Lindero Canyon
- Little Rock Creek
- Malibou Lake
- Medea Canyon
- Mint Canyon
- Newhall Creek
- Oak Springs
- Old Topanga Canyon
- Palo Comado Creek
- Pine Canyon
- Placerita Creek
- Railroad Canyon
- Ramirez Canyon
- Sand Canyon
- San Francisquito Canyon
- San Martinez-Chiquito Canyon
- Santa Maria Canyon
- Stokes Canyon
- Topanga Canyon
- Trancas Creek
- Triunfo Creek
- Unnamed Canyon near Serra Retreat Area
- Vasquez Canyon
- Violin Canyon
- Wildwood Canyon
- Zuma Creek

### 6.4.2 Climate Variations

Although awareness of potential flooding sources is important, rainfall and precipitation characteristics in the County provide clarity on when these sources are likely to experience flooding:

- In the coastal and mountain areas, precipitation is mainly the result of winter rains associated with North-Pacific extra-tropical cyclones. Major storms approach from the west or northwest, and they often consist of one or more frontal systems that can last four days or longer.
- The mountain ranges greatly intensify the amount of precipitation. Seasonal normal rainfall for the County ranges from 27.50 inches in the San Gabriel Mountains to 7.83 inches in the desert.
- Warm rains from southerly spring storms can increase snowmelt and thus flood runoff, depending on local topography.
- In mountainous regions, steep canyons and channel gradients encourage stormwater runoff.
- In the County's desert regions, the most serious flooding usually results from summer convective storms. This rainfall is most frequent in the upper San Gabriel Mountains and Mojave Desert regions (Los Angeles County Department of Public Works, 2013).

### 6.4.3 Development Effects

Stormwater runoff and drainage issues in the hill and valley areas of the County are dependent on the amount of development. More developed valley areas experience increased runoff volumes due to the large amount of impervious surface.

## 6.5 MAJOR FLOOD EVENTS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. Los Angeles County has experienced 13 flooding events since 1969 for which federal disaster declarations were issued, as summarized in Table 6-2. Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid large-scale events in the future.

Many flood events do not trigger federal disaster declaration protocol but still have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for flooding. The following sections provide an overview of some of the more significant floods that have affected unincorporated areas of the county.

### 6.5.1 Flood of 1914

Disastrous floods occurred in Los Angeles County in the winter of 1914. Floodwaters claimed lives and damaged property. In response to this event, the California State Legislature adopted the Los Angeles County Flood Control Act, which established the Los Angeles County Flood Control District.

**TABLE 6-2.**
**HISTORY OF LOS ANGELES COUNTY FLOOD EVENTS WITH FEDERAL DISASTER DECLARATIONS**

| Event Dates | Declaration # | Type of event |
|---|---|---|
| 1/26/1969 | DR-253 | Severe storms & flooding |
| 2/15/1978 | DR-547 | Coastal storms, mudslides & flooding |
| 1/8/1980 | DR-615 | Severe storms, mudslides & flooding |
| 1/21 - 3/30/1983 | DR-677 | Coastal storms, floods, slides & tornadoes |
| 1/17-22/1988 | DR-812 | Severe storms, high tides & flooding |
| 2/10-18/1992 | DR-935 | Rain/snow/wind storms, flooding, mudslides |
| 1/5 - 3/20/1993 | DR-979 | Severe winter storm, mud & landslides, & flooding |
| 1/3 - 2/10/1995 | DR-1044 | Severe winter storms, flooding, landslides, mud flows |
| 2/13 - 4/19/1995 | DR-1046 | Severe winter storms, flooding landslides, mud flow |
| 2/2 - 4/30/1998 | DR-1203 | Severe winter storms, and flooding |
| 12/27/2004 - 1/11/2005 | DR-1577 | Severe storms, flooding, debris flows, and mudslides |
| 2/16 - 23/2005 | DR-1585 | Severe storms, flooding, landslides, and mud and debris flows |
| 1/17 - 2/6/2010 | DR-1884 | Severe winter storms, flooding, and debris and mud flows |

Source: FEMA, 2014b

## 6.5.2 2014 Hurricane Marie

Hurricane Marie in August 2014 is the seventh-most intense Pacific hurricane on record. Although Hurricane Marie's center remained well away from land throughout its existence, its large size brought increased surf to areas from southwestern Mexico to southern California. Marie brought one of the largest hurricane-related surf events to southern California in decades. Swells of 10 to 15 feet battered coastal areas, with structural damage occurring on Santa Catalina Island and in the Greater Los Angeles Area. One person drowned in the surf near Malibu. A breakwater near Long Beach sustained $10 million worth of damage, with portions gouged out. Hundreds of ocean rescues were performed due to the storm, and overall losses reached $20 million.

In Mexico, off the coast of Los Cabos, three people drowned after their boat capsized in rough seas. In Colima and Oaxaca, heavy rains from outer bands caused flooding, resulting in two fatalities. Similar effects were felt across Baja California Sur.

## 6.5.3 1997-1998 El Niño

Noteworthy storm incidents in Los Angeles due to the 1997-1998 El Niño include the following:

- October 1997—Hurricane Nora caused three deaths and caused damage due to mudslides throughout the Los Angeles area.
- On February 6, 1998—Mud crashed into an apartment building in the Westlake area; more than 100 residents were evacuated.

- On February 8, 1998—An ocean-eroded cliff in Malibu buckled, causing one home to collapse and threatening two others.
- On February 13, 1998—A rain-soaked hillside collapsed in the Canoga Park area, forcing the evacuation of five homes and threatening several others.

### 6.5.4 1977-1978 Winter Storms

Significant coastal flooding resulted as a combination of high astronomical tides, strong onshore winds, and high storm waves in the winter of 1977-1978. This flooding caused significant damage, including an estimated $1 million to $8 million in property damage for private residences along the Malibu coastline, $150,000 in damage to Long Beach Harbor, $80,000 in damage to the Santa Monica Pier, and $140,000 in damage to a bicycle path in El Segundo.

In the La Crescenta area, a debris basin overflowed, inundating several homes with mud and water. Localized flooding damaged other homes in the area. Virtually all of the Flood Control District debris basins in this area were filled to capacity. In the Hidden Springs area, mud and water flowing down Mill Creek took 10 lives and destroyed numerous structures (FEMA Flood Insurance Study, 2008).

### 6.5.5 Summer Storms, 1968

Summer storms in 1968 caused damage in unincorporated County areas downstream of brush fires that occurred earlier in the summer. In the Malibu area, damage occurred along Malibu Creek and Topanga Canyon, where flows damaged homes, swept away bridges, and washed out roads. Approximately 500 people were left homeless or isolated. In the Santa Clarita Valley, most damage was caused by erosion and sedimentation of natural watercourses. In the Antelope Valley, at least one home was completely destroyed. Railroads, public utilities, and agriculture also sustained damage (FEMA Flood Insurance Study, 2008).

### 6.5.6 Dam Failures

The most catastrophic dam failure in California's history was that of the St. Francis Dam in Los Angeles County in March 1928. This failure resulted in the deaths of more than 450 people and destruction of nearly 1,000 homes and buildings. Numerous roads and bridges were destroyed or damaged beyond repair. The California Division of Safety of Dams came into existence as a direct result of this catastrophe. Other significant dam failures in California's history include the Baldwin Hills Dam failure in 1963, which resulted in three deaths, and the near-failure of the Lower San Fernando Dam in 1971.

## 6.6 LOCATION

### 6.6.1 Mapped FEMA Flood Zones

The September 26, 2008, Los Angeles County DFIRMs are FEMA's official delineation of Special Flood Hazard Areas for the County of Los Angeles. Identified SFHAs include shallow flooding, floodway, alluvial fans, and coastal areas. They were determined using statistical analysis of records of river flow, storm tides, and rainfall; information obtained through consultation with the City of Los Angeles and the County of Los Angeles; floodplain topographic surveys; and hydrologic and hydraulic analyses. FEMA's mapped flood zones for the County are shown on maps provided in Appendix F.

These maps are the basis for the exposure and vulnerability analyses presented in this floodplain management plan. They represent the best data available at the time of this analysis, but they are not

representative of all sources of flood risk. Extent and location mapping is not currently available for all flood hazard areas identified; such mapping has been identified as a need by this plan update process. Errors in the FEMA mapping were identified during the course of this project. It is not within the scope of this plan to correct errors in FEMA mapping, but it is within the scope to identify the correction of these errors as a proposed mitigation action.

### 6.6.2 County Floodways

The floodway is an area immediately adjacent to a water course where floodwaters during a flood are deepest and fastest-moving. It is the most dangerous part of the floodplain, and its hazardous nature requires that development in this area be carefully managed. The floodway must remain free of obstruction and construction unless engineering analysis demonstrates that flood hazards will not be increased on adjoining properties. Ideally, development in the floodway should be restricted to uses that do not interrupt the natural flow of the water (tennis courts, swimming pools, etc.).

The limits of the floodway are defined as the point where the velocity of flood flow is 10 feet per second or the water surface elevation is 1 foot above the floodplain water surface elevation. The first of either criteria reached controls the floodway width. Where the flow velocity exceeds 10 feet per second for the entire width of the floodplain, the floodplain lines and floodway lines are the same. The County's mapped floodways are shown in Appendix G. Los Angeles County Department of Public Works Capital Flood Protection requirements apply to all unincorporated areas mapped as floodways. The Capital Flood is the flooding produced by a 50-year frequency storm falling on a saturated watershed.

### 6.6.3 Non-SFHA Urban Drainage Flood Areas

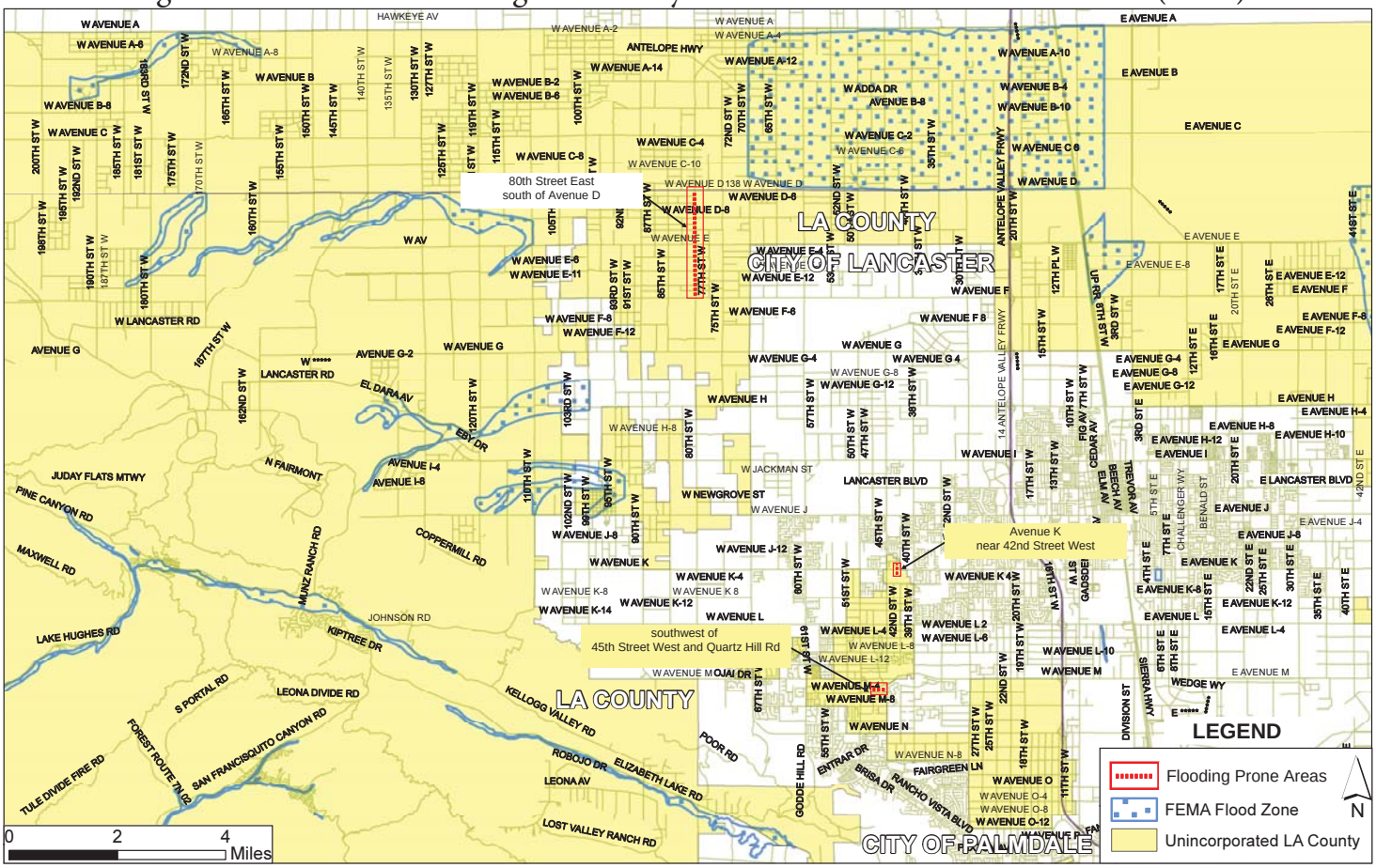
Flooding problem areas outside SFHAs are identified on a case by case basis. One source of information is mapping performed by the Los Angeles County Road Maintenance Division in northern unincorporated portions of the County. Areas mapped through this process are shown on Figure 6-4 and Figure 6-5.

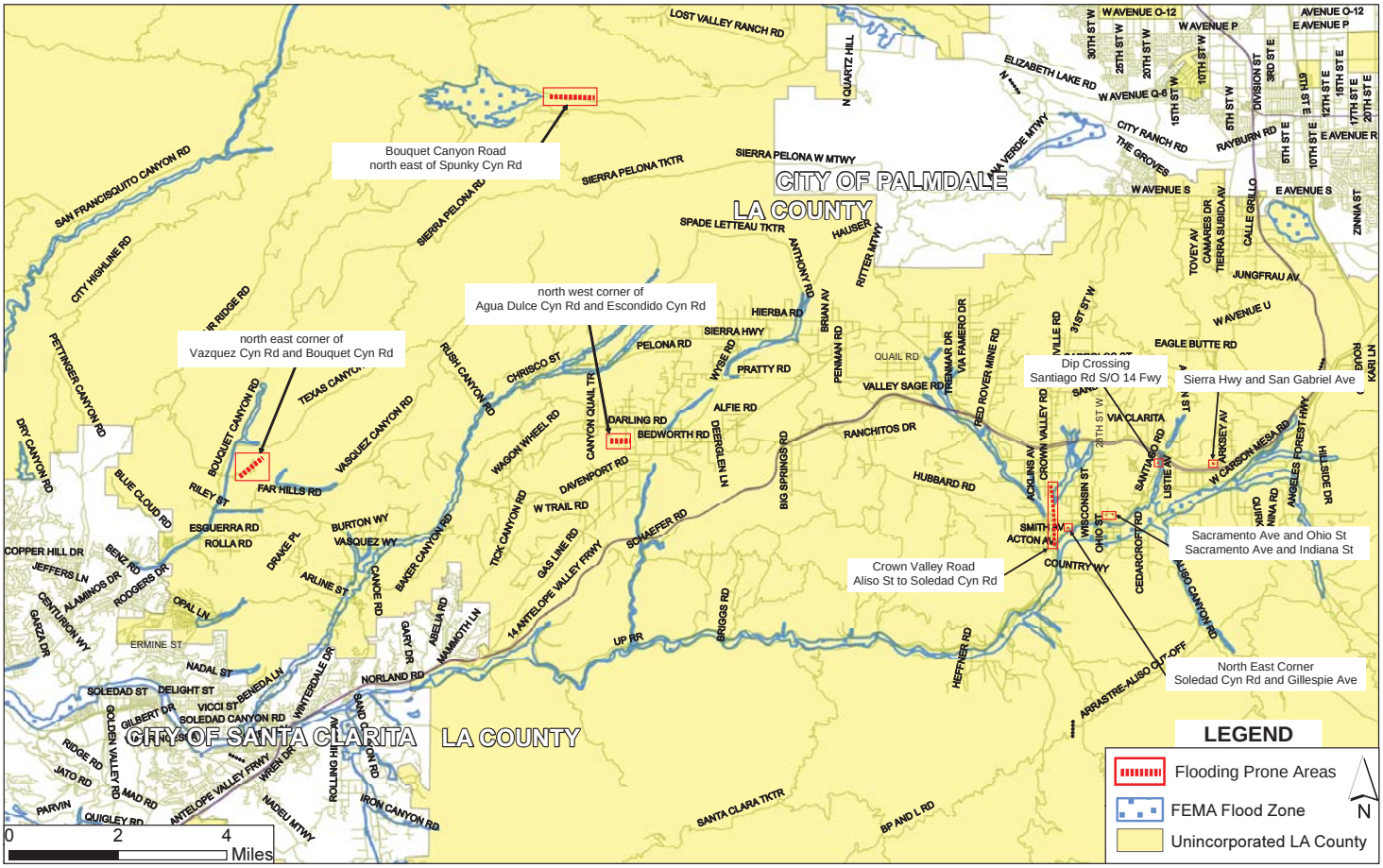
## 6.7 FREQUENCY

Floods are commonly described as having a 10-, 50-, 100-, and 500-year recurrence interval, meaning that floods of these magnitudes have (respectively) a 10-, 2-, 1-, or 0.2-percent chance of occurring in any given year. Assigning recurrence intervals to historical floods on different rivers can help indicate the intensity of a storm over a large area. This frequency is determined and measured by using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels. The flood frequency, in years, is equal to 100 divided by the discharge probability, as a percent. So, for example, the discharge with a 1-percent chance of being equaled or exceeded in any given year represents the 100-year flood event (Interagency Floodplain Management Review Committee, 1994).

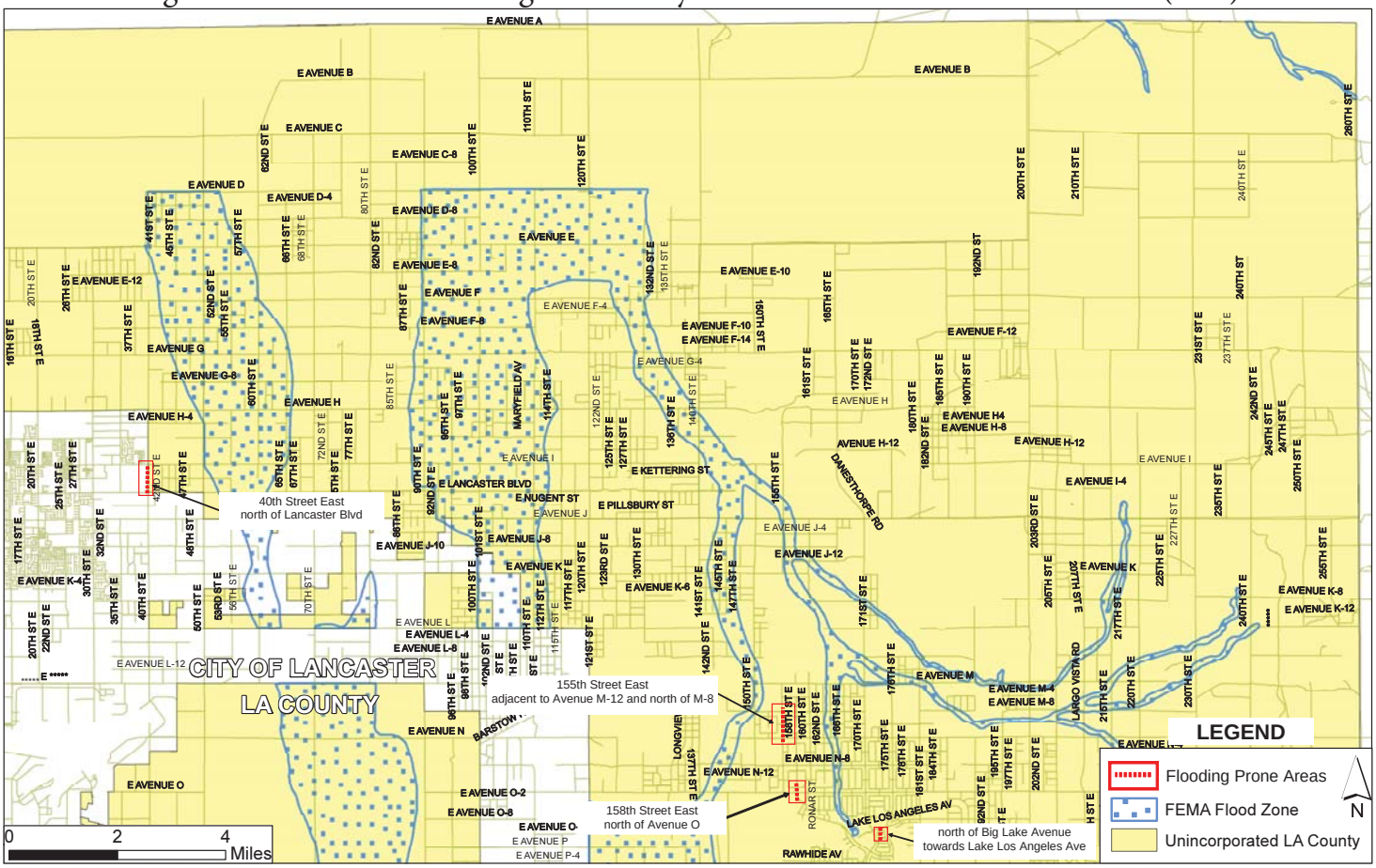
These measurements reflect statistical averages only; it is possible for two or more low-probability floods (with a 100-year or higher recurrence interval) to occur within a short time period. The 100-year flood has a 26-percent chance of occurring during the term of a 30-year mortgage. The 500-year flood has a 6-percent chance of occurring during that time.

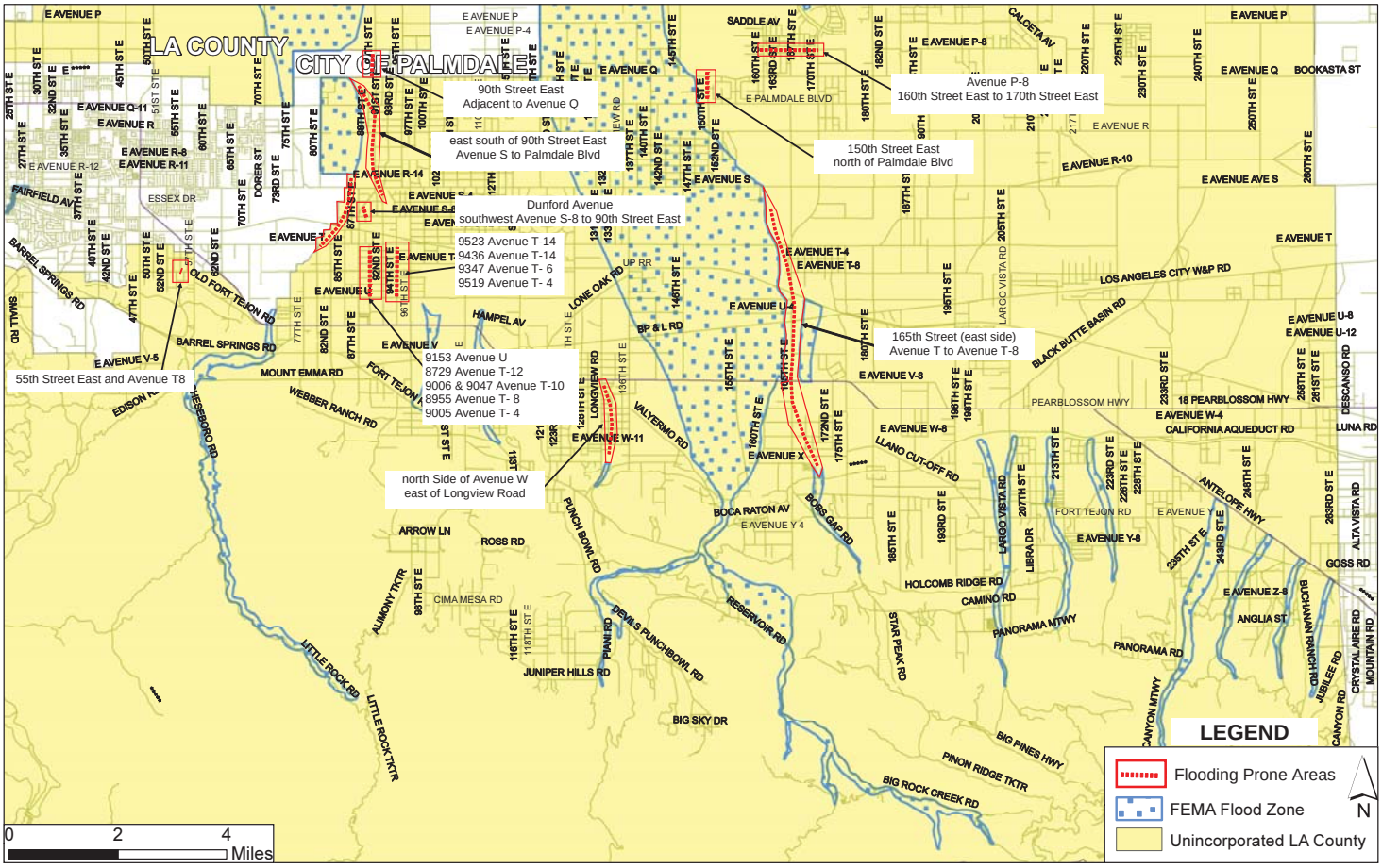
# Figure 6-4. Northern Los Angeles County Flood-Prone Areas Outside SFHA (West)



# Figure 6-5. Northern Los Angeles County Flood-Prone Areas Outside SFHA (East)



The 100-year flood, also called the base flood, is used by the NFIP as the standard to determine the need for flood insurance. The extent of flooding associated with the 100-year flood, referred to as the SFHA, is used as a regulatory boundary by many agencies. Many communities have maps that show the extent and likely depth of flooding for the base flood. Mapped water-surface elevations for the base flood are used in estimating flood damage. The 500-year floodplain is referred to on FIRMs as Zone X500. Flood elevations and depths are not shown for this zone, and insurance purchase is not required for properties within it.

The historical record indicates that large floods occur infrequently in Los Angeles County, but the damage they cause is significant, especially as development in the floodplain has increased dramatically. The frequency of other flood-related hazard events is more difficult to predict:

- Dam failures are difficult to predict and do not typically have an associated frequency. Dam vulnerability is unique to each dam, depending on its type, age, and previous incident information. Dam failure frequency is typically based on anecdotal information and historical events (Ferrante et al., 2012).
- Coastal erosion is a frequent event that is tied to both natural and human activities. While all beaches experience coastal erosion, rate and severity vary by location. Because coastal erosion is tied so closely to other activities, frequency rates and severity levels are best evaluated in conjunction with other related hazards' probabilities and by analyzing secondary impacts from storms, human actions, etc.
- Storm surge frequency is similar to coastal erosion in that its frequencies are tied to other hazard events, such as severe storms. In general, the severity of a storm can provide a rough prediction for the occurrence of storm surge.
- Sea level change is an ongoing process and can be monitored on both long-term and shorter-term scales. Global sea level changes are due to changes in the volume of water in ocean basins through thermal expansion, glacial melt, or net changes in the size of ocean basins. Global sea rise has been occurring for the past 20,000 years as a natural result of glacial maximum decline.

## 6.8 SEVERITY

### 6.8.1 Riverine Flooding

The principal factors affecting flood damage along a river or stream are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; Table 6-3 lists peak flows used by FEMA to map the floodplains of the planning area, as noted in the effective Los Angeles County Flood Insurance Study.

**TABLE 6-3.**
**SUMMARY OF PEAK DISCHARGES IN UNINCORPORATED LOS ANGELES COUNTY**

| Source/Location | Drainage Area (square miles) | Discharge (cubic feet/second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| 165th Street East Approximately 4.000 feet south of Pearblossom Highway | 7.3 | 500 | 1,700 | 2,300 | 4,700 |
| Acton Canyon Road, Escondido Canyon Road, and Crown Valley Road | 20.3 | — | — | 3,421 | 6,052 |
| Acton Canyon at Intersection of Crown Valley Road and Acton Avenue | 20.3 | — | — | 3,421 | 6,052 |
| Agua Dulce Canyon Approximately 5,600 feet upstream of Darling Road | 10.3 | — | — | 3,509 | 6,360 |
| Agua Dulce Canyon Approximately 800 feet upstream of Escondido Road | 14.3 | — | — | 4,401 | 7,977 |
| Amargosa Creek at 90th Street West | 6.9 | 500 | 2,000 | 3,100 | 4,500 |
| Amargosa Creek Approximately Midway between 20th Street West and 10th Street West | 32.7 | 1,800 | 3,300 | 5,000 | 10,100 |
| Anaverde Creek East of Antelope Valley Freeway | 16 | 700 | 2,100 | 3,000 | 6,400 |
| West of Antelope Valley Freeway North of Avenue H | 147 | 2,000 | 5,600 | 8,400 | 18,000 |
| East of Antelope Valley North of Avenue H | 206 | 3,000 | 9,000 | 13,000 | 30,000 |
| Avenue F at Sierra Highway | 206 | 3,000 | 9,000 | 13,000 | 30,000 |
| West of Sierra Highway at Avenue P-8 | 19 | 700 | 2,100 | 3,100 | 6,600 |
| West of 136th Street East of Avenue W-8 | 2.4 | 440 | 1,500 | 1,900 | 3,900 |
| At intersection of Sixth Street and Quincy Avenue | 1.0 | 271 | 598 | 763 | 1,194 |
| Ballona Creek | 16.7 | 2,100 | 4,700 | 6,000 | 9,400 |
| Big Rock Wash | 23.0 | — | — | 15,000 | — |
| Bouquet Canyon Approximately 4,500 feet upstream of Vasquez Canyon Road | 38.6 | — | — | 11,303 | 23,161 |
| Bouquet Canyon Approximately 2,600 feet upstream of Bouquet Canyon Road | 32.1 | — | — | 11,117 | 22,707 |
| Castaic Creek Approximately 2,100 feet upstream of Confluence with Charlie Canyon | 16.8 | — | — | 11,805 | 22,326 |
| Cheseboro Creek | 7.6 | 2,169 | 4,779 | 6,088 | 9,551 |
| Cold Creek – Cross Section A | 8.1 | 2,280 | 5,019 | 6,406 | 10,023 |
| Cold Creek – Cross Section C | 7.8 | 2,280 | 5,041 | 6,432 | 10,066 |
| Cold Creek – Cross Section G | 5.7 | 1,734 | 3,826 | 4,881 | 7,640 |
| Dark Canyon | 1.2 | 753 | 1,600 | 2,118 | 3,314 |
| Dowd Canyon at Calle Corona Extended | 3.9 | — | — | 2,982 | 5,963 |
| Dry Canyon – Cross Section C | 1.1 | 527 | 1,104 | 1,484 | 2,323 |
| Dry Canyon – Cross Section M | 0.8 | 490 | 1,083 | 1,382 | 2,162 |
| Dry Canyon – Cross Section T | 0.4 | 242 | 534 | 681 | 1,065 |
| Dry Canyon – Approximately 2,000 feet upstream of San Francisquito Road | 5.5 | — | — | 5,235 | 10,470 |

**TABLE 6-3.**
**SUMMARY OF PEAK DISCHARGES IN UNINCORPORATED LOS ANGELES COUNTY**

| Source/Location | Drainage Area (square miles) | Discharge (cubic feet/second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Elizabeth Canyon Approximately 2,300 feet downstream of Elizabeth Lake Pine Canyon Road | 7.7 | — | — | 3,455 | 7,176 |
| Escondido Canyon – Cross Section B | 3.2 | 958 | 2,116 | 2,700 | 4,226 |
| Escondido Canyon – Cross Section F | 1.7 | 986 | 2,176 | 2,778 | 4,346 |
| Garapito Canyon – Cross Section A | 2.9 | 996 | 2,171 | 2,807 | 4,392 |
| Garapito Canyon – Cross Section E | 2.0 | 675 | 1,470 | 1,910 | 2,974 |
| Gorman Creek Approximately 250 feet north of Interstate Highway 5 Overcrossing Gorman Road | 3.8 | — | — | 1,713 | 3,221 |
| Halsey Canyon Approximately 1,150 feet downstream of Halsey Canyon Road | 7.3 | — | — | 5,544 | 10,163 |
| Halsey Canyon Approximately 500 feet downstream of Romero Canyon Road | 5.9 | — | — | 4,523 | 8,292 |
| Haskell Canyon approximately 1,300 feet downstream of Headworks | 6.7 | — | — | 5,363 | 10,516 |
| Haskell Canyon approximately 6,400 feet upstream of confluence with Bouquet Canyon | 10.4 | — | — | 7,268 | 14,072 |
| Iron Canyon Approximately 2,000 feet upstream of Sand Canyon Road | 2.8 | — | — | 2,078 | 2,833 |
| Las Flores Canyon | 4.1 | 1,758 | 3,882 | 4,954 | 7,752 |
| Las Virgenes Creek – Cross Section D | 14.3 | 3,591 | 7,928 | 10,175 | 15,832 |
| Las Virgenes Creek – Cross Section H | 12.2 | 3,542 | 7,822 | 9,980 | 15,619 |
| Liberty Canyon | 1.4 | 938 | 2,072 | 2,645 | 4,140 |
| Lindero Canyon – Cross Section C | 6.7 | 1,725 | 3,809 | 4,860 | 7,604 |
| Lindero Canyon – Cross Section E | 4.1 | 1,369 | 3,024 | 3,858 | 6,037 |
| Lindero Canyon – Cross Section H | 3.8 | 1,343 | 2,965 | 3,783 | 5,920 |
| Lindero Canyon – Cross Section M | 3.4 | 1,290 | 2,847 | 3,632 | 5,685 |
| Lindero Canyon – Cross Section N | 3.1 | 1,258 | 2,776 | 3,542 | 5,545 |
| Little Rock Reservoir | 48.0 | — | — | 20,000 | — |
| Los Angeles River – At Compton Creek | 808 | 92,900 | 133,000 | 142,000 | 143,000 |
| Los Angeles River – At Imperial Highway | 752 | 89,400 | 126,000 | 140,000 | 156,000 |
| Malibu Creek – Cross Section A | 109.6 | 14,183 | 31,648 | 40,544 | 63,934 |
| Malibu Creek – Cross Section B | 109.2 | 14,183 | 31,648 | 40,544 | 63,934 |
| Malibou Lake | 64.6 | 11,859 | 26,556 | 34,043 | 53,712 |
| Medea Canyon – Cross Section B | 24.6 | 5,794 | 12,788 | 16,319 | 25,537 |
| Medea Canyon – Cross Section H | 23.0 | 6,174 | 13,628 | 17,389 | 25,537 |
| Medea Canyon – Cross Section K | 22.2 | 6,363 | 14,074 | 17,925 | 28,049 |
| Medea Canyon – Cross Section P | 6.3 | 2,558 | 5,647 | 7,204 | 11,272 |
| Mint Canyon 3,600 feet downstream of Vazquez Canyon Road | 26.8 | — | — | 7,896 | 14,179 |

**TABLE 6-3.**
**SUMMARY OF PEAK DISCHARGES IN UNINCORPORATED LOS ANGELES COUNTY**

| Source/Location | Drainage Area (square miles) | Discharge (cubic feet/second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Mint Canyon 1,600 feet downstream of Sierra Highway Crossing | 29.3 | — | — | 8,300 | 14,581 |
| Mint Canyon Approximately 2,600 feet downstream of Davenport Road | 19.9 | — | — | 6,691 | 12,604 |
| Newhall Creek Approximately 800 feet downstream of Sierra Highway | 5.2 | — | — | 3,224 | 4,396 |
| Newhall Creek Approximately 650 feet upstream of Sierra Highway | 6.2 | — | — | 3,390 | 5,424 |
| Newhall Creek Approximately 650 downstream of Railroad Canyon | 7.3 | — | — | 3,892 | 6,228 |
| Oak Springs Canyon Approximately 100 feet upstream of Union Pacific Railroad | 5.7 | — | — | 2,703 | 4,054 |
| Old Topanga Canyon – Cross Section E | 1.7 | 567 | 1,253 | 1,597 | 2,499 |
| Old Topanga Canyon – Cross Section H | 0.8 | 251 | 554 | 706 | 1,104 |
| Palo Comado Creek – Cross Section E | 4.1 | 1,159 | 2,562 | 3,268 | 5,113 |
| Palo Comado Creek – Cross Section J | 3.5 | 1,074 | 2,374 | 3,028 | 4,738 |
| Palo Comado Creek – Cross Section K | 3.2 | 1,032 | 2,279 | 2,908 | 4,551 |
| Pine Canyon Approximately 1,200 feet upstream of Lake Hughes Road | 6.4 | — | — | 2,969 | 6,166 |
| Placerita Creek Approximately 850 feet downstream of Antelope Valley Freeway | 6.3 | — | — | 3,546 | 5,673 |
| Placerita Creek Approximately 2,000 feet upstream of Quigley Canyon Road | 7.1 | — | — | 4,085 | 6,313 |
| Placerita Creek Approximately 2,900 feet upstream of Quigley Canyon Road | 8.6 | — | — | 4,988 | 7,482 |
| Placerita Creek Approximately 575 feet upstream of San Fernando Road | 9.3 | — | — | 5,321 | 7,981 |
| Plum Canyon approximately 2,350 feet upstream of Bouquet Canyon Road | 3.4 | — | — | 1,942 | 3,453 |
| Railroad Canyon Approximately 350 feet upstream of San Fernando Road | 1.2 | — | — | 835 | 1,253 |
| Ramirez Canyon – Cross Section B | 3.3 | 1,066 | 2,352 | 3,000 | 4,696 |
| Ramirez Canyon – Cross Section I | 2.8 | 1,150 | 2,540 | 3,240 | 5,070 |
| Rio Hondo River – At Stewart and Gray Road | 132 | 35,600 | 41,000 | 39,300 | 40,200 |
| Rio Hondo River – At Beverly Boulevard | 113 | 33,800 | 37,500 | 38,000 | 38,400 |
| Rio Hondo River – At Outflow from Whittier Narrows Dam | 110 | 33,500 | 36,500 | 36,500 | 36,500 |
| Sand Canyon Approximately 800 feet upstream of Placerita Canyon Road | 6.4 | — | — | 4,371 | 5,961 |
| Sand Canyon Approximately 2,900 feet downstream of Placerita Canyon Road | 7.3 | — | — | 4,908 | 6,693 |

**TABLE 6-3.**
**SUMMARY OF PEAK DISCHARGES IN UNINCORPORATED LOS ANGELES COUNTY**

| Source/Location | Drainage Area (square miles) | Discharge (cubic feet/second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Sand Canyon Approximately 250 feet downstream of Iron Canyon Confluence | 10.1 | — | — | 6,372 | 8,689 |
| San Francisquito Canyon at Spunky Road | 2.7 | — | — | 2,140 | 4,281 |
| San Martinez-Chiquito Canyon Approximately 1,000 feet upstream of Chiquito Canyon Road (Lower Crossing) | 4.7 | — | — | 4,659 | 8,607 |
| San Martinez-Chiquito Canyon Approximately 400 feet upstream of Chiquito Canyon Road (Upper Crossing) | 3.1 | — | — | 3,112 | 5,705 |
| San Martinez-Chiquito Canyon Approximately 250 feet downstream of Verdale Street | 1.1 | — | — | 1,205 | 2,208 |
| Santa Clara River – Approximately 3,500 feet upstream of Arrastre Canyon Road | 67.7 | — | — | 8,408 | 13,849 |
| Santa Clara River – 7,600 feet upstream of Oak Springs Canyon | 172.7 | — | — | 13,412 | 22,588 |
| Santa Clara River – At Sand Canyon Road | 179.4 | — | — | 13,934 | 23,467 |
| Santa Clara River – Approximately 2,600 feet upstream of Los Angeles Aqueduct | 235.4 | — | — | 15,182 | 26,369 |
| Approximately 1,800 feet south of Intersection of San Fernando Road and Magic Mountain Parkway | 1.9 | — | — | 1,437 | 2,495 |
| Santa Maria Canyon | 3.1 | 1,070 | 2,333 | 3,016 | 4,719 |
| South Fork Santa Clara River Approximately 600 feet downstream of Golden State Freeway | 12.8 | — | — | 8,417 | 13,596 |
| South Fork Santa Clara River Approximately 500 feet Downstream of Wiley Canyon Road | 12.9 | — | — | 8,483 | 13,704 |
| Stokes Canyon – Cross Section B | 2.9 | 1,089 | 2,403 | 3,067 | 4,799 |
| Stokes Canyon – Cross Section C | 2.4 | 934 | 2,062 | 2,632 | 4,117 |
| Topanga Canyon – Cross Section H | 19.6 | 4,095 | 9,040 | 11,537 | 18,054 |
| Topanga Canyon – Cross Section M | 15.0 | 5,404 | 11,930 | 15,223 | 23,882 |
| Topanga Canyon – Cross Section Q | 14.5 | 5,208 | 11,499 | 14,672 | 22,960 |
| Topanga Canyon – Cross Section T | 7.3 | 2,560 | 5,656 | 7,215 | 11,289 |
| Topanga Canyon – Cross Section V | 7.0 | 2,364 | 5,222 | 6,601 | 10,422 |
| Topanga Canyon – Cross Section X | 5.5 | 1,862 | 4,113 | 5,247 | 8,210 |
| Trancas Creek – Upstream of Pacific Coast Highway | 8.6 | 2,499 | 5,518 | 7,040 | 11,106 |
| Triunfo Creek – Cross Section B | 28.7 | 1,781 | 11,396 | 14,898 | 24,298 |
| Triunfo Creek – Cross Section E | 28.3 | 4,846 | 11,544 | 15,090 | 24,606 |
| Unnamed Canyon (Serra Retreat Area, Malibu Area) | 0.4 | 281 | 619 | 791 | 1,237 |
| Vasquez Canyon Approximately 1,373 feet upstream of Vasquez Canyon Road | 4.2 | — | — | 2,851 | 5,009 |

**TABLE 6-3.**
**SUMMARY OF PEAK DISCHARGES IN UNINCORPORATED LOS ANGELES COUNTY**

| Source/Location | Drainage Area (square miles) | Discharge (cubic feet/second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Violin Canyon Approximately 2,000 feet downstream of Interstate Highway 5 | 10.5 | — | — | 9,421 | 17,818 |
| Wildwood Canyon Approximately 600 feet upstream of Intersection of Valley Street and Maple Street | 0.23 | — | — | 172 | 279 |
| Zuma Canyon – Cross Section A | 8.9 | 2,024 | 4,469 | 5,705 | 8,925 |
| Zuma Canyon – Cross Section B | 8.4 | 2,079 | 4,590 | 5,858 | 9,167 |

The FEMA Flood Insurance Study identified the following as waterways in unincorporated areas of the County that have relatively high velocity discharges:

- Trancas Creek
- Malibu Creek
- Garapito Creek
- Cold Creek
- Cheseboro Creek
- Palo Comado Creek
- Las Virgenes Creek
- Medea Creek
- Lindero Creek
- Triunfo Creek
- Hacienda Creek
- Zuma Canyon
- Ramirez Canyon
- Escondido Canyon
- Unnamed Canyon (Serra Retreat Area)
- Las Flores Canyon
- Topanga Canyon
- Old Topanga Canyon
- Dark Canyon
- Dry Canyon

Such discharges historically tend to erode the main channel, creating the potential for more unpredictable flood flows and greater flood risk to structures in the floodplain.

## 6.8.2 Coastal Flooding

FEMA evaluates the potential impact of a flood event along the coastline through coastal hydraulic analysis and wave run-ups. Wave run-ups are defined as "the uprush of the wave along the shore; also, the combined vertical and horizontal distance that a tsunami moves inland from the shoreline" (Keller and Blodgett, 2008). The FEMA standard definition of wave run-up is " the height above the stillwater elevation (tide and surge) reached by the swash" (FEMA 2005a). Figure 6-6 shows the features of wave run-up.

Run-up calculations provide a greater understanding of potential beach and dune erosion that may result from a flood or storm. Run-up can be impacted by factors including local water level, wave conditions of a particular incident (height, period, steepness, direction), and the nature of the impacted beach/structure (FEMA 2005a). Run-up analysis considers "wave setup," which is the increased elevation of the water level that occurs from transferring wave-related momentum to the surf zone (FEMA 2005b).

Wave run-up measurements are important for making accurate evaluations of overtopping that occurs when a barrier's crest height is lower than the potential run-up level, so that waves running up the face of the barrier pass over the crest. If a run-up calculation indicates potential overtopping, it can increase a hazard zone in flood maps (FEMA 2005b).

Source: FEMA 2005a

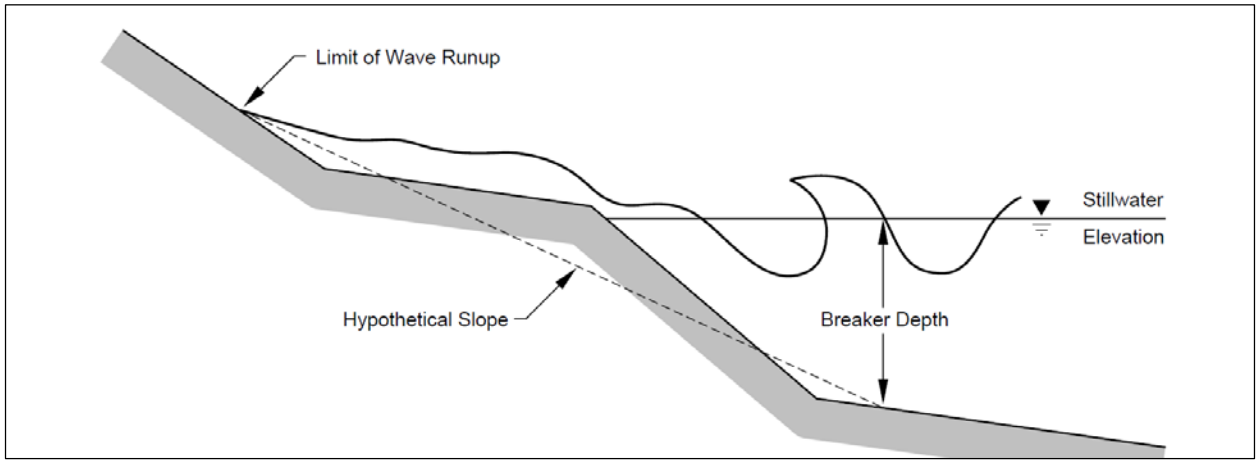



*Figure 6-6. Wave Run-Up*

A summary of wave run-up and setup information for relevant Pacific Ocean beach areas in Los Angeles County is provided in Table 6-4 and Table 6-5.

**TABLE 6-4.**
**SUMMARY OF ELEVATIONS FOR WAVE RUN-UP IN THE COUNTY OF LOS ANGELES**

| | Wave Run-Up Elevation (feet) | | |
|---|---|---|---|
| | 10-Percent Annual Chance | 1-Percent Annual Chance | 0.2-Percent Annual Chance |
| At Will Rogers Beach, approximately 400 feet south of the Intersection of Tramonto Drive and Porto Marina Way | 14.3 | 19 | 22.1 |
| At Will Rogers Beach, Approximately 300 feet South of the Intersection of Breve Way and Porta Marina Way | 13.4 | 17.5 | 20.4 |
| At Will Rogers Beach, at Sunset Boulevard Extended | 11.3 | 13.9 | 16.5 |
| At Will Rogers Beach at Temescal Canyon Road Extended | 10.9 | 13.3 | 15.8 |
| At Will Rogers Beach, Approximately 900 feet South of the Intersection of Beirut Avenue and Via De Las Olas | 11 | 13.5 | 16 |
| At Will Rogers Beach at Entrada Drive Extended | 12 | 15.1 | 17.8 |
| At Venice Beach at Washington Street Extended | 12 | 15.1 | 17.8 |
| At Dockweiler Beach, at Culver Boulevard Extended | 11.3 | 14 | 16.6 |
| At Dockweiler Beach, at Beaumont Street Extended | 11.9 | 14.9 | 17.6 |
| At Dockweiler Beach, at Foutainbleau Street Extended | 12.5 | 15.9 | 18.7 |
| At Dockweiler Beach, at Ipswich Street Extended | 13.7 | 18 | 21 |
| At Dockweiler Beach, Approximately 900 feet Northwest of the Intersection of Imperial Highway and Vista Del Mar | 13.1 | 17.1 | 19.9 |
| At Dockweiler Beach, Approximately 5,000 feet Northwest of the Corporate Limits | 12.8 | 16.1 | 18.9 |
| At Dockweiler Beach, Approximately 4,100 feet Northwest of the Corporate Limits | 12 | 15.2 | 17.9 |

**TABLE 6-4.**
**SUMMARY OF ELEVATIONS FOR WAVE RUN-UP IN THE COUNTY OF LOS ANGELES**

| | Wave Run-Up Elevation (feet) | | |
|---|---|---|---|
| | 10-Percent Annual Chance | 1-Percent Annual Chance | 0.2-Percent Annual Chance |
| Along Dockweiler Beach, Approximately 3,400 feet Northwest of the Corporate Limits | 11.5 | 14.2 | 16.8 |
| Along Dockweiler Beach, Approximately 2,400 feet Northwest of the Corporate Limits | 10.9 | 13.3 | 15.8 |
| Along Dockweiler Beach, Approximately 1,000 feet Northwest of the Corporate Limits | 11.5 | 14.3 | 16.9 |
| Along Dockweiler Beach, Approximately 100 feet Northwest of the Corporate Limits | 12.1 | 15.3 | 18.1 |
| At Corporate Limits, at Royal Palms Beach, Approximately 1,000 feet Northwest of Shad Place Extended | 14.1 | 18.7 | 21.7 |
| At Royal Palms Beach, at Anchovy Avenue Extended | 12.9 | 16.7 | 19.5 |
| At Whites Point | 12.3 | 15.7 | 18.4 |
| At Beach, at Weymouth Avenue Extended | 13.5 | 17.7 | 20.6 |
| At Point Fermin Beach, at Barbara Street Extended | 12.3 | 15.7 | 18.4 |
| At Point Fermin Beach, at Cabrillo Avenue Extended | 13.8 | 18.2 | 21.2 |
| Approximately 1,000 feet North of Point Fermin along Beach | 17.4 | 24.7 | 28.3 |
| At Beach, at Carolina Street Extended | 16.5 | 22.7 | 26.1 |
| At Beach, at Pacific Avenue Extended | 15.5 | 21 | 24.3 |
| At Cabrillo Beach, at 40th Street Extended | 14.1 | 18.7 | 21.7 |
| Catalina Avenue Extended at Beach | 7.3 | 7.9 | 8.2 |
| Approximately 1,500 feet North of Catalina Avenue Extended along Beach | 8.8 | 10 | 10.7 |
| At Hamilton Beach | 7.9 | 8.8 | 9.2 |
| At Sequit Point | 11.5 | 14.3 | 16.9 |
| At Arroyo Sequit Mouth | 10.7 | 13 | 15.5 |
| Approximately 800 feet East of Arroyo Sequit Mouth along Beach | 11.5 | 14.3 | 17 |
| Approximately 800 feet South of the Intersection of Nicholas Beach Road and Pacific Coast Highway | 12 | 15.2 | 17.8 |
| Approximately 2,400 feet West of Los Alisos Canyon Creek Mouth along Beach | 14.3 | 19 | 22 |
| At Los Alisos Canyon Creek Mouth | 12 | 15.1 | 17.8 |
| Approximately 900 feet Southeast of the Intersection of Encinal Canyon Road and Pacific Coast Highway along Beach | 12.3 | 15.7 | 18.4 |
| At Encinal Canyon Creek Mouth | 12.9 | 16.7 | 19.5 |
| Approximately 250 feet South of the Intersection of Seal Level Drive and Roxanne Beach Road | 10.9 | 13.3 | 15.8 |
| At Lechuza Point | 15.5 | 20.8 | 24.3 |
| At Steep Hill Canyon Creek Mouth | 13.1 | 17 | 19.9 |
| At Trancas Creek | 10.9 | 13.3 | 15.8 |

**TABLE 6-4.**
**SUMMARY OF ELEVATIONS FOR WAVE RUN-UP IN THE COUNTY OF LOS ANGELES**

| | Wave Run-Up Elevation (feet) | | |
|---|---|---|---|
| | 10-Percent Annual Chance | 1-Percent Annual Chance | 0.2-Percent Annual Chance |
| Approximately 200 feet West of Point Dume | 12.4 | 16 | 18.8 |
| At Point Dume | 15.5 | 20.8 | 24.3 |
| At Dume Cove, Approximately 500 feet Southeast of the Intersection of Dume Drive and Cliffside Drive | 13.1 | 16.9 | 19.9 |
| At Dume Cove, Approximately 400 feet South of the Intersection of Fernhill Drive and Cliffside Drive | 12.1 | 15.3 | 18.1 |
| At Dume Cove, Approximately 750 feet South of the Intersection of Grayfox Street and Cliffside Drive | 13.1 | 16.9 | 19.9 |
| At Paradise Cove, at Walnut Canyon | 12.4 | 15.8 | 18.6 |
| At Paradise Cove, Approximately 2,000 feet Northeast of Walnut Canyon Creek Mouth along Beach | 15.8 | 20.8 | 24.3 |
| At Paradise Cove, at Ramirez Canyon Mouth | 11.5 | 14.3 | 16.9 |
| At Escondido Beach, at Escondido Canyon Mouth | 10.7 | 12.9 | 15.5 |
| At Escondido Beach, Approximately 200 feet East of the Intersection of Latigo Shore Place and Latigo Shore Drive | 11.5 | 14.3 | 16.9 |
| Approximately 500 feet West of Solstice Canyon Creek Mouth along Beach | 13.9 | 18.3 | 21.3 |
| At Solstice Canyon Creek Mouth | 12.1 | 15.3 | 18.1 |
| At Corral Beach, at Corral Canyon Creek Mouth | 11.3 | 13.9 | 16.4 |
| At Corral Beach, Approximately 250 feet South of the Intersection of Malibu Road and Pacific Coast Highway | 13 | 16.9 | 19.6 |
| Approximately 1,500 feet East of Corral Canyon Creek Mouth along Beach | 13 | 16.9 | 19.6 |
| At Puerco Beach, Approximately 200 feet South of the Intersection of Puerco Canyon Road and Malibu Road | 11.3 | 13.9 | 16.4 |
| At Puerco Beach, at Puerco Canyon Creek Mouth | 13 | 16.9 | 19.6 |
| At Amarillo Beach, Approximately 2,200 feet East of Marie Canyon Creek Mouth along Beach | 11.3 | 13.9 | 16.4 |
| At Amarillo Beach, Approximately 3,000 feet East of Marie Canyon Creek Mouth Along Beach | 13 | 16.9 | 19.6 |
| At Malibu Beach, Approximately 850 feet Southwest of Intersection of Malibu Road and Malibu Colony Drive | 11.3 | 13.9 | 16.4 |
| At Malibu Creek Mouth | 10.6 | 12.8 | 15.2 |
| At Las Flores Canyon Mouth | 11.3 | 13.9 | 16.4 |
| Approximately 2,500 feet East of Las Flores Canyon Mouth along Beach | 11.6 | 14.5 | 17.1 |
| Approximately 1,500 feet West of Piedra Gorda Canyon Creek Mouth Along Beach | 11.4 | 14.2 | 16.8 |
| Approximately 100 feet South of the Intersection of Budwood Motorway and Pacific Coast Highway | 11.9 | 14.9 | 17.6 |
| At Topanga Canyon Mouth | 11.4 | 14.1 | 16.7 |

**TABLE 6-5.**
**SUMMARY OF ELEVATIONS FOR WAVE SETUP IN THE COUNTY OF LOS ANGELES**

| | Wave Setup Elevation (feet) | | |
|---|---|---|---|
| | 10-Percent Annual Chance | 1-Percent Annual Chance | 0.2-Percent Annual Chance |
| At Marina Del Ray Entrance Channel and Ballona Creek | 7.7 | 8.9 | 11.1 |
| At Los Angeles Harbor | 7.7 | 8.9 | 11.1 |
| At Malibu Creek Mouth | 7.7 | 8.9 | 11.1 |
| At Marina Del Ray | 7.7 | 8.9 | 11.1 |

## 6.9 WARNING TIME

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

Each watershed has unique qualities that affect its response to rainfall. A hydrograph, which is a graph or chart illustrating stream flow in relation to time, is a useful tool for examining a stream's response to rainfall. Once rainfall starts falling over a watershed, runoff begins and the stream begins to rise. Water depth in the stream channel (stage of flow) will continue to rise in response to runoff even after rainfall ends. Eventually, the runoff will reach a peak and the stage of flow will crest. It is at this point that the stream stage will remain the most stable, exhibiting little change over time until it begins to fall and eventually subside to a level below flooding stage.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first measurable rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time to the time that a community has to take actions to protect lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage.

The Los Angeles County flood threat system consists of a network of precipitation gages throughout the watershed and stream gages at strategic locations in the county that constantly monitor and report stream levels. This information is fed into a U.S. Geological Survey forecasting program, which assesses the flood threat based on the amount of flow in the stream (measured in cubic feet per second). In addition to this program, data and flood warning information is provided by the National Weather Service (NWS). All of this information is analyzed to evaluate the flood threat and possible evacuation needs. Los Angeles County is responsible for dissemination of flood warnings to all municipalities within the County. Figure 6-7 shows stream gage locations for Los Angeles County, as provided in the 2012-2013 Hydrologic Report.

Figure 6-8 is a typical hydrograph for major waterways in Los Angeles County. The hydrograph provides real-time data with action levels, minor, moderate, and major flood stages in relation to current river heights.

Source: Los Angeles County Hydrologic Report, 2013-2014

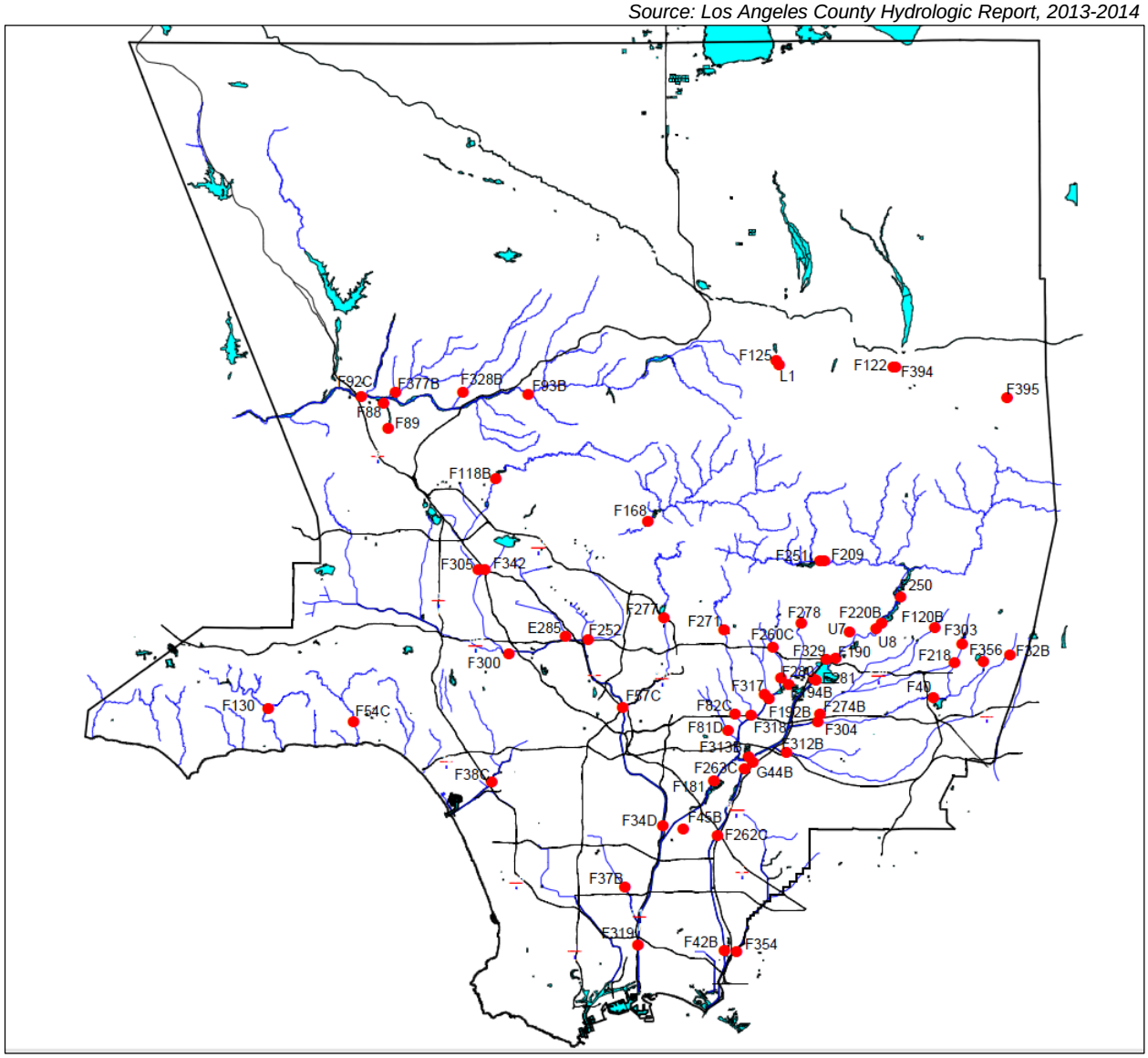



*Figure 6-7. Stream Gage Locations in Los Angeles County*

Source: Los Angeles County Hydrologic Report, 2012-2013

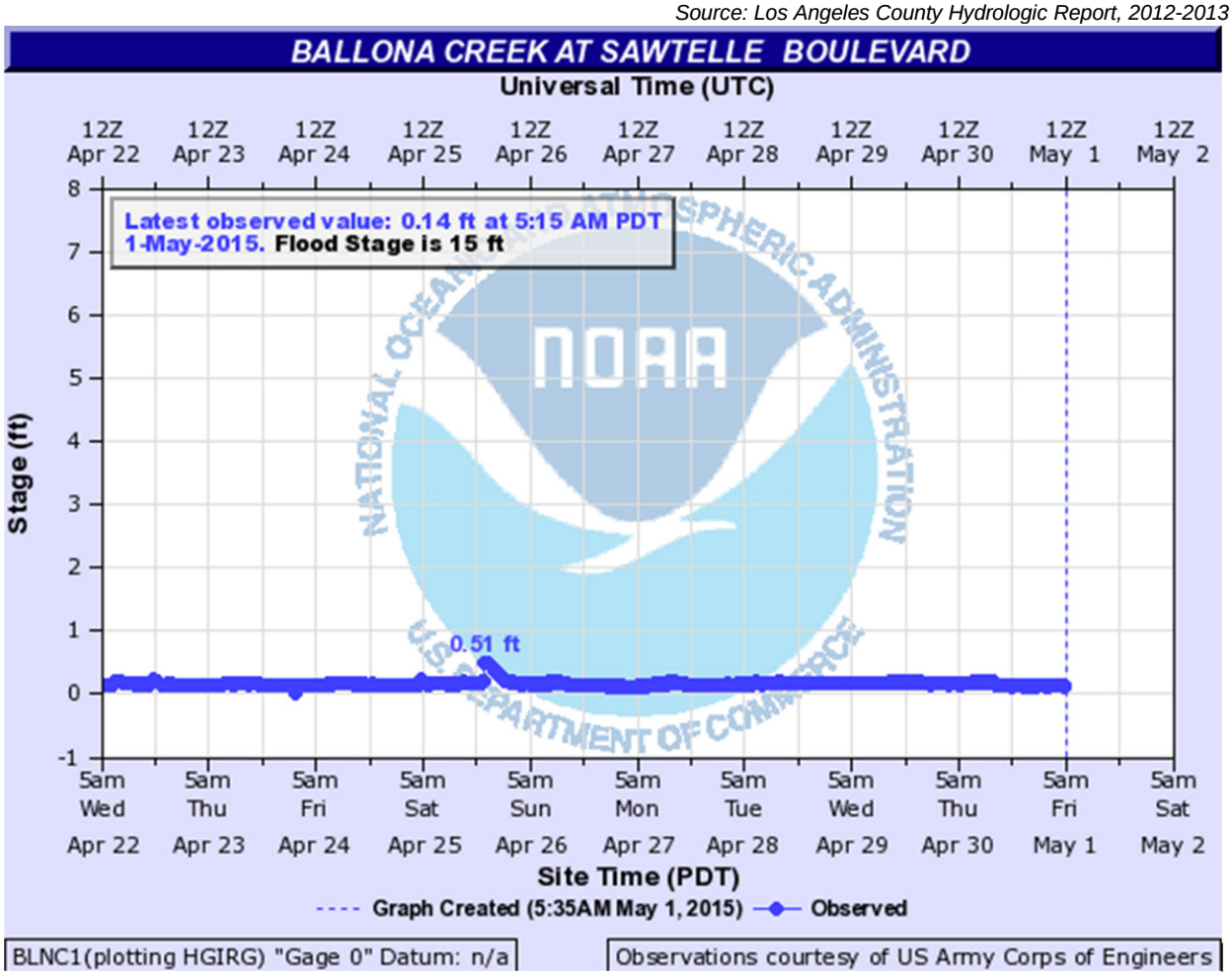



*Figure 6-8. Ballona Creek Hydrograph at Sawtelle Boulevard*

The NWS issues watches and warnings as follows when forecasts indicate rivers may approach bank-full levels:

- Minor Flooding—Minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding—Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding—Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS, 2011).

When a watch is issued, the public should prepare for the possibility of a flood. When a warning is issued, the public is advised to stay tuned to a local radio station for further information and be prepared to take quick action if needed. A warning means a flood is imminent, generally within 12 hours, or is occurring. Local media broadcast NWS warnings.

Thresholds for flood warnings have been established on the major rivers within Los Angeles County as follows:

- Los Angeles River—Forecasted river stage of 13.9 feet or higher at the gage near Tujunga Avenue
- Ballona Creek—Forecasted river stage of 15 feet or higher at the gage near Sawtelle Boulevard.

## 6.10 LOS ANGELES COUNTY DRAINAGE AREA PROJECT

In 1915, the State Legislature created the Los Angeles County Flood Control District to control floods and conserve water. Early bond issues financed construction of 14 dams in the San Gabriel Mountain, flood channel modifications, and construction of debris basins to trap sediment. In 1936, federal legislation made the Army Corps a participant in Los Angeles County's flood protection program. The Army Corps' Los Angeles River, San Gabriel River and Ballona Creek projects included the construction of five flood storage reservoirs or basins, 24 debris basins, 95 miles of main channels, 191 miles of tributary channels and two jetties. This regional flood control system is described in the Los Angeles County Drainage Area (LACDA) study. It includes the Los Angeles River, San Gabriel River, Rio Hondo Channel and Ballona Creek. Flood control facilities in the LACDA system fall into four general categories:

- Debris basins, found at the mouth of canyons, trap debris carried by floodwaters, leaving relatively clean water to flow unimpeded in downstream channels.
- Flood control reservoirs control and reduce stream flow so that downstream main channel capacities are not exceeded. The Army Corps operates five major reservoirs:
  - Hansen Dam—25,446 acre-feet
  - Lopez Dam—441 acre-feet
  - Santa Fe Dam—30,887 acre-feet
  - Sepulveda Dam—17,425 acre-feet
  - Whittier Narrows Dam—34,947 acre-feet

  Locally operated facilities include 15 flood control and water supply reservoirs in the upper watershed areas of the LACDA basin. Combined, these local reservoirs have a maximum combined capacity of 109,146 acre-feet. The City of Los Angeles has built recreational facilities at the Hansen Dam and Sepulveda Dam (including golf courses, riding and hiking trails, picnic etc.)
- Improved channels speed the passage of flood flows through local communities and into the main stem river system. Improved tributary channels include Arroyo Seco and Compton Creek.
- Main channel improvements pass the controlled or partially controlled flows to the ocean. The Los Angeles River is improved the majority of the reach below Sepulveda Dam; its sides and bottom are generally lined with concrete or grouted rock. Sepulveda and Hansen Dams regulate flows to the main channel of the Los Angeles River.

In total, the LACDA system has over 100 miles of main stem channel, over 370 miles of tributary channels, 129 debris basins, 15 flood control and water conservation dams, and five flood control dams.

## 6.11 SECONDARY HAZARDS

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides

when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers. Potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

## 6.12 FUTURE TRENDS

The County of Los Angeles has established a commitment to mitigating natural hazards and improving community resilience to hazards, in order to protect life and property and preserve natural systems. The County links hazard mitigation to County of Los Angeles 2035 General Plan development goals to ensure that the County's continued development is managed as sustainably and efficiently as possible (Los Angeles County, 2014b). The General Plan identifies goals and initiatives for natural hazard planning, including, but not limited to, the following (Los Angeles County, 2015):

- Goal LU 3: A development pattern that discourages sprawl, and protects and conserves areas with natural resources and significant ecological areas.
- Goal LU 5: Vibrant, livable, and healthy communities with a mix of land uses, services, and amenities.
- Goal LU 7: Compatible land uses that complement neighborhood character and the natural environment.
- Goal M 7: Transportation networks that minimize negative impacts to the environment and communities.
  - Policy M 7.1: Minimize roadway runoff through the use of permeable surface materials, and other low impact designs, wherever feasible.
- Goal C/NR 3: Permanent, sustainable preservation of genetically and physically diverse biological resources and ecological systems including: habitat linkages, forests, coastal zone, riparian habitats, streambeds, wetlands, woodlands, alpine habitat, chaparral, shrublands, and significant ecological areas.
- Goal S 2: An effective regulatory system that prevents or minimizes personal injury, loss of life, and property damage due to flood and inundation hazards.

The County has several other plans and initiatives designed to promote healthy watersheds, maintain coastal zones, and manage stormwater. These plan components strive to steer future trends in development away from increasing flood risks in Los Angeles County's unincorporated areas. Additionally, Los Angeles County participates in both the NFIP and CRS programs (Class 7). It has adopted flood damage prevention regulations in response to those requirements. The County is committed to maintaining its good standing under the NFIP through initiatives identified in this plan.

The County forecasts that the unincorporated areas will continue to see substantial population growth, with a projected population of 1,399,500 by 2035 (Los Angeles County, 2015). This is a 33 percent increase from the 2008 population of 1,052,800. As the County targets increased local industry and businesses, new houses, and other opportunities, it will do so in a way that carefully regulates development and redevelopment in critical and flood-prone areas. The cumulative implementation of these plans and regulations will reduce the impacts of future growth in the floodplains and high-risk unincorporated areas of Los Angeles County, and will lessen the impacts of flooding on future development.

## 6.13 SCENARIO

The primary water courses in the planning area have the potential to flood at regular intervals (disaster declarations for flooding have been issued an average of once every 3.5 years), generally in response to a succession of intense winter rainstorms or other seasonal short-duration, high-intensity storms. Storm patterns of warm, moist air usually occur between early November and late March. A series of such weather events can cause severe flooding in the planning area. The worst-case scenario is a series of storms that flood numerous drainage basins in a short time or that lead to coastal flooding in addition to riverine or flash flooding. This could overwhelm response and floodplain management capabilities within the planning area. Major roads could be blocked, preventing critical access for many residents and critical functions. High in-channel flows could cause water courses to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, Los Angeles County would not be able to make repairs quickly enough to restore critical facilities and infrastructure. The floodplains mapped and identified by Los Angeles County will continue to take the brunt of these floods. Additionally, as the ground becomes saturated, groundwater flooding typical of the planning area would be significant.

## 6.14 ISSUES

Important issues associated with flood hazards in the planning area include but are not limited to the following issues identified by the Steering Committee:

- There needs to be a sustained effort to gather historical damage data, such as high water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects.
- Some County codes, such as the Subdivision, Health and Safety – Water Hazards, and Flood Control District Property and Facilities ordinances, are old and in need of review or updating.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- Existing floodplain-compatible uses such as agricultural and open space need to be maintained. There is constant pressure to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards in the county.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The potential impact of climate change on flood conditions needs to be better understood.
- The capability for prediction forecast modeling needs to be enhanced.
- Flood warning capability should be tied to flood phases.
- There needs to be enhanced modeling to better understand the true flood risk.
- Floodplain restoration/reconnection opportunities should be identified as a means to reduce flood risk.
- Post-flood disaster response and recovery actions need to be solidified.
- Staff capacity is required to maintain the existing level of floodplain management.
- Floodplain management actions require interagency coordination.

- The approximate mapping on FEMA's current effective Flood Insurance Rate Maps has been found to have significant inaccuracies.
- The increasing cost of flood insurance is shifting the public's perception of flood risk.
- Certification/accreditation of levees is inconsistent within the planning area.
- The stormwater/urban drainage flooding risk has not been mapped, which makes it difficult to assess this hazard, other than looking at historical loss data.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards across Los Angeles County.
- A lack of concern about flood risk by property owners can translate to a lack of political will to make changes.
- With a large percentage of pre-FIRM flood insurance policies in force, the County can expect to see significant increases in the costs of flood insurance. This will create challenges in the promotion of flood insurance.

# CHAPTER 7.
# FLOOD HAZARD EXPOSURE

The Level 2 (user-defined) Hazus-MH protocol was used to assess exposure to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, which has a level of accuracy acceptable for planning purposes. The Hazus-MH default data was enhanced using local GIS data from local, state and federal sources.

## 7.1 POPULATION

Population counts of those living in the 10-, 50-, 100- and 500-year floodplains were generated by analyzing structures in the floodplain. The total planning area population from the 2010 Census was multiplied by the ratio of the number of structures in the 100-year floodplain to the total number of structures. Using this approach, the populations in each floodplain were estimated as follows:

- 10-year floodplain— 280 (less than 1 percent of the planning area population)
- 50-year floodplain—460 (less than 1 percent of the planning area population)
- 100-year floodplain—5,677 (Less that 1 percent of the planning area population)
- 500-year floodplain—46,353 (4.5 percent of the planning area population).
- County Floodway— 3,201 (less than 1 percent of the planning area population).

## 7.2 PROPERTY

### 7.2.1 Structures in the Floodplain

Table 7-1 and Table 7-2 summarize the total area and number of structures in the 100-year and 500-year floodplains by watershed.

The Hazus-MH modeling identified 64 structures within the 10-year floodplain, 84 percent of them residential:

- 2 in the Big Sycamore Canyon-Frontal Santa Monica Bay Watershed
- 36 in the Garapito Creek-Frontal Santa Monica Bay Watershed
- 26 in the Malibu Creek Watershed.

The modeling identified 110 structures within the 50-year floodplain, 82 percent of them residential:

- 1 in the Amargosa Creek Watershed
- 2 in the Big Sycamore Canyon-Frontal Santa Monica Bay Watershed
- 2 in the Big Tujunga Creek Watershed
- 54 in the Garapito Creek-Frontal Santa Monica Bay Watershed
- 51 in the Malibu Creek Watershed.

**TABLE 7-1.**
**AREA AND STRUCTURES WITHIN THE 100-YEAR FLOODPLAIN BY WATERSHED**

| | | Number of Structures | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Area (acres) | Residential | Commercial | Industrial | Agriculture | Religion | Government | Education | **Total** |
| Amargosa Creek | 7,396 | 44 | 11 | 0 | 1 | 0 | 1 | 0 | **57** |
| Ballona Creek | 36.58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 5,522 | 18 | 10 | 0 | 1 | 0 | 1 | 1 | **31** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 78 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | **5** |
| Big Tujunga Creek | 80.61 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | **20** |
| Bouquet Canyon | 1,160 | 30 | 3 | 0 | 0 | 1 | 0 | 0 | **34** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 5,300 | 150 | 18 | 1 | 1 | 6 | 5 | 0 | **181** |
| Chino Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dominguez Channel | 0.62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Garapito Creek-Frontal Santa Monica Bay | 582.4 | 97 | 5 | 4 | 0 | 1 | 0 | 0 | **107** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 3,810.79 | 289 | 63 | 0 | 3 | 5 | 5 | 1 | **366** |
| Lake Palmdale-Piute Ponds | 2,467 | 8 | 0 | 0 | 6 | 0 | 0 | 0 | **14** |
| Le Montaine Creek-Eller Slough | 1,226.6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **1** |
| Little Rock Wash | 4,383.4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | **2** |
| Lower Los Angeles River | 68.71 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | **1** |
| Lower Piru Creek | 109.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 705.53 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | **43** |
| Malibu Creek | 843.45 | 57 | 14 | 0 | 0 | 1 | 1 | 0 | **73** |
| Mescal Creek-Rocky Buttes | 8,068.3 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | **84** |
| Rio Hondo | 227.82 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| Rock Creek-Buckhorn Lake | 15,845 | 83 | 3 | 0 | 6 | 0 | 0 | 0 | **92** |
| Rogers Lake | 199.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 10,558 | 93 | 1 | 0 | 10 | 1 | 0 | 0 | **105** |
| Sacatara Creek-Kings Canyon | 5,190 | 48 | 1 | 0 | 15 | 0 | 0 | 0 | **64** |
| San Jose Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 9,084 | 50 | 4 | 2 | 16 | 0 | 0 | 0 | **72** |
| Upper Los Angeles River | 25.41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 2,390.5 | 2 | 5 | 0 | 3 | 0 | 0 | 0 | **10** |
| Upper San Gabriel River | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 2,804.7 | 371 | 19 | 0 | 2 | 2 | 2 | 0 | **396** |
| West Fork San Gabriel River | 2.10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **88,166.54** | **1491** | **158** | **8** | **64** | **18** | **18** | **2** | **1759** |

**TABLE 7-2.**
**AREA AND STRUCTURES WITHIN THE 500-YEAR FLOODPLAIN BY WATERSHED**

| | | Number of Structures | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Area (acres) | Residential | Commercial | Industrial | Agriculture | Religion | Government | Education | **Total** |
| Amargosa Creek | 15,345.13 | 1,385 | 74 | 9 | 3 | 7 | 7 | 0 | **1,485** |
| Ballona Creek | 37.04 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 5,521.97 | 18 | 10 | 0 | 1 | 0 | 1 | 1 | **31** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 78.79 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | **5** |
| Big Tujunga Creek | 88.96 | 30 | 1 | 0 | 0 | 1 | 0 | 0 | **32** |
| Bouquet Canyon | 1,159.94 | 30 | 3 | 0 | 0 | 1 | 0 | 0 | **34** |
| Calleguas Creek | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 5,502.75 | 601 | 25 | 1 | 1 | 7 | 5 | 0 | **640** |
| Chino Creek | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 94.66 | 465 | 0 | 0 | 0 | 0 | 0 | 0 | **465** |
| Cottonwood Creek-Tylerhorse Canyon | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 26.80 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | **7** |
| Dominguez Channel | 109.54 | 100 | 22 | 12 | 0 | 0 | 0 | 0 | **134** |
| Frontal Santa Monica Bay-San Pedro Bay | 139.13 | 23 | 18 | 22 | 0 | 0 | 1 | 0 | **64** |
| Garapito Creek-Frontal Santa Monica Bay | 719.70 | 102 | 5 | 4 | 0 | 1 | 1 | 0 | **113** |
| Grapevine Creek | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 3,810.79 | 289 | 63 | 0 | 3 | 5 | 5 | 1 | **366** |
| Lake Palmdale-Piute Ponds | 11,830.64 | 47 | 10 | 5 | 6 | 2 | 4 | 0 | **74** |
| Le Montaine Creek-Eller Slough | 1,226.60 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **1** |
| Little Rock Wash | 6,532.20 | 1,012 | 35 | 1 | 10 | 5 | 7 | 0 | **1,070** |
| Lower Los Angeles River | 1,343.05 | 2,467 | 258 | 116 | 1 | 17 | 4 | 0 | **2,863** |
| Lower Piru Creek | 109.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 1,546.06 | 2,533 | 25 | 4 | 0 | 18 | 3 | 11 | **2,594** |
| Malibu Creek | 865.13 | 75 | 14 | 0 | 0 | 1 | 1 | 0 | **91** |
| Mescal Creek-Rocky Buttes | 8,068.31 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | **84** |
| Rio Hondo | 234.06 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| Rock Creek-Buckhorn Lake | 15,844.49 | 83 | 3 | 0 | 6 | 0 | 0 | 0 | **92** |
| Rogers Lake | 199.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 14,697.46 | 167 | 1 | 0 | 11 | 1 | 1 | 0 | **181** |
| Sacatara Creek-Kings Canyon | 13,061.80 | 72 | 5 | 0 | 17 | 0 | 0 | 0 | **94** |
| San Jose Creek | 24.04 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | **50** |
| San Nicholas Island-Santa Catalina Island | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 13,180.40 | 451 | 9 | 2 | 17 | 11 | 0 | 0 | **490** |
| Upper Los Angeles River | 25.84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 2,406.59 | 4 | 6 | 0 | 3 | 0 | 0 | 0 | **13** |
| Upper San Gabriel River | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 2,930.37 | 577 | 22 | 1 | 2 | 2 | 3 | 0 | **607** |
| West Fork San Gabriel River | 2.10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **126,763.38** | **10,678** | **609** | **177** | **81** | **79** | **44** | **13** | **11,681** |

The modeling identified 947 structures within the County floodways, 83 percent of them residential:

- 7 in the Big Tujunga Creek Watershed
- 183 in the Bouquet Canyon Watershed
- 158 in the Castaic Creek Watershed
- 11 in the Garapito Creek-Frontal Santa Monica Bay Watershed
- 344 in the Headwaters of Santa Clara River Watershed
- 70 in the Malibu Creek Watershed
- 19 in the Rio Hondo Watershed
- 2 in the Upper Los Angeles River Watershed
- 171 in the Upper Santa Clara River Watershed.

### 7.2.2 Exposed Value

The Hazus analysis estimated $48.3 million of building-and-contents exposure to the 10-year flood, and $99.8 million of building-and-contents exposure to the 50-year flood, both representing less than 1 percent of the total replacement cost of the planning area. The analysis estimated $1.142 billion of building-and-contents exposure within the County-mapped floodways. This too represents less than 1 percent of the of the total replacement cost of the planning area.

Table 7-3 and Table 7-4 summarize the estimated value of exposed buildings in the 100-year and 500-year floodplains by watershed. The analysis estimated $1.23 billion of building-and-contents exposure to the 100-year flood, representing 0.89 percent of the total replacement cost of the planning area, and $9.48 billion of building and contents exposure to the 500-year flood, representing 6.88 percent of the total replacement cost value of the planning area.

### 7.2.3 Land Use in the Floodplain

Some land uses are more vulnerable to flooding, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. Table 7-5 shows the present land use of all parcels in the 100-year and 500-year floodplains within the planning area based on County Assessor data, including vacant parcels and parcels in public/open space uses. About 86.6 percent of the parcels in the 100-year floodplain are classified as either vacant or uncategorized.

**TABLE 7-3.**
**VALUE OF BUILDINGS WITHIN 100-YEAR FLOODPLAIN BY WATERSHED**

| | Estimated Flood Exposure[a] | | | % of Total Replacement Value |
|---|---|---|---|---|
| | Structure | Contents | **Total** | |
| Amargosa Creek | $31,287,003 | $26,341,832 | **$57,628,835** | 1.49% |
| Ballona Creek | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | $38,489,145 | $36,658,719 | **$75,147,864** | 11.98% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | $991,246 | $495,623 | **$1,486,868** | 0.11% |
| Big Tujunga Creek | $6,422,059 | $5,361,601 | **$11,783,660** | 3.61% |
| Bouquet Canyon | $8,473,272 | $5,083,704 | **$13,556,976** | 1.62% |
| Calleguas Creek | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | $91,175,837 | $76,224,991 | **$167,400,828** | 2.63% |
| Chino Creek | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | $0 | $0 | **$0** | 0.00% |
| Cottonwood Creek-Tylerhorse Canyon | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | $0 | $0 | **$0** | 0.00% |
| Dominguez Channel | $0 | $0 | **$0** | 0.00% |
| Frontal Santa Monica Bay-San Pedro Bay | $0 | $0 | **$0** | 0.00% |
| Garapito Creek-Frontal Santa Monica Bay | $24,394,750 | $14,833,171 | **$39,227,921** | 2.04% |
| Grapevine Creek | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | $147,018,457 | $116,725,123 | **$263,743,580** | 8.04% |
| Lake Palmdale-Piute Ponds | $12,837,401 | $12,014,994 | **$24,852,394** | 2.87% |
| Le Montaine Creek-Eller Slough | $35,293 | $17,646 | **$52,939** | 0.10% |
| Little Rock Wash | $3,140,478 | $3,140,478 | **$6,280,956** | 0.67% |
| Lower Los Angeles River | $9,952,605 | $14,928,908 | **$24,881,513** | 0.09% |
| Lower Piru Creek | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | $7,262,058 | $3,631,029 | **$10,893,086** | 0.09% |
| Malibu Creek | $45,244,651 | $34,175,359 | **$79,420,010** | 3.04% |
| Mescal Creek-Rocky Buttes | $12,528,051 | $6,264,025 | **$18,792,076** | 1.16% |
| Rio Hondo | $1,616,423 | $1,616,423 | **$3,232,845** | 0.03% |
| Rock Creek-Buckhorn Lake | $14,994,990 | $9,786,446 | **$24,781,436** | 32.55% |
| Rogers Lake | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | $34,473,781 | $25,302,104 | **$59,775,885** | 17.96% |
| Sacatara Creek-Kings Canyon | $42,497,186 | $39,020,957 | **$81,518,142** | 14.26% |
| San Jose Creek | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | $28,917,807 | $24,116,993 | **$53,034,800** | 4.21% |
| Upper Los Angeles River | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | $27,348,048 | $27,128,247 | **$54,476,295** | 18.98% |
| Upper San Gabriel River | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | $94,432,998 | $63,196,965 | **$157,629,962** | 2.24% |
| West Fork San Gabriel River | $0 | $0 | **$0** | 0.00% |
| **Total** | **$683,533,539** | **$546,065,338** | **$1,229,598,871** | **0.89%** |

a. Exposure estimates from Hazus analysis

**TABLE 7-4.**
**VALUE OF BUILDINGS WITHIN 500-YEAR FLOODPLAIN BY WATERSHED**

| | Estimated Flood Exposure[a] | | | % of Total Replacement Value |
|---|---|---|---|---|
| | Structure | Contents | **Total** | |
| Amargosa Creek | $448,537,643 | $261,752,082 | **$710,289,724** | 18.35% |
| Ballona Creek | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | $38,489,145 | $36,658,719 | **$75,147,864** | 11.98% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | $991,246 | $495,623 | **$1,486,868** | 0.11% |
| Big Tujunga Creek | $7,595,195 | $5,948,169 | **$13,543,364** | 4.15% |
| Bouquet Canyon | $8,473,272 | $5,083,704 | **$13,556,976** | 1.62% |
| Calleguas Creek | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | $217,493,985 | $156,182,323 | **$373,676,307** | 5.88% |
| Chino Creek | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | $80,809,856 | $40,404,928 | **$121,214,784** | 100.00% |
| Cottonwood Creek-Tylerhorse Canyon | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | $2,480,323 | $1,240,162 | **$3,720,485** | 0.10% |
| Dominguez Channel | $214,093,414 | $260,794,975 | **$474,888,389** | 3.00% |
| Frontal Santa Monica Bay-San Pedro Bay | $253,744,784 | $283,032,799 | **$536,777,583** | 16.96% |
| Garapito Creek-Frontal Santa Monica Bay | $26,854,420 | $16,886,612 | **$43,741,032** | 2.27% |
| Grapevine Creek | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | $147,018,457 | $116,725,123 | **$263,743,580** | 8.04% |
| Lake Palmdale-Piute Ponds | $82,630,399 | $82,834,071 | **$165,464,470** | 19.14% |
| Le Montaine Creek-Eller Slough | $35,293 | $17,646 | **$52,939** | 0.10% |
| Little Rock Wash | $245,765,548 | $151,648,890 | **$397,414,438** | 42.69% |
| Lower Los Angeles River | $1,939,677,098 | $2,123,860,472 | **$4,063,537,570** | 14.69% |
| Lower Piru Creek | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | $763,023,830 | $551,856,793 | **$1,314,880,624** | 10.74% |
| Malibu Creek | $53,709,710 | $38,407,889 | **$92,117,599** | 3.52% |
| Mescal Creek-Rocky Buttes | $12,528,051 | $6,264,025 | **$18,792,076** | 1.16% |
| Rio Hondo | $1,616,423 | $1,616,423 | **$3,232,845** | 0.03% |
| Rock Creek-Buckhorn Lake | $14,994,990 | $9,786,446 | **$24,781,436** | 32.55% |
| Rogers Lake | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | $55,841,933 | $36,804,789 | **$92,646,722** | 27.84% |
| Sacatara Creek-Kings Canyon | $77,049,868 | $71,223,684 | **$148,273,552** | 25.93% |
| San Jose Creek | $12,002,577 | $6,001,289 | **$18,003,866** | 0.09% |
| San Nicholas Island-Santa Catalina Island | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | $121,866,269 | $78,686,319 | **$200,552,588** | 15.91% |
| Upper Los Angeles River | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | $35,501,341 | $31,707,322 | **$67,208,664** | 23.42% |
| Upper San Gabriel River | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | $140,177,092 | $97,091,445 | **$237,268,537** | 3.36% |
| West Fork San Gabriel River | $0 | $0 | **$0** | 0.00% |
| **Total** | **$5,003,002,162** | **$4,473,012,722** | **$9,476,014,882** | **6.88%** |

a. Exposure estimates from Hazus analysis

**TABLE 7-5.**
**PRESENT LAND USE WITHIN THE FLOODPLAIN**

| Land Use | 100-Year Floodplain Area (acres) | 100-Year Floodplain % of Total Area | 500-Year Floodplain Area (acres) | 500-Year Floodplain % of Total Area |
|---|---|---|---|---|
| Agriculture | 2,015.73 | 2.4% | 2,117.06 | 1.7% |
| Commercial | 1,529.72 | 1.8% | 2,828.79 | 2.3% |
| Education | 79.00 | 0.1% | 140.82 | 0.1% |
| Government Services | 2,644.76 | 3.1% | 3,016.95 | 2.4% |
| Industrial/Manufacturing | 131.94 | 0.2% | 430.37 | 0.3% |
| Religion/Membership Organizations | 103.90 | 0.1% | 162.04 | 0.1% |
| Residential | 4,951.10 | 5.8% | 10,215.68 | 8.3% |
| Vacant | 65,865.69 | 76.9% | 90,862.00 | 73.6% |
| Uncategorized (includes water features, open space) | 8,330.35 | 9.7% | 13,599.89 | 11.0% |
| **Total** | **85,652.17** | **100.0%** | **123,373.60** | **100.0%** |

Source: Summarized from Los Angeles County parcel data. Acreage covers only mapped parcels and thus excludes many rights of way.

## 7.3 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities must remain operable during flood events to maintain essential services. Critical facilities and infrastructure in the 100-year and 500-year floodplains of the planning area are summarized in Table 7-6 through Table 7-9. Three transportation facilities were identified in the 10-year floodplain in the Malibu Creek watershed. Nine critical infrastructure features (one wastewater and eight bridges) are located in the 50-year floodplain. The wastewater facility and six of the bridges are in the Malibu Creek watershed. The two other bridges are in the Garapito Creek-Frontal Santa Monica Bay watershed.

### 7.3.1 Hazardous Materials Facilities

Hazardous materials facilities are those that use or store materials that can harm the environment if damaged by a flood. During a flood event, containers holding these materials can rupture and leak into the surrounding area, having a disastrous effect on the environment as well as residents. Thirty-seven businesses in the 500-year floodplain in the planning area report having hazardous materials under the Environmental Protection Agency's Toxic Release Inventory program. No facilities were identified in the 10-, 50- or 100-year floodplains.

### 7.3.2 Utilities and Infrastructure

Populations can be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and prevent access, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Dikes can fail or be overtopped, inundating the land that they protect. The following sections describe exposure of specific types of critical infrastructure.

**TABLE 7-6.**
**CRITICAL FACILITIES IN THE 100-YEAR FLOODPLAIN**

| Watershed | Medical & Health Services | Government Function | Protective Function | Schools | Hazardous Materials | **Total** |
|---|---|---|---|---|---|---|
| Amargosa Creek | 0 | 0 | 0 | 2 | 0 | **2** |
| Ballona Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Tujunga Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Bouquet Canyon | 0 | 0 | 0 | 0 | 0 | **0** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Chino Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Dominguez Channel | 0 | 0 | 0 | 0 | 0 | **0** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 0 | 0 | 0 | 0 | **0** |
| Garapito Creek-Frontal Santa Monica Bay | 0 | 0 | 0 | 2 | 0 | **2** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 0 | 0 | 1 | 1 | 0 | **2** |
| Lake Palmdale-Piute Ponds | 0 | 0 | 0 | 0 | 0 | **0** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 0 | **0** |
| Little Rock Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower Los Angeles River | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| Malibu Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 0 | 0 | 0 | **0** |
| Rio Hondo | 0 | 0 | 0 | 0 | 0 | **0** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Sacatara Creek-Kings Canyon | 0 | 0 | 0 | 1 | 0 | **1** |
| San Jose Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Los Angeles River | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 1 | 0 | 0 | 1 | 0 | **2** |
| West Fork San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **1** | **0** | **1** | **7** | **0** | **9** |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 7-7.**
**CRITICAL FACILITIES IN THE 500-YEAR FLOODPLAIN**

| Watershed | Medical & Health Services | Government Function | Protective Function | Schools | Hazardous Materials | **Total** |
|---|---|---|---|---|---|---|
| Amargosa Creek | 0 | 0 | 2 | 3 | 0 | **5** |
| Ballona Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Tujunga Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Bouquet Canyon | 0 | 0 | 0 | 0 | 0 | **0** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 0 | 0 | 0 | 1 | 0 | **1** |
| Chino Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 0 | **0** |
| Dominguez Channel | 0 | 0 | 0 | 0 | 7 | **7** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 0 | 1 | 0 | 2 | **3** |
| Garapito Creek-Frontal Santa Monica Bay | 0 | 0 | 0 | 2 | 0 | **2** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 0 | 0 | 1 | 1 | 0 | **2** |
| Lake Palmdale-Piute Ponds | 0 | 0 | 0 | 0 | 0 | **0** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 0 | **0** |
| Little Rock Wash | 0 | 0 | 0 | 1 | 0 | **1** |
| Lower Los Angeles River | 0 | 0 | 0 | 16 | 28 | **44** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| Malibu Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 0 | 0 | 0 | **0** |
| Rio Hondo | 0 | 0 | 0 | 0 | 0 | **0** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Sacatara Creek-Kings Canyon | 0 | 0 | 0 | 1 | 0 | **1** |
| San Jose Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 0 | 0 | 0 | 2 | 0 | **2** |
| Upper Los Angeles River | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper San Gabriel River | 0 | 0 | 0 | 1 | 0 | **1** |
| Upper Santa Clara River | 1 | 0 | 1 | 0 | 0 | **2** |
| West Fork San Gabriel River | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **1** | **0** | **5** | **28** | **37** | **71** |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 7-8.**
**CRITICAL INFRASTRUCTURE IN 100-YEAR FLOODPLAIN**

| Watershed | Bridges | Transportation | Water Supply | Wastewater | Power | Communications | Dams | **Total** |
|---|---|---|---|---|---|---|---|---|
| Amargosa Creek | 6 | 0 | 0 | 1 | 0 | 0 | 1 | **8** |
| Ballona Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 4 | 0 | 0 | 0 | 0 | 0 | 0 | **4** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Tujunga Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Bouquet Canyon | 1 | 0 | 0 | 0 | 0 | 0 | 1 | **2** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 8 | 0 | 0 | 0 | 0 | 0 | 0 | **8** |
| Chino Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dominguez Channel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Garapito Creek-Frontal Santa Monica Bay | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 9 | 1 | 0 | 0 | 0 | 0 | 0 | **10** |
| Lake Palmdale-Piute Ponds | 7 | 0 | 0 | 0 | 0 | 0 | 0 | **7** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Little Rock Wash | 1 | 0 | 0 | 0 | 0 | 0 | 1 | **2** |
| Lower Los Angeles River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Malibu Creek | 5 | 1 | 0 | 0 | 0 | 0 | 2 | **8** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rio Hondo | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Sacatara Creek-Kings Canyon | 3 | 0 | 0 | 0 | 0 | 0 | 0 | **3** |
| San Jose Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Los Angeles River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 7 | 0 | 0 | 0 | 0 | 0 | 0 | **7** |
| Upper San Gabriel River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 9 | 0 | 0 | 0 | 0 | 0 | 0 | **9** |
| West Fork San Gabriel River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **68** | **2** | **0** | **1** | **0** | **0** | **5** | **76** |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 7-9.**
**CRITICAL INFRASTRUCTURE IN 500-YEAR FLOODPLAIN**

| Watershed | Bridges | Transportation | Water Supply | Wastewater | Power | Communications | Dams | **Total** |
|---|---|---|---|---|---|---|---|---|
| Amargosa Creek | 6 | 1 | 0 | 1 | 0 | 1 | 1 | **10** |
| Ballona Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Rock Creek-Big Rock Wash | 4 | 0 | 0 | 0 | 0 | 0 | 0 | **4** |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Big Tujunga Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Bouquet Canyon | 1 | 0 | 0 | 0 | 0 | 0 | 1 | **2** |
| Calleguas Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Castaic Creek | 8 | 0 | 0 | 0 | 0 | 0 | 0 | **8** |
| Chino Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Cottonwood Creek-Tylerhorse Canyon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dalton Wash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Dominguez Channel | 1 | 1 | 0 | 0 | 0 | 0 | 0 | **2** |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| Garapito Creek-Frontal Santa Monica Bay | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Grapevine Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Headwaters Santa Clara River | 9 | 1 | 0 | 0 | 0 | 0 | 0 | **10** |
| Lake Palmdale-Piute Ponds | 7 | 1 | 0 | 1 | 0 | 0 | 0 | **9** |
| Le Montaine Creek-Eller Slough | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Little Rock Wash | 2 | 0 | 0 | 0 | 0 | 0 | 1 | **3** |
| Lower Los Angeles River | 20 | 0 | 0 | 0 | 0 | 0 | 0 | **20** |
| Lower Piru Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Lower San Gabriel River | 18 | 0 | 0 | 0 | 0 | 0 | 0 | **18** |
| Malibu Creek | 5 | 1 | 0 | 0 | 0 | 0 | 2 | **8** |
| Mescal Creek-Rocky Buttes | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rio Hondo | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Rock Creek-Buckhorn Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rogers Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Rosamond Lake | 2 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |
| Sacatara Creek-Kings Canyon | 3 | 0 | 0 | 0 | 0 | 0 | 0 | **3** |
| San Jose Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| San Nicholas Island-Santa Catalina Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Sheep Creek-El Mirage Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Town of Pearblossom | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| Upper Los Angeles River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Piru Creek | 7 | 0 | 0 | 0 | 0 | 0 | 0 | **7** |
| Upper San Gabriel River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Upper Santa Clara River | 9 | 0 | 0 | 0 | 0 | 0 | 0 | **9** |
| West Fork San Gabriel River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **106** | **6** | **0** | **2** | **0** | **2** | **5** | **121** |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

### Roads

The following major roads in the planning area pass through the 100-year floodplain and thus are exposed to flooding:

- Interstate 10
- Interstate 110
- Interstate 210
- Interstate 405
- Interstate 5
- State Highway 27
- Camino El Real
- Glendale Freeway
- Hollywood Freeway
- Marina Freeway
- Pacific Coastal Highway
- Ronald Reagan Freeway
- San Diego Freeway
- Topanga Canyon Blvd
- W Pomona Freeway
- US Highway 101
- State Highway 118
- State Highway 1
- State Highway 2
- State Highway 47
- State Highway 90
- State Highway 110
- Foothill Freeway
- Golden State Freeway
- Lincoln Blvd
- N Santa Ana Freeway
- Pasadena Freeway
- S Santa Ana Freeway
- Santa Monica Freeway
- Ventura Freeway

Some of these roads are built above the flood level, and others function as levees to prevent flooding. Still, in severe flood events these roads can be blocked or damaged, preventing access to some areas.

### Bridges

Flooding can significantly impact road bridges, which provide the only ingress and egress to some areas. While most bridges within the planning area are sufficiently protected from the impacts of flooding, some may have support structures within the river channel that can be exposed to erosion and scour damage in high flow events, as evidenced by the Interstate 10 bridge collapse in Riverside County in July 2015.There are 106 bridges that are in or cross over the 100- or 500-year floodplain in the planning area.

### Water and Sewer Infrastructure

Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers and streams.

## 7.4 ENVIRONMENT

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Hazardous materials and roadway pollution such as oil can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

## 7.4.1 The Riparian Environment

Wildlife populations are limited by shelter, space, food and water. Many species of mammals, birds, reptiles, amphibians and fish live in Los Angeles County in plant communities that are dependent upon streams, wetlands and floodplains. Riparian areas are the zones along the edge of a river or stream that are influenced by or are an influence upon the water body. Since water supply is a major limiting factor for many animals, riparian communities are of special importance. Changes in hydrologic conditions can result in a change in the riparian plant community, and wildlife and fish are impacted when plant communities are eliminated or fundamentally altered.

## 7.4.2 Significant Ecological Areas and Coastal Resource Areas

Protection of the biological resources of floodplains is important to Los Angeles County. Equipped with planning tools such as the Conservation and Natural Resource Element of the Los Angeles County General Plan, the Los Angeles River Master Plan and the Enhanced Watershed Management Plans, the County has established preserve areas that maintain the beneficial natural floodplain functions. The Los Angeles County General Plan identifies Significant Ecological Areas (SEAs) that have significant overlap with floodplains of the County (see Figure 7-1). The following excerpts from the County General Plan describe SEAs that overlap the regulated floodplain in the County. For more detailed descriptions of these areas, please refer to the descriptions provided in the General Plan.

### *Santa Clara River SEA*

The Santa Clara River SEA extends along the entire County reach of the Santa Clara River, primarily within unincorporated areas of the County. The SEA encompasses a wide variety of topographic features and habitat types, as well as major tributaries—all of which contribute to this diversity. It is a major biotic corridor for the County (and Ventura County). The orientation and extent of the SEA depends upon the surface and subsurface hydrology of the Santa Clara River, from its headwaters, tributaries, and watershed basin, to the point at which it exits the County's jurisdiction. Nearly all of the SEA is designated by Audubon California as a Globally Important Bird Area (IBA). The Santa Clara River IBA extends beyond the SEA in both upstream and downstream directions (across Soledad Pass to the Barrel Springs area in the Antelope Valley and through Ventura County to the mouth of the River at the Pacific Ocean).

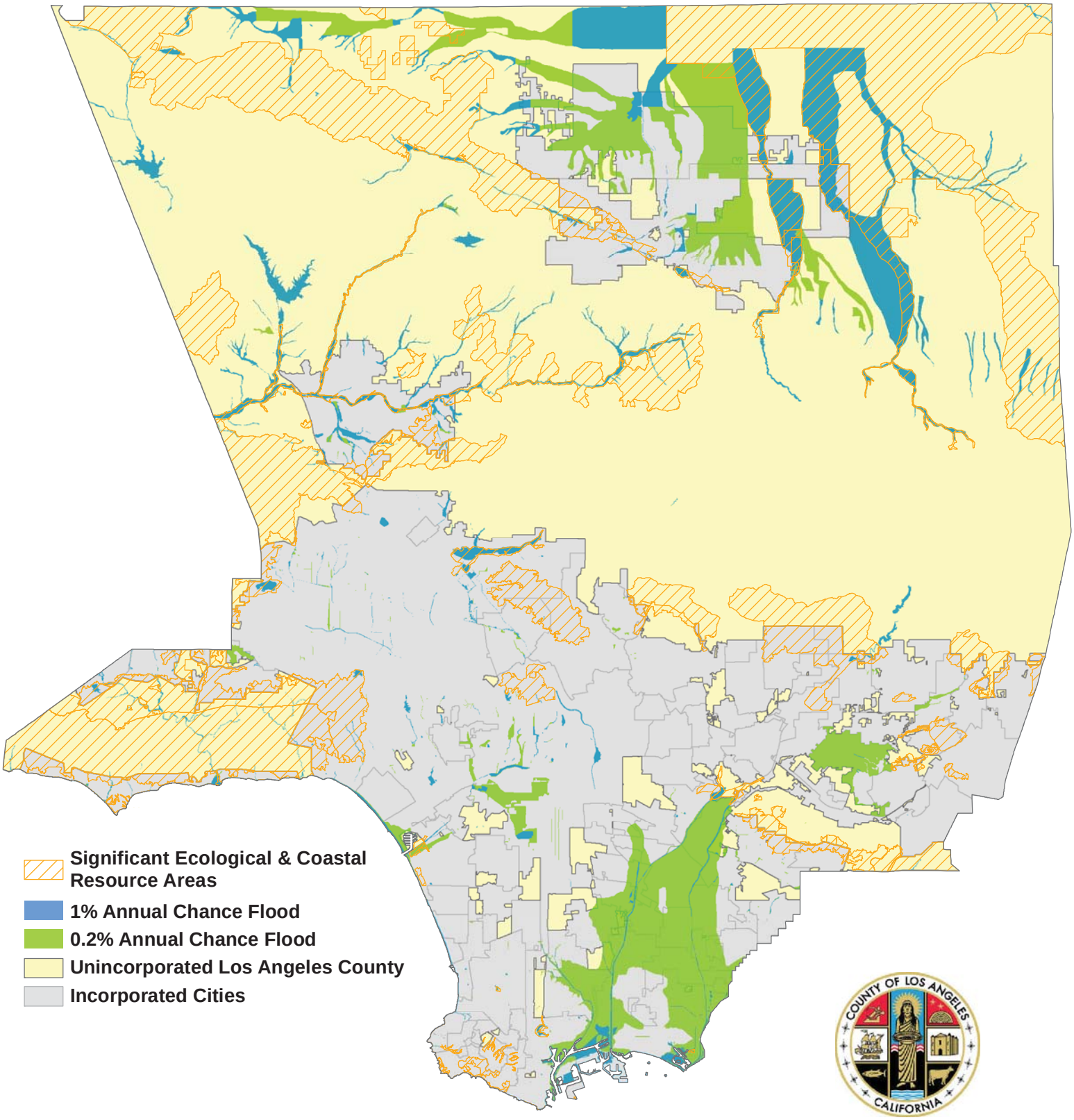
### *Santa Felicia SEA*

The Santa Felicia SEA is located northwest of the City of Santa Clarita within unincorporated area of the County. Some of the SEA extends into the Angeles National Forest. The area is west of the Interstate 5 and north of State Route 126 and encompasses almost the entire County portion of the Santa Felicia watershed that drains into Lake Piru and Piru Creek. Piru Creek has the largest watershed of any tributary of the Santa Clara River. The SEA is largely composed of natural coastal slopes of the western San Gabriel Mountains, with south-facing slopes of coastal sage scrub and grasslands, north-facing slopes of oak woodland and chaparral, and canyons of riparian oak forest and other riparian habitats. This habitat has been diminished by development, and the SEA is one place in the County where the natural habitat remains.

### *Antelope Valley SEA*

The Antelope Valley SEA is in the central portion of the Antelope Valley, primarily east of the cities of Palmdale and Lancaster, within a predominantly unincorporated area of the County. The SEA is focused on the principal watercourses of the area: Little Rock Wash and Big Rock Wash and tributaries, such as Mescal Creek. Audubon California recognizes the area of Edwards Air Force Base as a Globally Important Bird Area, which is visited by tens of thousands of migrant birds during the spring and fall migratory seasons, and supports the breeding of rare and endangered birds during the spring and summer months.

**Figure 7-1.**
**Significant Ecological Areas, Coastal Resource Areas & FEMA DFIRM Flood Hazard Areas**




Data Sources: Los Angeles County

### Puente Hills SEA

The Puente Hills SEA is located in the Puente Hills in the southeastern portion of the County. The Puente Hills are an inland topographical feature that separates the San Gabriel Valley to the north and the coastal plain to the south. The hills are oriented east-west and stretch from the San Gabriel River on the west approximately to the San Bernardino-Los Angeles County line to the east, where they transition into the Chino Hills. The SEA includes portions of the Whittier Narrows Dam Recreation Area and Flood Control Basin, and much of the undeveloped land throughout the Puente Hills. Nearly the entire SEA is designated as the Puente-Chino Hills State IBA by Audubon California. The main area hosts migrating and resident birds that use the extensive mosaic of lowland terrestrial habitats, and notable extensive areas of grassland and oak and walnut woodlands. This IBA extends well beyond the SEA into Orange and San Bernardino counties, and in general, goes beyond the SEA boundaries in most places. The northwestern disjunct area of the SEA is part of the Los Angeles Flood Control Basin IBA, which hosts many resident and migrating birds that use the wetlands. This IBA extends beyond the SEA on both the Rio Hondo and a long distance upstream along the San Gabriel River.

### Santa Monica Mountains SEA and CRA

The Santa Monica Mountains SEA is located within the Santa Monica Mountains in a mostly unincorporated area of the County. Much of the area is in the Santa Monica Mountains National Recreation Area, but is privately owned. Many of the federal lands under the jurisdiction of the National Park Service are included in the SEA designation. Many of the state parklands, notably Malibu Creek State Park and Topanga State Park, are also included in the SEA. The SEA includes nearly all of the canyons and ridges from the Ventura-Los Angeles County line, and east to Sullivan Canyon, which is near the communities of Pacific Palisades Brentwood to the south and Encino to the north. From south to north, the SEA extends from the Pacific Ocean shoreline or urban-wildland interface of Malibu, through the unincorporated area of the Santa Monica Mountains proper, to the northern edge of the SEA extending along the undeveloped southern edge of the San Fernando Valley or irregularly along the Ventura-Los Angeles County line. This SEA recognizes the rare habitat of a small regional mountain range with a high diversity of topography and moisture regimes, and with vegetation adapted to a Mediterranean climate, which is globally rare, existing elsewhere only along western portions of continents at 30- to 40-degree latitude. Although the habitats may seem common within the Santa Monica Mountains, in terms of limited indigenous global ranges of the constituent species, their special adaptations to climate, the relatively intact character of the habitats, and the plant assemblage of the Santa Monica Mountains are unique. Development within the SEA that extends the nearby expansive urban development of the Los Angeles Basin and San Fernando Valley needs to be carefully considered to preserve these special resources.

### Ballona Wetlands CRA

The Ballona Wetlands CRA is located south of Marina del Rey, north of Playa Del Rey, and west and northwest of Playa Vista. One extending arm reaches north to the State Route 90 overcrossing and another reaches south to include the restored freshwater marsh adjacent to the Playa Del Rey and Playa Vista districts of the City of Los Angeles. The Ballona Wetlands are a remnant of what was the County's largest coastal lagoon. The Ballona watershed covers over 130 square miles, and the lagoon area was so large (about 11 to 12 square miles) that it included freshwater peripheries. Incorporated in the lagoon complex were 10 kinds of habitat that ranged from coastal saltwater marsh to grassy prairie to oak and willow woodland adjacent to freshwater areas. The lagoon connected via Ballona Creek, that sometimes was the Los Angeles River, to La Cienega, a large swampy area (about 13 to 14 square miles) that was north and east of the Baldwin Hills. The CRA lies at the base of the Ballona Creek watershed and includes part of the Ballona Creek flood control channel that drains 130 square miles, from what is now a highly urbanized area. While the Ballona Wetlands ecosystem has been substantially degraded over the years due to human activity and urban development, it is still a rich ecological system that bridges the gap between aquatic

marine and freshwater land environments. It provides crucial habitat for hundreds of plant and animal species.

### *Malibu Coastline CRA*

The Malibu Coastline CRA is located in the shoreline and offshore coastal area of Malibu, which is adjacent to the Santa Monica Mountains. The CRA supports significant areas of aquatic plant and other subtidal communities, which provide habitat for a variety of fishes, birds, marine mammals, and other wildlife. Rocky outcrops intermixed with sandy spaces are found to a depth of 600 feet, and the nearshore area down to about 100 feet depth is considered the most productive and dynamic of all the marine communities outside the tropics. All of the many offshore rocks within 12 nautical miles of the coast are part of the California Coastal National Monument that is managed by the Bureau of Land Management in the U.S. Department of the Interior.

# CHAPTER 8.
# FLOOD HAZARD VULNERABILITY

Not all areas that are exposed to the flood risk experience actual flooding or serious damage during a flood event. Vulnerability refers to expected actual harm or damage from a flood. This chapter describes vulnerabilities of population, property, critical infrastructure and the environment. The analysis focuses on two areas of the regulated floodplain:

- The special flood hazard area depicted on the current Flood Insurance Rate Map for Los Angeles County
- The portions of the planning area for which the County has adopted floodway maps as described in Section 6.6.2. The County has not generated floodway data for all of the mapped SFHA. The vulnerability analysis focuses on the difference in flood depths where County floodway data is available.

Data output for these two different areas should be interpreted separately, not cumulatively. Loss values for County floodway areas are not in addition to those reflected in the SFHA; they are a subset of the total SFHA loss.

## 8.1 POPULATION

### 8.1.1 Vulnerable Populations

An analysis using Hazus-MH model demographic data (based on 2010 U.S. Census data) identified populations vulnerable to the flood hazard as follows:

- Economically Disadvantaged Populations—An estimated 28.6 percent of the people within the households in the census blocks that intersect the 100-year floodplain are economically disadvantaged, defined as having household incomes of $20,000 or less.
- Population over 65 Years Old—An estimated 9.4 percent of the population in the census blocks that intersect the 100-year floodplain are over 65 years old. Approximately 28 percent of the over-65 population in the floodplain also have incomes considered to be economically disadvantaged and are considered to be extremely vulnerable.
- Population under 16 Years Old—An estimated 23.9 percent of the population within census blocks located in or near that intersect the 100-year floodplain are under 16 years of age.

In addition, persons with disabilities or others with access and functional needs are more likely to have difficulty responding to a flood or other hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to the 2010 – 2012 Census estimates, there are 949,797 individuals in Los Angeles County with some form of disability, representing 9.6 percent of the county total. (U.S. Census, 2013a).

In addition to human populations, animals, specifically pets and livestock, may be vulnerable in flood events. Animals must be included in evacuation and sheltering plans for their protection and the protection of their owners, who may risk their own lives to ensure the safety of their animals.

### 8.1.2 Public Health and Safety

Floods present threats to public health and safety. Floodwater is generally contaminated by pollutants such as sewage, human and animal feces, pesticides and insecticides, fertilizers, oil, asbestos, and rusting building materials. The following health and safety risks are commonly associated with flood events:

- **Unsafe food—**Floodwaters contain disease-causing bacteria, dirt, oil, human and animal wastes, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and thus must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.
- **Contaminated drinking and washing water and poor sanitation—**Flooding impairs clean water sources with pollutants and affects sanitary toilets. Direct and indirect contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne infectious disease. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection and illnesses if they are broken or overflow. Unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks, including life-threatening cholera, typhoid, dysentery and some forms of hepatitis.
- **Mosquitoes and animals—**Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities.
- **Molds and mildews—**Excessive exposure to molds and mildews can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases and to trigger cold-like symptoms such as sore throat, watery eyes, wheezing and dizziness. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets and bathrooms. Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people and pregnant women are considered most vulnerable to mold-induced health problems.
- **Carbon monoxide poisoning—**Carbon monoxide poisoning is as a potential hazard after major floods. Carbon monoxide can be found in combustion fumes, such as those generated by small gasoline engines, stoves, generators, lanterns and gas ranges, or by burning charcoal or wood. In the event of power outages following floods, flood victims tend to use alternative

sources of fuels for heating, cooling, or cooking inside enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation. Carbon monoxide builds up from these sources and poisons the people and animals inside.

- **Hazards when reentering and cleaning flooded homes and buildings—**Flooded buildings can pose health hazards after floodwaters recede. Electrical power systems can become hazardous. People should avoid turning on or off the main power while standing in floodwater. Gas leaks from pipelines or propane tanks can trigger explosion when entering and cleaning damaged buildings or working to restore utility service. Flood debris—such as broken bottles, wood, stones and walls—may cause wounds and injuries when cleaning damaged buildings. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks and other industrial chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup.
- **Mental stress and fatigue—**Exposure to extreme disaster events can cause psychological distress. Having experienced a devastating flood, seen loved ones lost or injured, and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Post-flood recovery—especially when prolonged—can cause anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Behavior changes may also occur in children. There is also a long-term concern among the affected that their homes can be flooded again in the future.

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

## 8.1.3 Impacts on People

Table 8-1 summarizes Hazus-estimated impacts on the planning area population for each flood scenario.

**TABLE 8-1.**
**ESTIMATED FLOOD IMPACT ON PERSONS[a]**

| | Number of Displaced Persons | Number of Persons Requiring Publicly Provided Short-Term Shelter[b] |
|---|---|---|
| 10-Year Flood | 246 | 103 |
| 50-Year Flood | 359 | 158 |
| 100-Year Flood | 5,717 | 3,134 |
| 500-Year Flood | 21,162 | 15,057 |
| County Floodway | 1,474 | 763 |

a. Results shown are not precise, but are estimates of damage that may occur as the result of the modeled flood.
b. The number of persons requiring publicly provided shelter is less than the number of displaced persons because not all households will require public assistance to find short-term shelter.

Note: Sources of data used in Hazus modeling are described in Table 5-1.

## 8.2 PROPERTY

### 8.2.1 Loss Estimates

Hazus-MH calculates flood losses to structures based on flooding depth and structure type. Using historical flood insurance claim data, Hazus-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, local data on facilities was used instead of the default inventory data provided with Hazus-MH. The results of these analyses for the scenario flood events are summarized in Table 8-2 through Table 8-6.

### 8.2.2 National Flood Insurance Program Statistics

Table 8-7 lists flood insurance statistics that help identify vulnerability in Los Angeles County. The County and 85 municipalities within it participate in the NFIP, with 17,584 flood insurance policies providing $4.76 billion in coverage. According to FEMA statistics, 7,910 flood insurance claims were paid between January 1, 1978 and June 30, 2014, for a total of $55 million, an average of $6,961 per claim.

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRM for Los Angeles County was available in 1980.

The following information from flood insurance statistics is relevant to reducing flood risk:

- The use of flood insurance in the planning area is above the national average. Approximately 65.3 percent of insurable buildings within the SFHA in the planning area are covered by flood insurance. According to an NFIP study, about 49 percent of single-family homes in special flood hazard areas are covered by flood insurance nationwide.
- The average cost of a flood insurance policy within the planning are a is $1,304
- The average cost of a flood insurance policy within the SFHA is $1,604 per year.
- The average cost of a policy outside the SFHA is $869.
- 78% of the policies in force are for residences.
- 69.3% of the policies are for pre-FIRM construction.
- The amount of insurance in force represents 41 percent of the total value of the assets exposed within the SFHA.
- The high percentage of flood insurance policies in force outside the SFHA (roughly 41 percent of the policies) suggests that the currently effective mapping does not reflect the total flood risk.
- The average claim paid in the planning area ($8,319) represents about 2.14 percent of the 2014 average replacement cost value of structures in the floodplain. This correlates to a flood depth damage function of less than 1 foot for a 1-story structure with no basement using the U.S. Army Corps of Engineers generic flood-depth/damage curves.

**TABLE 8-2.**
**LOSS ESTIMATES FOR 10-YEAR FLOOD EVENT**

| Watershed | Structures Impacted[a] | Estimated Loss Associated with Flood | | | % of Total Replace-ment Cost |
|---|---|---|---|---|---|
| | | Structure | Contents | **Total** | |
| Amargosa Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Ballona Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 2 | $104,158 | $61,514 | **$165,672** | 0.01% |
| Big Tujunga Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Bouquet Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Calleguas Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Chino Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Cottonwood Creek-Tylerhorse Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Dominguez Channel | 0 | $0 | $0 | **$0** | 0.00% |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Garapito Creek-Frontal Santa Monica Bay | 32 | $1,304,271 | $942,814 | **$2,247,086** | 0.12% |
| Grapevine Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | 0 | $0 | $0 | **$0** | 0.00% |
| Lake Palmdale-Piute Ponds | 0 | $0 | $0 | **$0** | 0.00% |
| Le Montaine Creek-Eller Slough | 0 | $0 | $0 | **$0** | 0.00% |
| Little Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Malibu Creek | 21 | $2,188,044 | $8,041,560 | **$10,229,604** | 0.39% |
| Mescal Creek-Rocky Buttes | 0 | $0 | $0 | **$0** | 0.00% |
| Rio Hondo | 0 | $0 | $0 | **$0** | 0.00% |
| Rock Creek-Buckhorn Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rogers Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Sacatara Creek-Kings Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| San Jose Creek | 0 | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | 0 | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Upper San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | 0 | $0 | $0 | **$0** | 0.00% |
| West Fork San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| **Total** | **55** | **$3,596,473** | **$9,045,888** | **$12,642,362** | **< 1** |

a. Impacted structures are those structures with finished floor elevations below the Hazus-estimated 10-year water surface elevation. These structures are the most likely to receive damage in a 10-year flood event

Notes:
Values in this table are only for purposes of comparison among results. See Section 5.2.5 for a discussion of data limitations. Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-3.**
**LOSS ESTIMATES FOR 50-YEAR FLOOD EVENT**

| Watershed | Structures Impacted[a] | Estimated Loss Associated with Flood | | | % of Total Replace-ment Cost |
|---|---|---|---|---|---|
| | | Structure | Contents | **Total** | |
| Amargosa Creek | 1 | $30,178 | $10,059 | **$40,237** | 0.00% |
| Ballona Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 2 | $114,630 | $73,517 | **$188,146** | 0.01% |
| Big Tujunga Creek | 1 | $324,037 | $1,839,547 | **$2,163,584** | 0.66% |
| Bouquet Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Calleguas Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Chino Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Cottonwood Creek-Tylerhorse Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Dominguez Channel | 0 | $0 | $0 | **$0** | 0.00% |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Garapito Creek-Frontal Santa Monica Bay | 42 | $1,967,987 | $1,801,805 | **$3,769,793** | 0.20% |
| Grapevine Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | 0 | $0 | $0 | **$0** | 0.00% |
| Lake Palmdale-Piute Ponds | 0 | $0 | $0 | **$0** | 0.00% |
| Le Montaine Creek-Eller Slough | 0 | $0 | $0 | **$0** | 0.00% |
| Little Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Malibu Creek | 42 | $6,434,823 | $19,029,231 | **$25,464,054** | 0.97% |
| Mescal Creek-Rocky Buttes | 0 | $0 | $0 | **$0** | 0.00% |
| Rio Hondo | 0 | $0 | $0 | **$0** | 0.00% |
| Rock Creek-Buckhorn Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rogers Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Sacatara Creek-Kings Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| San Jose Creek | 0 | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | 0 | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Upper San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | 0 | $0 | $0 | **$0** | 0.00% |
| West Fork San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| **Total** | **88** | **$8,871,655** | **$22,754,159** | **$31,625,814** | **< 1** |

a. Impacted structures are those structures with finished floor elevations below the Hazus-estimated 50-year water surface elevation. These structures are the most likely to receive damage in a 50-year flood event

Notes:
Values in this table are only for purposes of comparison among results. See Section 5.2.5 for a discussion of data limitations. Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-4.**
**LOSS ESTIMATES FOR 100-YEAR FLOOD EVENT**

| Watershed | Structures Impacted[a] | Estimated Loss Associated with Flood | | | % of Total Replace-ment Cost |
|---|---|---|---|---|---|
| | | Structure | Contents | **Total** | |
| Amargosa Creek | 56 | $3,800,965 | $4,982,350 | **$8,783,315** | 0.23% |
| Ballona Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | 29 | $4,095,099 | $6,641,270 | **$10,736,368** | 1.71% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 2 | $120,485 | $77,901 | **$198,386** | 0.01% |
| Big Tujunga Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Bouquet Canyon | 24 | $922,975 | $495,970 | **$1,418,945** | 0.17% |
| Calleguas Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | 119 | $9,338,229 | $13,581,201 | **$22,919,430** | 0.36% |
| Chino Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Cottonwood Creek-Tylerhorse Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Dominguez Channel | 0 | $0 | $0 | **$0** | 0.00% |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Garapito Creek-Frontal Santa Monica Bay | 52 | $2,058,236 | $1,701,337 | **$3,759,573** | 0.20% |
| Grapevine Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | 294 | $13,044,393 | $16,531,522 | **$29,575,915** | 0.90% |
| Lake Palmdale-Piute Ponds | 14 | $967,622 | $2,337,206 | **$3,304,828** | 0.38% |
| Le Montaine Creek-Eller Slough | 1 | $6,353 | $2,118 | **$8,470** | 0.02% |
| Little Rock Wash | 2 | $165,834 | $1,027,303 | **$1,193,136** | 0.13% |
| Lower Los Angeles River | 1 | $1,293,839 | $2,985,782 | **$4,279,620** | 0.02% |
| Lower Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Malibu Creek | 56 | $5,626,901 | $12,349,952 | **$17,976,853** | 0.69% |
| Mescal Creek-Rocky Buttes | 84 | $2,209,071 | $734,708 | **$2,943,779** | 0.18% |
| Rio Hondo | 1 | $80,821 | $484,927 | **$565,748** | 0.01% |
| Rock Creek-Buckhorn Lake | 92 | $2,058,289 | $1,565,463 | **$3,623,752** | 4.76% |
| Rogers Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | 105 | $4,167,354 | $4,683,652 | **$8,851,006** | 2.66% |
| Sacatara Creek-Kings Canyon | 64 | $3,919,028 | $7,087,795 | **$11,006,823** | 1.93% |
| San Jose Creek | 0 | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | 0 | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | 71 | $2,974,447 | $4,934,891 | **$7,909,338** | 0.63% |
| Upper Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | 8 | $1,030,298 | $3,016,674 | **$4,046,972** | 1.41% |
| Upper San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | 299 | $11,233,333 | $8,015,450 | **$19,248,783** | 0.27% |
| West Fork San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| **Total** | **1374** | **$69,113,572** | **$93,237,472** | **$162,351,040** | **< 1** |

a. Impacted structures are those structures with finished floor elevations below the Hazus-estimated 100-year water surface elevation. These structures are the most likely to receive damage in a 100-year flood event

Notes:

Values in this table are only for purposes of comparison among results. See Section 5.2.5 for a discussion of data limitations. Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-5.**
**LOSS ESTIMATES FOR 500-YEAR FLOOD EVENT**

| Watershed | Structures Impacted[a] | Estimated Loss Associated with Flood | | | % of Total Replace-ment Cost |
|---|---|---|---|---|---|
| | | Structure | Contents | **Total** | |
| Amargosa Creek | 469 | $21,307,616 | $15,862,002 | **$37,169,618** | 0.96% |
| Ballona Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | 30 | $4,103,630 | $6,642,433 | **$10,746,063** | 1.71% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 2 | $130,254 | $80,476 | **$210,730** | 0.02% |
| Big Tujunga Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Bouquet Canyon | 24 | $922,975 | $495,970 | **$1,418,945** | 0.17% |
| Calleguas Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | 296 | $24,092,084 | $26,177,494 | **$50,269,578** | 0.79% |
| Chino Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | 2 | $11,168 | $3,723 | **$14,890** | 0.01% |
| Cottonwood Creek-Tylerhorse Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | 5 | $270,500 | $151,331 | **$421,831** | 0.01% |
| Dominguez Channel | 121 | $7,371,703 | $15,055,898 | **$22,427,602** | 0.14% |
| Frontal Santa Monica Bay-San Pedro Bay | 12 | $2,875,940 | $9,668,138 | **$12,544,078** | 0.40% |
| Garapito Creek-Frontal Santa Monica Bay | 65 | $3,157,566 | $3,355,634 | **$6,513,200** | 0.34% |
| Grapevine Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | 294 | $13,044,393 | $16,531,522 | **$29,575,915** | 0.90% |
| Lake Palmdale-Piute Ponds | 30 | $5,759,117 | $14,665,879 | **$20,424,995** | 2.36% |
| Le Montaine Creek-Eller Slough | 1 | $6,353 | $2,118 | **$8,470** | 0.02% |
| Little Rock Wash | 287 | $8,854,373 | $8,941,119 | **$17,795,491** | 1.91% |
| Lower Los Angeles River | 253 | $46,746,371 | $132,296,028 | **$179,042,399** | 0.65% |
| Lower Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | 405 | $23,403,184 | $36,903,413 | **$60,306,597** | 0.49% |
| Malibu Creek | 64 | $6,189,394 | $12,800,442 | **$18,989,836** | 0.73% |
| Mescal Creek-Rocky Buttes | 84 | $2,209,071 | $734,708 | **$2,943,779** | 0.18% |
| Rio Hondo | 1 | $80,821 | $484,927 | **$565,748** | 0.01% |
| Rock Creek-Buckhorn Lake | 92 | $2,058,289 | $1,565,463 | **$3,623,752** | 4.76% |
| Rogers Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | 109 | $4,323,559 | $5,217,976 | **$9,541,534** | 2.87% |
| Sacatara Creek-Kings Canyon | 84 | $7,690,921 | $12,301,466 | **$19,992,387** | 3.50% |
| San Jose Creek | 0 | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | 0 | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | 148 | $4,860,403 | $6,985,139 | **$11,845,541** | 0.94% |
| Upper Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | 11 | $3,375,813 | $6,373,103 | **$9,748,916** | 3.40% |
| Upper San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | 455 | $25,188,080 | $28,501,923 | **$53,690,003** | 0.76% |
| West Fork San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| **Total** | **3344** | **$218,033,578** | **$361,798,325** | **$579,831,898** | **0.42%** |

a. Impacted structures are those structures with finished floor elevations below the Hazus-estimated 500-year water surface elevation. These structures are the most likely to receive damage in a 500-year flood event

Notes:
Values in this table are only for purposes of comparison among results. See Section 5.2.5 for a discussion of data limitations. Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-6.**
**LOSS ESTIMATES FOR THE COUNTY FLOODWAY**

| Watershed | Structures Impacted[a] | Estimated Loss Associated with Flood | | | % of Total Replace-ment Cost |
|---|---|---|---|---|---|
| | | Structure | Contents | **Total** | |
| Amargosa Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Ballona Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Big Rock Creek-Big Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Big Sycamore Canyon-Frontal Santa Monica Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Big Tujunga Creek | 4 | $682,459 | $458,843 | **$1,141,302** | 0.35% |
| Bouquet Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Calleguas Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Castaic Creek | 31 | $3,552,747 | $5,486,885 | **$9,039,632** | 0.14% |
| Chino Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Colorado Lagoon-Frontal Alamitos Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Cottonwood Creek-Tylerhorse Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| Dalton Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Dominguez Channel | 0 | $0 | $0 | **$0** | 0.00% |
| Frontal Santa Monica Bay-San Pedro Bay | 0 | $0 | $0 | **$0** | 0.00% |
| Garapito Creek-Frontal Santa Monica Bay | 5 | $75,382 | $25,127 | **$100,510** | 0.01% |
| Grapevine Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Headwaters Santa Clara River | 131 | $6,210,091 | $7,621,044 | **$13,831,135** | 0.42% |
| Lake Palmdale-Piute Ponds | 0 | $0 | $0 | **$0** | 0.00% |
| Le Montaine Creek-Eller Slough | 0 | $0 | $0 | **$0** | 0.00% |
| Little Rock Wash | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Lower Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Lower San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Malibu Creek | 37 | $4,374,590 | $13,246,293 | **$17,620,883** | 0.67% |
| Mescal Creek-Rocky Buttes | 0 | $0 | $0 | **$0** | 0.00% |
| Rio Hondo | 9 | $4,572,128 | $6,561,750 | **$11,133,879** | 0.11% |
| Rock Creek-Buckhorn Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rogers Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Rosamond Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Sacatara Creek-Kings Canyon | 0 | $0 | $0 | **$0** | 0.00% |
| San Jose Creek | 0 | $0 | $0 | **$0** | 0.00% |
| San Nicholas Island-Santa Catalina Island | 0 | $0 | $0 | **$0** | 0.00% |
| Sheep Creek-El Mirage Lake | 0 | $0 | $0 | **$0** | 0.00% |
| Town of Pearblossom | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Los Angeles River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Piru Creek | 0 | $0 | $0 | **$0** | 0.00% |
| Upper San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| Upper Santa Clara River | 18 | $861,240 | $2,506,999 | **$3,368,239** | 0.05% |
| West Fork San Gabriel River | 0 | $0 | $0 | **$0** | 0.00% |
| **Total** | **235** | **$20,328,637** | **$35,906,941** | **$56,235,580** | **< 1** |

a. Impacted structures are those structures with finished floor elevations below the Hazus-estimated flood water surface elevation. These structures are the most likely to receive damage in a flood event

Notes:
Values in this table are only for purposes of comparison among results. See Section 5.2.5 for a discussion of data limitations. Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-7.**
**FLOOD INSURANCE STATISTICS FOR LOS ANGELES COUNTY**

| Jurisdiction | Date of Entry Initial FIRM Effective Date | # of Flood Insurance Policies as of 6/30/2014 | Insurance In Force ($) | Total Annual Premium ($) | Claims, 11/1978 to 6/30/2014 | Value of Claims paid, 11/1978 to 6/30/2014 ($) |
|---|---|---|---|---|---|---|
| Unincorporated County | 2/12/80 | 1,986 | 506,634,500 | 2,570,129 | 2,936 | 24,650,173 |
| Agoura Hills | 4/3/86 | 47 | 13,238,600 | 38,120 | 57 | 345,482 |
| Alhambra | 9/26/08 | 3 | 483,000 | 824 | 8 | 17,162 |
| Arcadia | 9/26/08 | 12 | 4,780,000 | 10,425 | 8 | 5,884 |
| Artesia | 9/26/08 | 3 | 724,000 | 1,115 | — | — |
| Avalon | 9/29/78 | 74 | 19,228,600 | 134,356 | 5 | 56,470 |
| Azusa | 9/26/08 | 7 | 1,590,700 | 6,831 | 1 | 750 |
| Baldwin Park | 5/26/78 | 2 | 700,000 | 828 | 2 | 47,602 |
| Bell | 9/26/08 | — | — | — | — | — |
| Bell Gardens | 9/26/08 | — | — | — | — | — |
| Bellflower | 6/7/98 | 35 | 9,042,700 | 16,711 | 8 | 27,385 |
| Beverly Hills | 9/26/08 | 183 | 61,728,900 | 112,307 | 215 | 1,463,737 |
| Bradbury | 9/26/08 | — | — | — | 8 | 20,720 |
| Burbank | 3/16/81 | 123 | 37,645,200 | 136,481 | 24 | 26,597 |
| Calabasas | 2/12/80 | 63 | 18,097,000 | 44,868 | 12 | 32,970 |
| Carson | 6/7/98 | 72 | 23,496,000 | 64,809 | 39 | 64,171 |
| Cerritos | 9/26/08 | 43 | 13,279,000 | 19,940 | 4 | 3,886 |
| Claremont | 11/20/00 | 31 | 8,362,000 | 11,218 | 5 | 6,484 |
| Commerce | 9/26/08 | 1 | 550,000 | 1,721 | 1 | 5,443 |
| Compton | 6/7/98 | 79 | 18,648,400 | 57,706 | 16 | 139,855 |
| Covina | 10/22/71 | 8 | 1,953,100 | 2,735 | 5 | 729 |
| Cudahy | 9/26/08 | 5 | 735,000 | 1,572 | 1 | 0 |
| Culver City | 1/2/80 | 76 | 24,699,100 | 104,082 | 24 | 92,942 |
| Diamond Bar | 9/26/08 | 10 | 2,910,000 | 3,774 | 3 | 6,806 |
| Downey | 6/7/98 | 87 | 25,681,600 | 57,594 | 15 | 76,915 |
| Duarte | 9/26/08 | 8 | 2,425,300 | 3,401 | 3 | 1,725 |
| El Monte | 6/16/99 | 3 | 700,000 | 1,042 | — | — |
| El Segundo | 9/26/08 | 9 | 2,318,000 | 3,229 | 3 | 3,772 |
| Gardena | 6/7/98 | 15 | 4,737,200 | 14,874 | 5 | 4,416 |
| Glendale | 9/26/08 | 97 | 24,774,600 | 66,934 | 59 | 131,893 |
| Glendora | 9/26/08 | 54 | 15,370,200 | 47,062 | 6 | 63,707 |
| Hawaiian Gardens | 5/14/71 | 3 | 576,800 | 1,280 | 1 | 0 |

**TABLE 8-7.**
**FLOOD INSURANCE STATISTICS FOR LOS ANGELES COUNTY**

| Jurisdiction | Date of Entry Initial FIRM Effective Date | # of Flood Insurance Policies as of 6/30/2014 | Insurance In Force ($) | Total Annual Premium ($) | Claims, 11/1978 to 6/30/2014 | Value of Claims paid, 11/1978 to 6/30/2014 ($) |
|---|---|---|---|---|---|---|
| Hawthorne | 4/12/79 | 8 | 1,932,000 | 2,841 | — | — |
| Hermosa Beach | 9/26/08 | 61 | 18,734,900 | 29,471 | 9 | 10,545 |
| Hidden Hills | 7/9/84 | 27 | 6,676,300 | 34,781 | 36 | 391,043 |
| Industry | 9/26/08 | 5 | 2,200,000 | 14,581 | 1 | 500 |
| Inglewood | 9/26/08 | 23 | 6,120,000 | 9,595 | 21 | 10,855 |
| Irwindale | 9/26/08 | 1 | 350,000 | 414 | — | — |
| La Canada Flintridge | 9/26/08 | 76 | 23,652,100 | 37,033 | 40 | 1,570,107 |
| La Habra Heights | 9/26/08 | 2 | 700,000 | 828 | 2 | 3,442 |
| La Mirada | 2/7/80 | 12 | 3,400,000 | 7,542 | 7 | 30,046 |
| La Puente | 9/26/08 | 1 | 350,000 | 412 | 5 | 7,942 |
| La Verne | 9/26/08 | 4 | 982,100 | 2,978 | 6 | 21,907 |
| Lakewood | 6/7/98 | 99 | 28,394,600 | 41,307 | 10 | 21,781 |
| Lancaster | 6/1/82 | 95 | 25,326,000 | 74,975 | 11 | 25,519 |
| Lawndale | 9/26/08 | 4 | 860,600 | 2,267 | 1 | 5,430 |
| Lomita | 9/26/08 | 6 | 2,050,000 | 2,464 | 1 | 0 |
| Long Beach | 9/15/83 | 3,805 | 960,975,000 | 4,644,572 | 307 | 2,121,372 |
| Los Angeles | 2/12/80 | 7,864 | 2,168,776,200 | 6,917,627 | 3,434 | 18,992,386 |
| Lynwood | 4/15/80 | 99 | 21,320,300 | 110,675 | 19 | 179,525 |
| Malibu | 9/26/08 | 601 | 182,900,300 | 1,623,401 | 88 | 1,791,056 |
| Manhattan Beach | 9/26/08 | 72 | 23,233,000 | 30,534 | 11 | 59,921 |
| Maywood | 9/26/08 | | | | | |
| Monrovia | 9/26/08 | 16 | 4,924,400 | 10,649 | 12 | 25,937 |
| Montebello | 3/18/80 | 12 | 4,430,000 | 8,402 | 2 | 3,935 |
| Monterey Park | 9/26/08 | 14 | 4,830,000 | 5,770 | 24 | 18,085 |
| Norwalk | 9/26/08 | 20 | 5,160,000 | 8,133 | 3 | 8,167 |
| Palmdale | 6/1/82 | 101 | 25,006,200 | 86,610 | 20 | 275,660 |
| Palos Verdes Estates | 11/21/01 | 39 | 11,610,000 | 34,585 | 14 | 39,749 |
| Paramount | 6/7/98 | 26 | 6,080,800 | 18,958 | 14 | 34,661 |
| Pasadena | 9/26/08 | 62 | 18,094,500 | 41,662 | 56 | 180,430 |
| Pico Rivera | 6/7/98 | 81 | 23,782,300 | 67,191 | 13 | 18,872 |
| Pomona | 9/26/08 | 11 | 2,705,900 | 18,904 | 5 | 38,621 |

**TABLE 8-7.**
**FLOOD INSURANCE STATISTICS FOR LOS ANGELES COUNTY**

| Jurisdiction | Date of Entry Initial FIRM Effective Date | # of Flood Insurance Policies as of 6/30/2014 | Insurance In Force ($) | Total Annual Premium ($) | Claims, 11/1978 to 6/30/2014 | Value of Claims paid, 11/1978 to 6/30/2014 ($) |
|---|---|---|---|---|---|---|
| Rancho Palos Verdes | 9/26/08 | 27 | 7,025,700 | 16,477 | 7 | 5,729 |
| Redondo Beach | 9/15/83 | 66 | 17,706,100 | 60,292 | 31 | 1,216,135 |
| Rolling Hills Estates | 9/26/08 | 9 | 2,213,000 | 3,123 | 9 | 12,344 |
| Rolling Hills | 9/26/08 | 9 | 2,765,000 | 3,615 | 1 | 0 |
| Rosemead | 9/26/08 | 1 | 350,000 | 414 | 2 | 582 |
| San Dimas | 1/4/77 | 7 | 1,585,700 | 4,508 | 9 | 9,920 |
| San Fernando | 11/2/76 | 2 | 560,000 | 768 | 16 | 130,914 |
| San Gabriel | 11/27/70 | 5 | 1,658,000 | 3,992 | 2 | 5,639 |
| San Marino | 9/26/08 | 8 | 2,612,000 | 3,844 | 1 | 0 |
| Santa Clarita | 9/29/89 | 600 | 148,500,500 | 844,043 | 44 | 72,685 |
| Santa Fe Springs | 4/15/80 | 17 | 8,160,000 | 16,427 | — | — |
| Santa Monica | 9/26/08 | 171 | 58,018,400 | 117,197 | 35 | 116,860 |
| Sierra Madre | 9/26/08 | 14 | 3,166,900 | 10,114 | 24 | 80,992 |
| Signal Hill | 9/26/08 | 6 | 1,470,000 | 2,189 | 6 | 45,609 |
| South El Monte | 9/26/08 | 3 | 964,800 | 4,392 | — | — |
| South Gate | 6/7/98 | 16 | 4,679,400 | 14,939 | 5 | 4,668 |
| South Pasadena | 4/14/72 | 13 | 4,286,600 | 7,564 | 13 | 122,828 |
| Torrance | 12/18/79 | 54 | 16,930,000 | 34,442 | 11 | 10,088 |
| Walnut | 9/26/08 | 1 | 350,000 | 2,183 | 5 | 1,371 |
| West Covina | 2/4/12 | 45 | 11,831,900 | 77,642 | 1 | 1,354 |
| West Hollywood | 6/18/87 | 55 | 17,651,800 | 52,450 | 24 | 23,976 |
| Westlake | 9/26/08 | 33 | 9,896,100 | 17,444 | 3 | 566 |
| Whittier | 1/16/81 | 36 | 10,854,400 | 47,070 | 15 | 17,990 |

### *Flood Insurance Reform*

The NFIP is currently $24 billion in debt and taxpayers will be forced to pay for any additional payouts until that situation is solved. The Biggert-Waters Flood Insurance Reform Act of 2012 changed the NFIP to make it more sustainable. It requires the NFIP to raise rates to reflect true flood risk, make the program more financially stable, and change how FIRM updates impact policyholders. The new law eliminates some artificially low rates and discounts, as well as subsidies to certain pre-FIRM policyholders. Most flood insurance rates will move to reflect full risk, and flood insurance rates will rise on some policies. There are investments property owners and communities can make to reduce the impact of rate changes.

The Homeowner Flood Insurance Affordability Act of 2014 delays the increases in flood insurance premiums mandated under the Biggert–Waters Flood Insurance Reform Act of 2012 for four years. During that time, FEMA is supposed to come up with a plan to make the premiums cheaper and reassess its maps of areas that are likely to flood and therefore require flood insurance. The 2014 law also allows those who sell their homes to pass lower flood insurance premiums on to the next homeowner.

These laws will have profound impacts on the costs of flood insurance and implementation of the NFIP. How changes will impact local communities is not yet known. However, 69 percent of current policies in force in the planning area are the pre-FIRM subsidized policies that the legislation is targeting.

## 8.3 CRITICAL FACILITIES AND INFRASTRUCTURE

Hazus-MH assesses the potential damage to critical facilities from flooding using depth/damage function curves. Based on historical averages, these curves indicate potential damage amounts as a percentage of the value of structures or contents. Actual damage to facilities may be less than these conservative estimates. For critical buildings, Hazus also estimates functional down-time, which is the time it might take to restore a facility to 100 percent of its functionality after flood damage occurs. Results for the 100-year and 500-year flood events are summarized in Table 8-8 through Table 8-10.

**TABLE 8-8.**
**ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM 100-YEAR FLOOD**

| | Number of Facilities Affected | % of Total Value Damaged (Each Facility) | | Days to 100% Functionality |
|---|---|---|---|---|
| | | Building | Contents | |
| Medical and Health | 1 | 0 | 0 | N/A |
| Protective Function | 1 | 10 | 20 | 480 |
| Schools | 6 | 5.0 – 13.33 | 27.0 – 72.5 | 480 - 630 |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-9.**
**ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM 500-YEAR FLOOD**

| | Number of Facilities Affected | % of Total Value Damaged (Each Facility) | | Days to 100% Functionality |
|---|---|---|---|---|
| | | Building | Contents | |
| Medical and Health | 1 | 0 | 0 | 360 |
| Protective Function | 5 | 17 | 44 | 560 |
| Schools | 28 | 12 | 48 | 554 |
| Hazardous Materials | 37 | 8 | 15 | — |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

**TABLE 8-10.**
**ESTIMATED DAMAGE TO CRITICAL INFRASTRUCTURE**
**FROM 100-YEAR AND 500-YEAR FLOODS**

| | 100-Year Flood | | 500-Year Flood | |
|---|---|---|---|---|
| | Number of Facilities Affected | % of Total Value Damaged (Each Facility) | Number of Facilities Affected | % of Total Value Damaged (Each Facility) |
| Wastewater | 1 | 8 | 2 | 9 |
| Communications | 0 | N/A | 2 | 1.36 |
| Bridges | 68 | 0.31 | 106 | 1 |
| Transportation | 1 | 2 | 6 | 2 |
| Dams | 0 | N/A | 5 | — |

Note: Sources of data used in Hazus modeling are described in Table 5-1.

The assessment shows that the percentage of critical facilities and infrastructure expected to experience any damage at all is small, and that the amount of damage for each affected facility is small:

- Of the 603 critical facilities identified in the planning area (see Table 3-5), only nine are within the 100-year floodplain (see Table 7-6) and only eight of those are predicted to experience any damage from a 100-year event (see Table 8-8). At those eight facilities, the Hazus worst-case estimate of building damage ranges from negligible to only 13 percent of the total building value.
- Of the 1,046 pieces of critical infrastructure identified in the planning area (see Table 3-6), only 76 are within the 100-year floodplain (see Table 7-8) and only 70 of those are predicted to experience any damage from a 100-year event (see Table 8-10). The Hazus worst-case estimate of damage for affected critical infrastructure is less than 1 percent of total value for the bridges that make up all but one of the affected critical infrastructure structures.

## 8.4 ENVIRONMENT

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. The principle environment impact from flood is the loss of aquatic habitat. One possible measure of environmental impacts from flooding is by looking at the amount of debris that that would be generated by each scenario flood event. Hazus-MH includes a debris estimation component. These estimates can provide local governments feedback for not only what they need to deal with through recovery, but also what the potential exposure is to debris that could be carried by floodwaters. The Hazus-MH debris estimates for each of the scenario flood events for the planning area are shown in Table 8-11.

**TABLE 8-11.**
**ESTIMATED FLOOD -CAUSED DEBRIS**

| | Debris[a] to Be Removed (tons) |
|---|---|
| 10-Year Flood Event | 600 |
| 50-Year Flood Event | 1,646 |
| 100-Year Flood Event | 5,784 |
| 500-Year Flood Event | 19,121 |
| County Floodways | 2,905 |

a. The Hazus flood debris model focuses on building-related debris, and does not address contents removal or additional debris loads such as vegetation and sediment. The Los Angeles County Department of Public Work's Sediment Management Strategy lists the estimated amounts of sediment produced in a Design Debris Event.

# CHAPTER 9.
# CLIMATE CHANGE CONSIDERATIONS FOR FLOODPLAIN MANAGEMENT

This chapter presents an overview of current understandings of how climate change will affect the Los Angeles region and implications for floodplain management. Information on climate change is being continually updated, and the information presented here is a snapshot of the best available information at the time this document was written.

## 9.1 WHAT IS CLIMATE CHANGE?

Climate, consisting of patterns of temperature, precipitation, humidity, wind and seasons, plays a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. "Climate change" refers to changes over a long period of time. Worldwide, average temperatures have increased 1.4ºF since 1880 (NASA, 2015). Although this change may seem small, it can lead to large changes in climate and weather.

The warming trend and its related impacts are caused by increasing concentrations of carbon dioxide and other greenhouse gases in the earth's atmosphere. Greenhouse gases are gases that trap heat in the atmosphere, resulting in a warming effect. Carbon dioxide is the most commonly known greenhouse gas; however, methane, nitrous oxide and fluorinated gases also contribute to warming. Emissions of these gases come from a variety of sources, such as the combustion of fossil fuels, agricultural production and changes in land use. According to the U.S. Environmental Protection Agency (EPA), carbon dioxide concentrations measured about 280 parts per million (ppm) before the industrial era began in the late 1700s and have risen 43 percent since then, reaching 399 ppm in 2014 (see Figure 9-1). The EPA attributes almost all of this increase to human activities (U.S. EPA, 2015).

If greenhouse gas emission are not reduced, the following changes are projected for Los Angeles County (C-Change.LA, 2015):

- By the middle of this century, the region will experience temperatures similar to current temperatures only about 75 to 80 percent of the time (274 to 292 days per year), with temperatures hotter than those currently experienced mostly in late summer and early fall.
- By the end of this century, the percentage of temperatures similar to current temperatures will decrease to only 50 to 65 percent of the time (183-243 days per year), with the greatest increases in December to January and July to August.

## 9.2 HOW CLIMATE CHANGE AFFECTS FLOODPLAIN MANAGEMENT

An essential aspect of floodplain management is predicting the likelihood of flooding in a planning area. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of flood events remains essentially unchanged over time. Thus, averages based on the past frequencies of floods are used to estimate future frequencies: if a river has flooded an average of once every five years for the past 100 years, then it can be expected to continue to flood an average of once every five years. But the assumption that future flooding behavior will be equivalent to past behavior is not valid if climate conditions are changing.

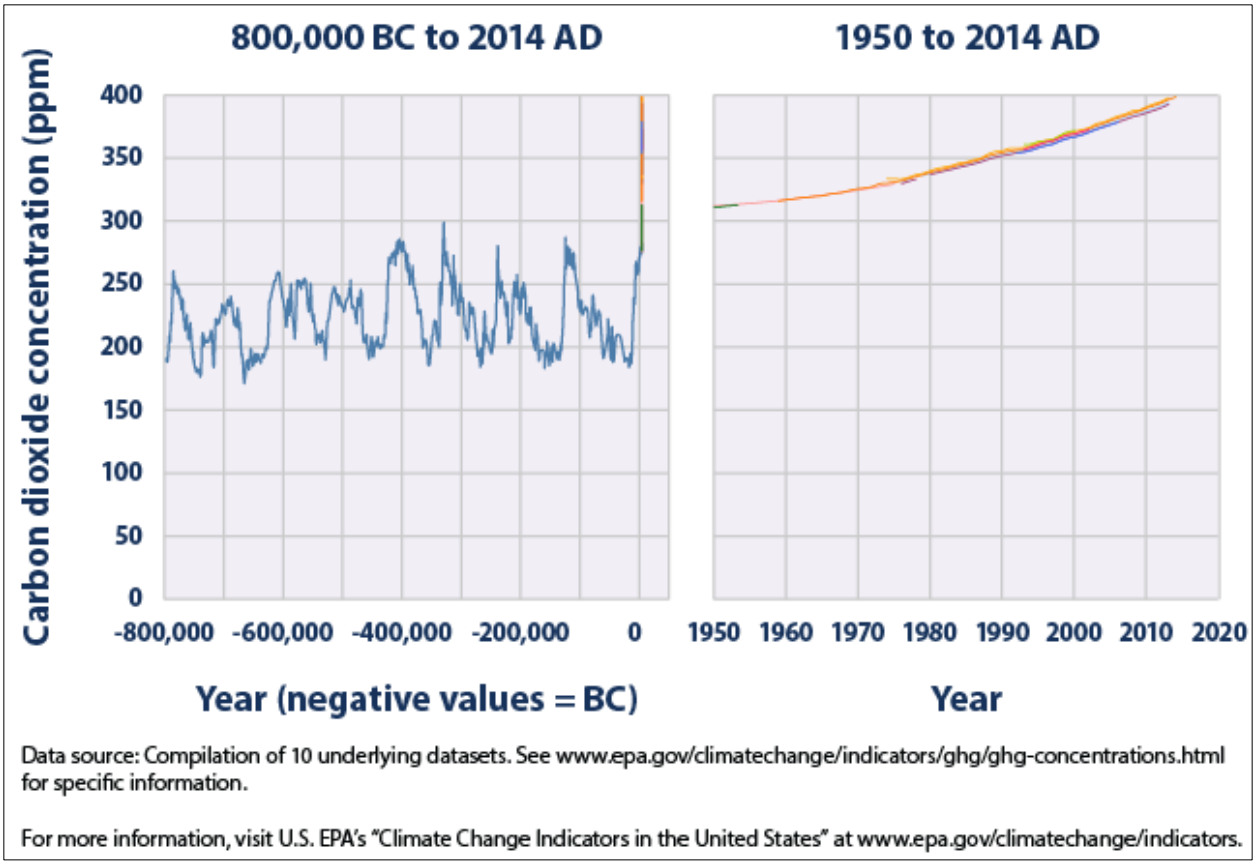



*Figure 9-1. Global Carbon Dioxide Concentrations Over Time*

Climate involves not only average temperature and precipitation but also the frequency and intensity of extreme weather events. According to studies by the University of California, Los Angeles and the U.S. Bureau of Reclamation, the average amount of precipitation that the Los Angeles Region receives in a typical year may be affected only slightly by climate change or not at all; however, there is potential for significant change in the intensity of individual storms, the amount of precipitation during the rainy season, or rainfall amounts in years of extreme wet weather or extreme dry weather. The frequency of flooding will not remain constant if broad precipitation patterns change over time. While predicting changes in flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment. For this reason, an understanding of climate change is pertinent to floodplain management activities. Information about how climate patterns are changing provides insight on the reliability of future flooding projections used in mitigation analysis.

Climate change will affect the people, property, economy and ecosystems of Los Angeles County in a variety of ways. Its impacts are most frequently associated with negative consequences and increased risk, such as increased flooding or increased heat-related public health concerns. The most important effect for the development of this plan is that climate change will have a measurable impact on the occurrence and severity of flooding. This chapter summarizes current understandings about climate change in order to provide a context for the recommendation and implementation of flood hazard mitigation measures in Los Angeles.

## 9.3 CURRENT GLOBAL INDICATIONS OF CLIMATE CHANGE

The major scientific agencies of the United States—including the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA)—agree that climate change is occurring. Multiple temperature records from all over the world have shown a warming trend, and the Intergovernmental Panel on Climate Change (IPCC) has stated that the warming of the climate system is unequivocal (IPCC, 2014). Of the 10 warmest years in the 134-year record, all but one (1998) occurred since 2000, and 2015 was the warmest year on record (NASA, 2016). Worldwide, average temperatures have increased 1.4ºF since 1880 (NASA, 2016).

Rising global temperatures have been accompanied by other changes in weather and climate. Many places have experienced changes in rainfall resulting in more intense rain, as well as more frequent and severe heat waves (IPCC, 2014). The planet's oceans and glaciers have also experienced changes: oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising (NASA, 2016). Global sea level has risen approximately 6.7 inches, on average, in the last 100 years (NASA, 2016). This has already put some coastal homes, beaches, roads, bridges, and wildlife at risk (USGCRP, 2009).

## 9.4 PROJECTED FUTURE IMPACTS

### 9.4.1 Global Projections

Scientists project that Earth's average surface temperature will continue to rise between 0.5ºF and 8.6ºF by 2100 (IPCC, 2014). Some research has concluded that every increase of 2ºF in average global average temperature can have the following impacts (NRC, 2011b):

- 3 to 10 percent increases in the amount of rain falling during the heaviest precipitation events, which can increase flooding risks
- 5 to 10 percent decreases in stream flow in some river basins.

The amount of sea level rise expected to occur as a result of climate change will increase the risk of coastal flooding for millions to hundreds of millions of people around the world, many of whom would have to permanently leave their homes (IPCC, 2014). By 2100, sea level is expected to rise another 1 to 4 feet, with an uncertainty range of 0.66 to 6.6 feet (Melillo et al., 2014). Rising seas will make coastal storms and the associated storm surges more frequent and destructive. Flooding may also become more intense even in areas where precipitation is expected to decline (Melillo et al., 2014). What is currently termed a once-in-a-century coastal flooding event could occur more frequently.

### 9.4.2 Projections for the County of Los Angeles

#### *Temperature*

In the Los Angeles region by 2050, the frequency of heat waves and hot days (i.e., days on which the temperature exceeds 95ºF) is expected to increase. The frequency may triple in coastal areas and central Los Angeles, quadruple in the San Fernando Valley and San Gabriel Valley, and increase five- or six-fold in desert and mountainous regions. Temperature changes are already occurring, as the 2013-2014 winter season was the warmest winter on record in the County. Each of the past three decades has been recorded as the hottest on record (Los Angeles County Department of Public Health, 2014).

Figure 9-2 illustrates projections of temperature changes in the County of Los Angeles over the next several decades. The brown dot shows average present-day temperatures in August, the blue dot shows predicted

future average August temperatures under a scenario where greenhouse gas emission reductions are accomplished on a global scale, and the red dot shows predicted future average August temperatures if no major mitigation activities occur. Without mitigation, temperatures could increase as much as 7ºF by 2100 (C-Change.LA, 2015).

*Source: C-Change.LA, 2014*

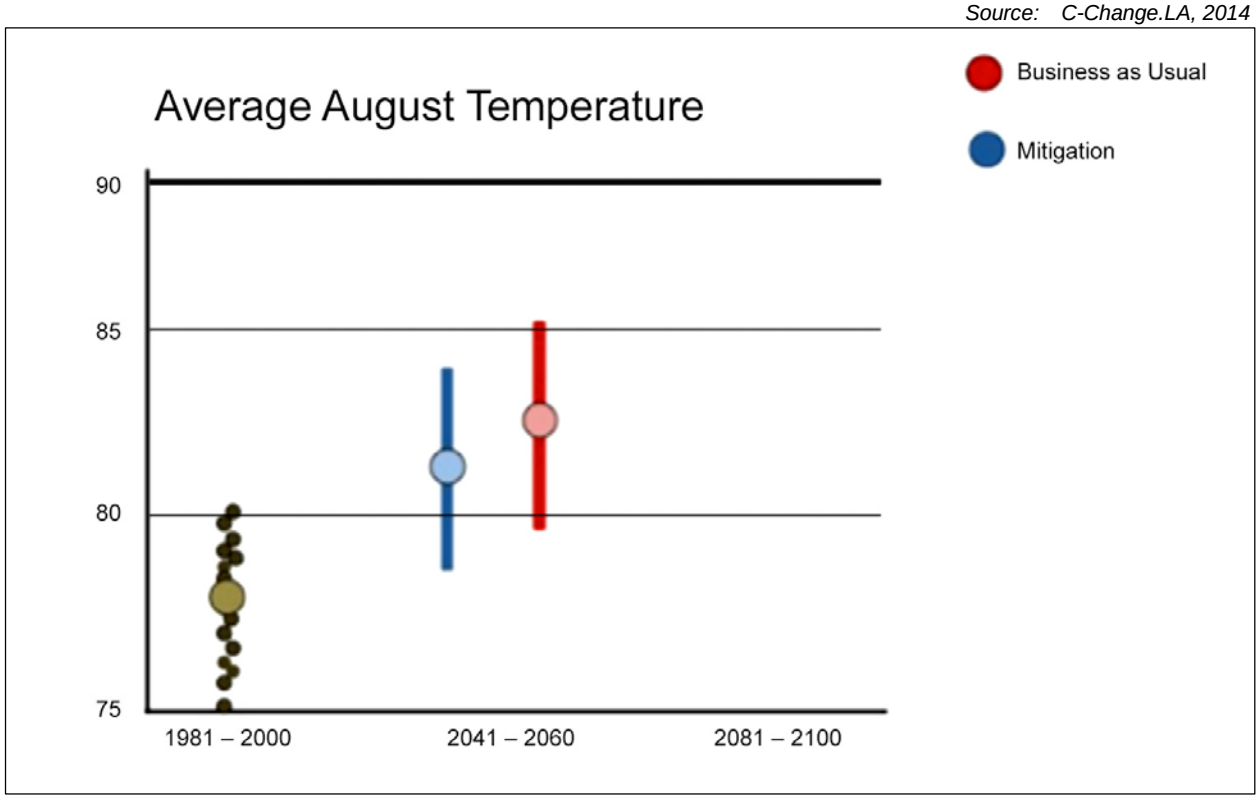



*Figure 9-2. Current and Predicted Rising Temperatures in the Los Angeles Region*

Temperature studies indicate that coastal areas will be less warm than the inland areas, while mountain peaks will experience the greatest amount of warming, due to loss of snow cover and resulting loss of reflection of the sun's heat (C-Change.LA 2014).

### *Precipitation*

The total amount of precipitation in the Los Angeles region over the coming century is expected to be similar to that of recent decades, with wide swings from year to year. However, a higher percentage of precipitation is expected to be in the form of rain rather than snow. This could increase the risk of flooding and decrease windows of time to capture local water (KCET 2016).

### *Snow and Runoff*

Annual snowfall could decrease by as much as 42 percent in the region's mountains by 2050, and snowpack could melt more than two weeks earlier in the season if greenhouse gas emissions are not reduced globally (KCET n.d.; C-Change.LA 2015). By the end of the century, two-thirds of present day snowfall is expected to be lost (C-Change.LA 2015). This not only would impact the County's potential for snowmelt floods, but it also could reduce freshwater supplies. Such significant changes in climate could lead to more frequent, intense, and longer severe weather events. A rising frequency of winter storms would also impact stream flows and increase flood rates (Los Angeles County Department of Public Health 2014).

### *Sea Level*

Sea levels are expected to rise in the Los Angeles region over the next century. Current estimates indicate an increase of 5 to 24 inches between 2000 and 2050 and 17 to 66 inches from 2000 to 2100 (USC, n.d.). A 55-inch sea level rise would cause Los Angeles County coastal areas subject to inundation from a 100-year flood to increase 46 percent, from 3,952 acres to 7,293 acres (California Energy Commission, 2015). The population vulnerable to such flooding would increase from 86,000 to 149,300, a 73-percent increase (Cal EMA, 2012).

Given these vulnerabilities, a team of regional partners from local, state and regional agencies are working to develop a comprehensive shoreline change and coastal erosion model (Coastal Storm Modeling System, CoSMoS) that will provide "region-specific flood hazard projections at a detailed parcel scale from Point Conception to the Mexican border" (USC, n.d.). This project, known as *Regional AdaptLA: Coastal Impacts Planning in the Los Angeles Region*, will also work with local jurisdictions toward climate adaptation capacity building, so that the model results can be effectively used in local planning (USC, n.d.). Forty sea level rise and coastal storm scenarios will be modeled, providing projections for coastal flooding, waves, currents, beach change, cliff retreat, and river discharge. These model results should aid communities in identifying specific vulnerabilities related to coastal storms and sea level rise (USC, n.d.).

## 9.5 RESPONSES TO CLIMATE CHANGE

### 9.5.1 Mitigation and Adaptation

Communities and governments worldwide are working to address, evaluate and prepare for climate changes that are likely to impact communities in coming decades. Generally, climate change discussions encompass two separate but inter-related considerations: mitigation and adaptation. The term "mitigation" can be confusing, because its meaning changes across disciplines:

- Mitigation in restoration ecology and related fields generally refers to policies, programs or actions that are intended to reduce or to offset the negative impacts of human activities on natural systems. Generally, mitigation can be understood as avoiding, minimizing, rectifying, reducing or eliminating, or compensating for known impacts (CEQ, 1978).
- Mitigation in climate change discussions is defined as "a human intervention to reduce the impact on the climate system." It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks (U.S. EPA, 2013g).
- Mitigation in emergency management is typically defined as the effort to reduce loss of life and property by lessening the impact of disasters (FEMA, 2013).

In this chapter, mitigation is used as defined by the climate change community. In the other chapters of this floodplain management plan, mitigation is primarily used in an emergency management context.

Adaptation refers to adjustments in natural or human systems in response to the actual or anticipated effects of climate change and associated impacts. These adjustments may moderate harm or exploit beneficial opportunities (U.S. EPA, 2013g).

Mitigation and adaptation are related, as the world's ability to reduce greenhouse gas emissions will affect the degree of adaptation that will be necessary. Some initiatives and actions can both reduce greenhouse gas emissions and support adaptation to likely future conditions. One subset of this type of strategy is known as ecosystem-based adaptation. Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change. This

includes the sustainable management, conservation and restoration of specific ecosystems that provide key services. In terms of floodplain management, many such actions are related to preserving or enhancing the natural beneficial functions of floodplain systems. Riparian forests can bind soils and hold large volumes of water during periods of significant precipitation, releasing it through the year. Floodplains can absorb large volumes of water during peak flows. Coastal ecosystems can hold out against storms, attenuating waves and reducing erosion.

The County of Los Angeles has already begun implementing progressive mitigation actions, and this plan is one way in which the County intends to identify and achieve more mitigation projects. The County's Community Climate Action Plan, an element of the General Plan, was developed to reduce greenhouse gas emissions associated with activities in unincorporated communities. The Community Climate Action Plan establishes a greenhouse gas reduction target that is consistent with state efforts. Potential solutions were developed in five areas: green building and energy; land use and transportation; water conservation and wastewater; waste reduction, reuse and recycling; and land conservation and tree planting. Although many of these actions are not directly tied to flood mitigation, most will indirectly serve to reduce future flood-related hazard events by reducing sea level rise and promoting green space and conservation of resources (Los Angeles County Department of Regional Planning 2015a).

### 9.5.2 Future Modeling Efforts

Most current modeling efforts are unable to assess climate change at a resolution small enough to determine specific impacts for individual communities. Typically, generalized assessments of larger climatic regions have been used to determine impacts that are most likely to affect these communities. Climate researchers worldwide are working to improve modeling efforts at more refined scales. At the University of California, Los Angeles, for example, research efforts are being conducted to model impacts for the greater Los Angeles region (C-Change.LA, 2015). As such models are developed in the future, the risk assessment presented in this floodplain management plan may be enhanced to better measure these impacts.

### 9.5.3 Response To Climate Change in California

California Assembly Bill 32, The California Global Warming Solutions Act, addresses greenhouse gas emissions. This law focuses on reducing greenhouse emissions rather than adapting to likely climate impacts. The success of implementing such reductions in California and worldwide will affect the degree to which flood management systems will need to be adapted to changing conditions.

## 9.6 POTENTIAL CLIMATE CHANGE IMPACT ON FLOOD HAZARDS

Developing projections of future climate change for a specific region is challenging, especially longer term projections. The further out a prediction reaches, the more subject to changing dynamics it becomes. Modeling that is currently available is limited in its ability to produce quantitative estimates of the effect of climate change on flood hazard risks; however, an understanding of the basic features of climate change allows for the following qualitative assessments of impacts on flood-related hazards. This overview serves as a basis for evaluating how risk will change as a result of future climate change impacts.

### 9.6.1 Coastal Erosion

Coastal areas may be impacted by climate change in different ways. Coastal areas are sensitive to sea-level rise, changes in the frequency and intensity of storms, increases in precipitation, and warmer ocean temperatures. According to NASA, warmer temperatures may lead to an increase in frequency of storms, thus leading to more weather events that cause coastal erosion (NASA, no date).

A study on increased storm wave heights from climate change indicated that sea level rise alone could double rates of coastal erosion and flooding and that increased frequency of major El Niño events (up to double the current frequency) could quadruple the rates of coastal erosion and flooding. Sea level rise and increased El Niño frequency combined could cause up to an order of magnitude increase in coastal erosion and flood frequency. While erosion rates would still be partially dependent on beach slopes and dune crest elevations, this possibility highlights the importance of incorporating climate change and climate control into mitigation practices (Ruggiero 2008 ).

## 9.6.2 Dam Failure

With numerous dams located throughout the Los Angeles region, the possibility of dam failure based on climate change is a key consideration, especially due to the densely populated areas downstream of most dams. In Los Angeles County there are generally two major types of dams—water supply and flood control. Water supply dams typically have stormwater diversions that direct stormwater away from their reservoirs due to water quality measures. Flood control dams, like those owned and operated by Los Angeles County Flood Control District, have reservoir water levels that are largely dependent on the weather. The design of these dams account for multiple factors, including the anticipated rainfall and runoff flows that could be expected within the tributary canyons. This rainfall and runoff, often portrayed on hydrograph plots as a function of varying time periods, can be significantly impacted by changes in the weather patterns. If the reservoir water surface elevations behind a dam increase more quickly or more frequently because of changing weather patterns, operations at the dam may be impacted and downstream communities may experience larger flows more frequently.

To protect against failures related to extreme rainfall runoff or water inflows from other sources, all dams have spillways that serve to release large amounts of reservoir water whenever the water surface elevations reach the spillway height. For flood control dams, spillway flows generally occur when rainfall runoff flow rates (reservoir inflows) exceed the capacity of the outlet control valves that release reservoir water into the downstream river or channel. Spillways significantly decrease the probability of dam overtopping and minimize the possibility of structural failure of a dam and erosion of the side slopes above the downstream water course. The State Department of Water Resources has jurisdiction over all non-federal dams that are over a certain height and/or storage. As a result, the state requires all dams within its jurisdiction to have spillways sized to pass the “probable maximum flood” event, which is the theoretical largest flood that could occur at a location based on the tributary watershed and probable maximum precipitation. The Los Angeles County Flood Control District is modifying its dams to meet the latest design standards to safely pass the probable maximum flood. As a result, dam overtopping scenarios in even the most extreme events are unlikely. Though spillway events can result in above-average discharges downstream, such events are not considered failures but rather part of the intended design. Climate change may increase the probability of spillway events and therefore could warrant corresponding design changes to downstream infrastructure, but is unlikely to increase the probability of dam failure.

## 9.6.3 Flood

### *Changes in Hydrology*

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward,

model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g. 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding (USGCRP, 2009). Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams reducing reservoir capacities, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts (Jin et al., 2015).

As hydrology changes, what is currently considered a 100-year flood may strike more often, leaving many communities already exposed to flood hazards at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.

### *Changes in Precipitation*

A 2014 study on precipitation by the University of California, Los Angeles found that Los Angeles County can expect approximately the same amount of total precipitation this century as it experienced the previous century, but that yearly precipitation amounts can vary significantly. Similar results were found in a 2013 study by the U.S. Bureau of Reclamation (U.S. Bureau of Reclamation, 2013). Therefore, even though total rates of precipitation should remain constant, Southern California could have an increased risk of flooding and smaller time to capture local water. This is a result of most of the precipitation falling in the form of rain, not snow, thus increasing winter flow rates (C-Change.LA, 2014).

## 9.6.4 Storm Surge

Storm surges are generated by the strong winds and intense low pressure associated with tropical cyclones, hurricanes, and severe storms. While not all severe storms create significant levels of storm surge, the surge index record shows a significant positive correlation between warmer years and extreme events (i.e., Hurricane Katrina-level events). Figure 9-3 correlates temperature with the past and projected future number of Hurricane Katrina-magnitude surge events per decade (separate lines on the figure represent results based on different modeling techniques and data sources). The results show an overall positive correlation between temperature increase and storm surge frequency (Grinsted et al., 2013).

Source: Grinsted et al., 2013

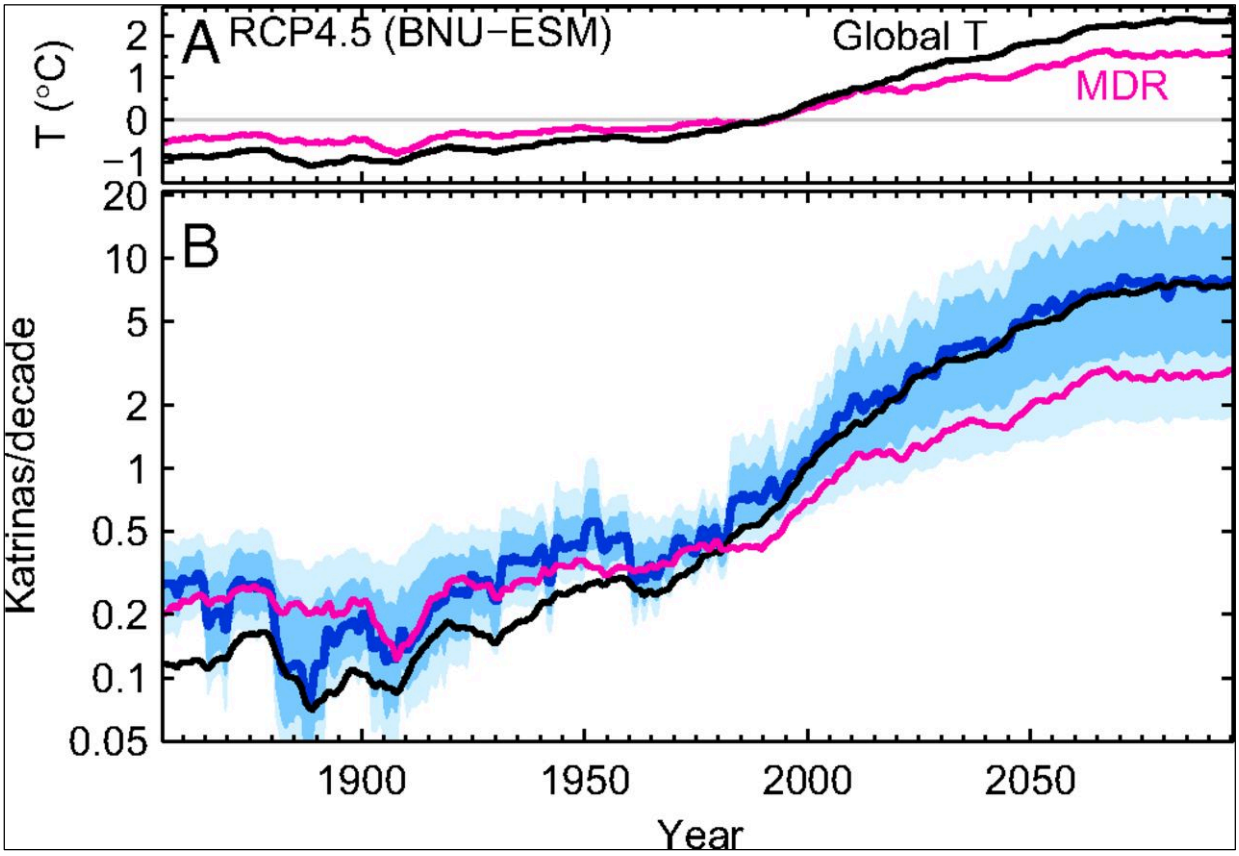



*Figure 9-3. Surge Event Frequency over Time and Climate Changes*

## 9.6.5 Sea Level Rise

Changes in global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity are captured in long-term sea level records. Sea levels provide a key to understanding the impact of climate change (NOAA 2012). Warmer temperatures result in the melting of glaciers and ice sheets. This melting means that less water is stored on land, so there is a greater volume of water in the oceans. Water also expands as it warms, and the heat content of the world's oceans has been increasing over the last several decades.

Sea level rise increases the risks coastal communities face from coastal hazards (floods, storm surges, and chronic erosion), as well as other related hazards like flooding near the mouths of streams, landslides, and seawater well intrusion. It may also lead to the loss of important coastal habitats, wetlands, and estuaries. In fact, sea level rise may have a stronger influence on hazard occurrences than an increase in El Niño events (Ruggiero 2008).

# PART 3 —
# MITIGATION STRATEGY

# CHAPTER 10.
# GUIDING PRINCIPLE, GOALS AND OBJECTIVES

This chapter identifies goals for reducing long-term vulnerabilities to flooding (CRS Step 6). After reviewing the goals and objectives identified for the 2010 plan and for other locally relevant planning documents, the Steering Committee developed updated goals and objectives and a mission statement. This work was completed through facilitated discussions over several meetings. Goals were selected that support the mission statement. Objectives were selected that meet multiple goals.

## 10.1 MISSION STATEMENT

A mission statement focuses the range of objectives and actions to be considered. The mission statement for the 2015 floodplain management plan is as follows:

> *Protect life, property, the economy and the environment of Los Angeles County by identifying and communicating risks and sustainable actions to reduce flood hazards.*

## 10.2 GOALS

The effectiveness of a mitigation strategy is assessed by determining how well its goals are achieved. The Steering Committee established the following updated goals for the 2015 floodplain management plan:

1. Protect life, safety, property and economy.
2. Work with local citizens and watershed management groups so that residents understand the flood hazard of the region based on best available data and science.
3. Increase resilience of infrastructure and critical facilities.
4. Account for flood risk in land use and planning.
5. Preserve, enhance or restore the natural environment's floodplain functions.
6. Encourage the development and implementation of long-term, cost-effective and environmentally sound mitigation projects.

## 10.3 OBJECTIVES

The following objectives were selected that meet multiple goals:

1. Work cooperatively with public agencies with responsibility for flood protection, and with stakeholders in planning for flood and inundation hazards.
2. Utilize best available data, science, and technologies to improve understanding of the location and potential impacts of flood hazards.
3. Provide state, county and local agencies and stakeholders with updated information about flood hazards, vulnerabilities, and mitigation measures.
4. Create a public outreach strategy.

5. Discourage new development in known flood hazard areas or ensure that, if development occurs in those areas, it is done in a way to minimize flood risk.
6. Consider open space land uses within known flood hazard areas.
7. Provide the highest degree of flood hazard protection at the least cost by working with environmentally friendly natural systems and by using prevention as the first priority.
8. Retrofit, purchase and relocate structures in known flood hazard areas, especially those known to be repetitively damaged.
9. Provide flood protection by maintaining flood control systems.
10. Sustain reliable local emergency operations and facilities during and after a flood event.
11. Consider climate change implications in planning for flood and inundation hazards.

# CHAPTER 11.
# MITIGATION INITIATIVES

## 11.1 ALTERNATIVES ANALYSIS

This section identifies a comprehensive range of alternatives that the County could consider to mitigate the flood issues identified by this plan. It provides a wide range of activities to ensure that all possible measures are explored, beyond the traditional approaches of flood control, acquisition, and regulation of land use. Presenting a complete range of possible alternatives diversifies the Comprehensive Floodplain Management Plan and positions it to be able to respond to changing conditions affecting the food hazard. An action that might not be feasible today could become feasible in the future due to a change in programs, capabilities or available resources. The resources in this section provide options for the County to consider as it implements and maintains this plan, in order to address changing conditions in mapped floodplains.

A Steering Committee session was held on January 27, 2015 to assess local strengths, weaknesses, obstacles and opportunities related to floodplain management. This meeting was the basis for considering and selecting mitigation actions for the floodplain management plan. The planning team prepared a catalog of mitigation alternatives based on the findings of this meeting (CRS Step 7). The Steering Committee reviewed and updated the catalog based on findings of public outreach efforts, the risk assessment results, and the actions identified in the 2010 plan. The resulting catalog includes alternatives that are categorized in three ways:

- By who would have responsibility for implementation:
  - Public sector (citizens of Los Angeles County)
  - Private sector (non-governmental parties)
  - Government sector (federal, state and local).
- By what the alternative would do:
  - Manipulate the flooding hazard
  - Reduce exposure to the flooding hazard
  - Reduce vulnerability to the flooding hazard
  - Increase the ability to respond to or be prepared for the flooding hazard.

The catalog provides a baseline of mitigation alternatives that are backed by a planning process, are consistent with the goals and objectives, and are within the capabilities of Los Angeles to implement. However, not all the alternatives meet all the selection criteria considered by the Steering Committee. The enhanced catalog was used by the planning team to select flood hazard mitigation actions.

### 11.1.1 Alternatives to Mitigate the Flood Hazard

#### *Public Sector Actions*

The following actions by the public sector have the potential to mitigate the flood hazard:

- Manipulate the flooding hazard:
  - Refrain from obstructing stormwater drains and culverts

  - Increase water conservation efforts
  - Install local stormwater capture systems
- Reduce exposure to the flooding hazard:
  - Locate outside of hazard area
  - Elevate utilities above base flood elevation
  - Institute low-impact development techniques on property
  - Assess projects to determine if they may inadvertently increase flood risk
- Reduce vulnerability to the flooding hazard:
  - Retrofit house (elevate house above base flood elevation)
  - Elevate items within house above base flood elevation
  - Build new house above base flood elevation
  - Floodproof non-residential structures
- Increase the ability to respond to or be prepared for the flooding hazard
  - Comply with National Flood Insurance Program
  - Buy flood insurance
  - Develop household mitigation plan, such as retrofit savings, communication capability with outside, 72-hour self-sufficiency during and after an event
  - Be aware of evacuation routes
  - Educate yourself on flood risk from related hazards, such as wildfire
  - Participate in Community Emergency Response Team training

### *Private Sector Actions*

The following actions by the private sector have the potential to mitigate the flood hazard:

- Manipulate the flooding hazard:
  - Refrain from obstructing stormwater drains and culverts
  - Increase water conservation efforts
  - Install local stormwater capture systems
- Reduce exposure to the flooding hazard:
  - Locate business critical facilities or functions outside hazard area
  - Institute low-impact development techniques on property
  - Assess projects to determine if they may inadvertently increase flood risk
- Reduce vulnerability to the flooding hazard:
  - Build redundancy for critical functions; retrofit critical buildings
  - Provide flood-proofing measures when new critical infrastructure must be located in floodplains
- Increase the ability to respond to or be prepared for the flooding hazard
  - Increase capability by having cash reserves for reconstruction
  - Support and implement hazard disclosure for the sale of property in identified risk zones
  - Solicit cost-sharing through partnerships with private sector stakeholders on projects with multiple benefits

### *Government Sector Actions*

The following actions by governments have the potential to mitigate the flood hazard:

- Manipulate the flooding hazard:
  - Clear stormwater drains and culverts
  - Perform dredging and levee construction, providing retention areas.
  - Provide structural flood control: levees, dams, channelization, revetments
  - Construct regional stormwater control facilities
  - Harden areas with significant erosion concerns
  - Promote/retain natural vegetation in areas with significant erosion concerns
  - Identify and implement sediment management strategies
  - Increase water conservation efforts
  - Continue to pursue holistic floodplain management and opportunities for promoting or preserving natural floodplain function
  - Develop and promote local stormwater capture systems
- Reduce exposure to the flooding hazard:
  - Locate or re-locate critical facilities outside of hazard areas
  - Acquire or relocate structures from identified repetitive loss properties
  - Promote open space uses in identified high hazard areas via techniques such as planned unit developments, easements, setbacks, greenways, sensitive area tracks
  - Adopt land development criteria such as planned unit developments, density transfers, clustering
  - Institute low impact development techniques on property
  - Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff
  - Perform a buildable lands analysis to determine areas where exposure may increase
  - Comply and work with provisions protecting endangered species within the County
- Reduce vulnerability to the flooding hazard:
  - Strengthen existing infrastructure
  - Provide redundancy for critical functions and infrastructure
  - Adopt appropriate regulatory standards such as cumulative substantial improvement/damage, freeboard, lower substantial damage threshold, compensatory storage
  - Stormwater management regulations and master planning
  - Adopt no-adverse-impact floodplain management policies that strive to avoid increasing the flood risk on downstream communities
  - Encourage mitigation of private property
  - Perform regular inspections and assessments of locally owned or maintained flood control infrastructure
  - Replace undersized culverts
  - Provide permanent protection for pump stations at risk of flooding
  - Identify and mitigate drainage issues resulting in ponding
  - Enhance road drainage programs.
  - Ensure that the permitting process is consistent with the adopted floodplain management ordinance
  - Elevate or relocate roads subject to frequent flooding
  - Develop guideline for floodplain fringe protections
  - Increase freeboard regulations
  - Account for climate change in relevant codes
  - Develop and maintain emergency warning systems
- Increase the ability to respond to or be prepared for the flooding hazard

- Produce more accurate flood hazard maps or identify areas for further study
- Provide technical information and guidance
- Enact tools to help manage development in hazard areas (stronger controls, tax incentives, information, enforcement of the NFIP)
- Include retrofit or replacement of critical systems in capital improvement programs
- Develop strategy to take advantage of post-disaster opportunities
- Warehouse critical infrastructure components
- Develop and adopt a continuity of operations plan
- Improve and build on Community Rating System program classification
- Maintain existing data and gather new data needed to define risks and vulnerability
- Provide training for staff and decision-makers in floodplain management
- Create a building and elevation inventory of structures in the floodplain
- Develop and implement a public information strategy
- Charge a hazard mitigation fee on all new permits to create a hazard mitigation funding source for initiatives or grant cost-share requirements
- Develop a flood task force
- Integrate floodplain management policies into other local planning mechanisms
- Develop and maintain a system for perishable data collection after a flood event
- Develop a framework and continue efforts for cooperation between agencies and districts in flood mitigation activities (e.g. sand and sand bag deployment)
- Retain good standing in National Flood Insurance Program
- Integrate flood mitigation opportunities into capital improvement programs
- Create a fund or earmark funds for in-kind contributions as grant opportunities become available
- Produce after-action reports on flood events
- Develop and update evacuation routes
- Participate in information sharing with other agencies (e.g. Corps of Engineers, NWS)
- Develop and update memorandums of understanding with other local jurisdictions and continue to coordinate emergency response and preparedness activities
- Identify sources of nuisance flooding
- Review and update floodplain damage prevention ordinances
- Require or encourage rapid damage assessment training
- Map locations of storm drains, catch basins and dry wells so they may be cleared
- Identify lake debris collection sites
- Continue to develop post-fire outreach strategies for impacted residents
- Develop and diversify public outreach materials
- Educate residents on types of projects that may inadvertently increase flood risk.
- Educate residents on nexus between water conservation, drought and flood
- Continue to identify opportunities for partnerships
- Promote the flood control district as a taxing authority to generate funding or identify sustainable funding solutions
- Support and implement hazard disclosure for the sale of property in identified risk zones and increase enforcement of disclosure provisions
- Put an emphasis on flash floods to clarify desert conditions, and provide mapping
- Map and create an inventory of open spaces with potential for beneficial functions
- Incorporate invasive species management into floodplain management activities
- Increase emergency services capabilities and public awareness of preparedness
- Sponsor/encourage/promote local Community Emergency Response Team activities
- Identify and monitor hotspots

## 11.1.2 Alternatives to Mitigate the Dam Failure Hazard

### *Public Sector Actions*

The following actions by the public sector have the potential to mitigate the dam failure hazard:

- Manipulate the dam failure hazard:
  - No actions by individuals have been identified that have the potential to manipulate the dam failure hazard.
- Reduce exposure to the dam failure hazard:
  - Relocate out of dam failure inundation areas
- Reduce vulnerability to the dam failure hazard:
  - Elevate your home to appropriate levels
  - Flood-proof your home to appropriate levels
- Increase abilities to respond to or be prepared for the dam failure hazard
  - Educate yourself on the risk associated with the dam failure hazard
  - Learn the evacuation routes for a dam failure event
  - Educate yourself on early warning procedures
  - Purchase flood insurance

### *Private Sector Actions*

The following actions by the private sector have the potential to mitigate the dam failure hazard for dams owned, operated and maintained by the private sector:

- Manipulate the dam failure hazard:
  - Dam removal
  - Heighten and/or strengthen the dam
- Reduce exposure to the dam failure hazard:
  - Replace earthen dams with hardened structures
- Reduce vulnerability to the dam failure hazard:
  - Flood-proof facilities in dam failure inundation areas
  - Ensure regularly scheduled inspection and maintenance of dams
- Increase abilities to respond to or be prepared for the dam failure hazard
  - Educate your employees on the probable impacts of a dam failure
  - Develop a continuity of operations plan
  - Develop and update emergency action plans
  - Educate employees on evacuation routes

### *Government Sector Actions*

The following actions by governments have the potential to mitigate the dam failure hazard for dams owned, operated and maintained by the government sector:

- Manipulate the dam failure hazard:

  - Dam removal
  - Heighten and/or strengthen dams
- Reduce exposure to the dam failure hazard:
  - Replace earthen dams with hardened structures
  - Relocate critical facilities out of dam failure inundation areas.
  - Seek open space land use opportunities in designated dam failure inundation areas
- Reduce vulnerability to the dam failure hazard:
  - Adopt higher regulatory floodplain standards in mapped dam failure inundation areas
  - Retrofit critical facilities in dam failure inundation areas
  - Consider low-density land uses in identified dam failure inundation areas
  - Ensure regularly scheduled engineering assessments of dams
- Increase abilities to respond to or be prepared for the dam failure hazard
  - Create scenario-based dam failure inundation area maps
  - Enhance emergency operations plan to include a dam failure component
  - Institute monthly communications checks with dam operators
  - Inform the public on risk reduction techniques
  - Adopt real-estate disclosure requirements for the sale of property in dam failure inundation areas
  - Establish early warning systems downstream of high hazard dams
  - Create and maintain proper inventory of dams
  - Update evacuation routes and educate the public on these routes
  - Identify succession planning and opportunities for passing on institutional knowledge
  - Develop and update emergency action plans
  - Promote the purchase of flood insurance in inundation areas

## 11.2 SELECTED MITIGATION INITIATIVES

The planning team and Steering Committee determined that some initiatives from the flood hazard mitigation catalog could be implemented to provide flood hazard mitigation benefits. Table 11-1 lists the recommended initiatives, the lead agency for each, and the proposed timeline. The parameters for the timeline are as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

A companion document prepared in conjunction with this plan, the *Los Angeles County Repetitive Loss Area Analysis*, provides a detailed assessment of areas in unincorporated Los Angeles County that have experienced repeated flood damage in the past, with recommended actions to mitigate flooding at each specific repetitive loss area.

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 1—Promote awareness of flood hazards to residents in flood hazard areas.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Regional Planning Department, Public Works (Building and Safety Division)<br>**Funding Source:** FEMA; Cal EMA; Public Works; County Regional Planning Department | Low | Ongoing | 1, 3, 4 | Yes-3 |
| 2—Develop and distribute flood protection information and materials to property owners, renters, and developers in high-risk areas.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Public Relations Group, Building and Safety Division, Land Development Division, Program for Public Information)<br>**Funding Source:** Public Works | Low | Ongoing | 3, 4 | Yes-21 |
| 3—Maintain a list of critical facilities located in FEMA-designated flood zones, provide flood protection information to operators of these critical facilities, and encourage the implementation of flood protection measures.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Los Angeles County Chief Executive Office Office of Emergency Management (CEO OEM), Public Works (Disaster Services Group)<br>**Funding Source:** Public Works; CEO OEM | Low | Ongoing | 1, 3 | No |
| 4—Investigate Repetitive Loss Properties identified by FEMA and update the Repetitive Loss Property and high-risk property list. Conduct the following flood control activities for these properties:<br>• Annually notify owners regarding local flood hazards and proper protection activities<br>• Provide technical advice regarding flood protection and flood preparedness<br>• Distribute a revised questionnaire to new Repetitive Loss Properties.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Building and Safety Division, Program for Public Information)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 2, 3, 4 | Yes-12, 20 |
| 5—Make sand bags available to flood risk property owners during the wet season, provide notifications of the availability of these materials, and track the distribution of the materials.<br>**Lead Agency:** Fire Department, Public Works (Administrative Services Division, Watershed Management Division)<br>**Support Agencies:** Public Works (Public Relations Group)<br>**Funding Source:** FEMA; Cal EMA; Fire Department; Public Works | Low | Ongoing | 3, 4, 10 | Yes-17 |

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 6—Provide public education about maintaining the stormwater system free of debris.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Public Relations Group, Flood Maintenance Division, Road Maintenance Division, Program for Public Information)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 4, 10 | Yes-22 |
| 7—Continue to maintain/enhance the County's classification under the Community Rating System to address increased flood insurance costs and promote safety and preparedness.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Regional Planning Department, Public Works (Flood Maintenance Division, Water Resources Division, Program Development Division, Public Relations Group, Program for Public Information)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 3, 4, 5, 7, 9 | No |
| 8—Implement the Program for Public Information (PPI) protocol identified in this plan including appropriate messaging for compliance with ADA.<br>**Lead Agency:** Public Works (Watershed Management Division, Public Relations Group)<br>**Funding Source:** FEMA; Cal EMA; Public Works | Low | Ongoing | 1, 3, 4 | No |
| 9—Provide emergency preparedness and flood protection information to the general public.<br>**Lead Agency:** CEO OEM<br>**Support Agencies:** Public Works (Watershed Management Division, Program for Public Information, Water Resources Division, Public Relations Group)<br>**Funding Source:** FEMA; Cal EMA; CEO OEM; Public Works; USC Sea Grant | Low | Ongoing | 1, 4, 10 | Yes-23 |
| 10—Distribute information regarding flood prevention and flood insurance at emergency operations and emergency preparedness events.<br>**Lead Agency:** CEO OEM<br>**Support Agencies:** Public Works (Watershed Management Division, Water Resources Division, Public Relations Group, Program for Public Information)<br>**Funding Source:** FEMA; Cal EMA; CEO OEM; Public Works | Low | Ongoing | 1, 4, 10 | Yes-24 |
| 11—Develop and maintain a list of priority maintenance-related problem sites.<br>**Lead Agency:** Public Works (Flood Maintenance Division)<br>**Support Agencies:** Public Works (Watershed Management Division, Water Resources Division, Road Maintenance Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 9 | Yes-8 |

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 12—Conduct routine maintenance of flood control facilities and additional maintenance as needed at priority maintenance-related flood problem sites.<br>**Lead Agency:** Public Works (Flood Maintenance Division, Road Maintenance Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 9 | Yes-9 |
| 13—Conduct a stormwater facilities condition assessment to identify the physical and hydraulic condition of the system and to support infrastructure management.<br>**Lead Agency:** Public Works (Flood Maintenance Division)<br>**Support Agencies:** Public Works (Watershed Management Division, Water Resources Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 2, 9 | Yes-7 |
| 14—Evaluate storm drain, open channel, and flood retention basin facilities for future improvements.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Design Division, Flood Maintenance Division, Water Resources Division) Stakeholders<br>**Funding Source:** Public Works | Low | Ongoing | 2, 9 | Yes-18 |
| 15—Pursue appropriate flood hazard mitigation grant funding.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Programs Development Division, Disaster Services Group), CEO OEM<br>**Funding Source:** Public Works; CEO OEM | Low | Ongoing | 1, 8, 9 | Yes-1 |
| 16—Consider the conversion of high-risk properties into open space.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Regional Planning Department, Parks and Recreation<br>**Funding Source:** FEMA; U.S. EPA; Cal EMA; Cal EPA; Public Works; County Regional Planning Department; County Parks and Recreation | Medium | Ongoing | 5, 6, 8 | Yes-13 |
| 17—Refine the plan check system to track properties in the flood zone and address drainage.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Building and Safety Division, Land Development Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 2, 5, 9 | Yes-10 |
| 18—Flag Repetitive Loss Properties in the plan, and check database for review and approval of building permit applications.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Building and Safety Division)<br>**Funding Source:** Public Works | Low | Ongoing | 5, 8, 9 | Yes-11 |

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 19—Maintain a database system for tracking all reviewed and approved elevation certificates prior to the closure of a building permit.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Building and Safety Division, Information Technology Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 2, 5 | No |
| 20—Evaluate opportunities for incorporating watershed ecosystem restoration into projects.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Regional Planning Department, Public Works (Water Resources Division), Stakeholders<br>**Funding Source:** FEMA, U.S. EPA; Cal EMA; Cal EPA; Public Works; County Regional Planning Department | Low | Ongoing | 1, 7, 11 | Yes-4 |
| 21—Where feasible, cost-effective and supported both publicly and politically, restore the natural and beneficial functions of floodplains.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Programs Development Division)<br>**Funding Source:** FEMA; U.S. EPA; Cal EMA; Cal EPA; Public Works | High/ Medium | Long term | 1, 2, 3, 6, 7 | No |
| 22—Encourage the application of biological resource measures for the control of stormwater and erosion to the best of their applicable limits.<br>**Lead Agency:** Fire Department, Public Works (Building and Safety Division, Design Division, Land Development Division)<br>**Support Agencies:** Regional Planning Department, Public Works (Environmental Programs Division, Watershed Management Division, Project Management Division, Water Resources Division)<br>**Funding Source:** FEMA; U.S. EPA; Cal EMA; Cal EPA; County Fire Department; Public Works | Low | Ongoing | 1, 2, 7 | Yes-16 |
| 23—Maintain the Operational Area Emergency Response Plan.<br>**Lead Agency:** CEO OEM<br>**Support Agencies:** Public Works (Disaster Services Group, Watershed Management Division)<br>**Funding Source:** FEMA; Cal EMA; Public Works; CEO OEM | Low | Ongoing | 1, 3, 10 | Yes-2 |
| 24—Maintain standards for the use of structural and non-structural techniques that mitigate flood hazards and manage stormwater pollution.<br>**Lead Agency:** Public Works (Building and Safety Division, Design Division, Land Development Division)<br>**Support Agencies:** Public Works (Watershed Management Division)<br>**Funding Source:** Public Works | Low | Ongoing | 2, 5, 8, 9 | Yes-14 |

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 25—Continue to require environmental review in the development process to provide for the creation or protection of natural resources that can mitigate the impacts of development.<br>**Lead Agency:** Regional Planning Department<br>**Support Agencies:** Public Works (Watershed Management Division, Programs Development Division, Land Development Division)<br>**Funding Source:** Public Works; County Regional Planning Department | Low | Ongoing | 5, 7 | Yes-15 |
| 26—Where appropriate, support retrofitting, purchase, or relocation of structures in hazard-prone (high risk) areas to prevent future structure damage. Give priority to properties with exposure to repetitive losses.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Regional Planning Department, Parks and Recreation, Public Works (Building and Safety Division, Programs Development Division)<br>**Funding Source:** FEMA Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, and Flood Mitigation Act; U.S. HUD; Cal EMA; Public Works; CEO OEM; County Regional Planning Department; County Parks and Recreation | Low | Ongoing | 5, 6, 8 | Yes-13 |
| 27—Use risked-based information from the *Los Angeles County Comprehensive Floodplain Management Plan* and the *Los Angeles County Hazard Mitigation Plan* to update the Safety Element of the County's General Plan.<br>**Lead Agency:** Regional Planning Department<br>**Support Agencies:** Public Works (Watershed Management Division)<br>**Funding Source:** County Regional Planning Department; Public Works | Low | Short term | 1, 2, 3 | No |
| 28—Continue to maintain good standing under the National Flood Insurance Program by implementing programs that meet or exceed the minimum NFIP requirements. Such programs include enforcing an adopted flood damage prevention ordinance, participating in floodplain mapping updates, and providing public assistance and information on floodplain requirements and impacts.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Building and Safety Division, Land Development Division, Flood Maintenance Division, Water Resources Division), Regional Planning Department<br>**Funding Source:** Public Works | Low | Ongoing | 1, 3, 4, 5, 7, 9 | No |
| 29—Consider the best available data and science to determine probable impacts on all forms of flooding from global climate change when making program enhancements or updates to the County's floodplain management program.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Funding Source:** FEMA; U.S. EPA; Cal EMA; Cal EPA; Public Works; USC Sea Grant | Low | Long term | 2, 3, 6, 11 | No |

**TABLE 11-1.**
**ACTION PLAN—FLOOD MITIGATION INITIATIVES**

| Action, Responsible Agencies and Potential Funding[a] | Estimated Project Cost[b] | Timeline | Objectives | In Previous Plan? Initiative # |
|---|---|---|---|---|
| 30—Identify flood-warning systems for properties where such systems can be beneficially employed.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** CEO OEM, Sheriff's Department, Public Works (Flood Maintenance Division, Disaster Services Group, Water Resources Division)<br>**Funding Source:** FEMA Hazard Mitigation Grant Program , Pre-Disaster Mitigation Grant Program, and Flood Mitigation Act; Cal EMA; Public Works; CEO OEM | Low | Ongoing | 1, 9, 10 | Yes-6 |
| 31—Consider the development of a comprehensive flood warning and response plan for the unincorporated County that would become a functional annex to the Operational Area Emergency Response Plan and meet the Community Rating System Activity 610 requirements.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** CEO OEM, Public Works (Disaster Services Group)<br>**Funding Source:** FEMA; Cal EMA; Public Works; CEO OEM | Medium/ Low | Long term | 1, 10 | No |
| 32—Continue to enforce the County's development regulations to prevent increases of the flood hazard on adjacent properties.<br>**Lead Agency:** Public Works (Building and Safety Division, Land Development Division)<br>**Support Agencies:** Public Works (Watershed Management Division)**Funding Source:** Public Works | Low | Ongoing | 1, 5, 9 | No |
| 33—Conduct an evaluation of FEMA-designated flood zones and revise/update them to reflect current conditions.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Support Agencies:** Public Works (Water Resources Division)<br>**Funding Source:** FEMA; Cal EMA; Public Works | Medium/ Low | Ongoing | 1, 2, 3 | No |
| 34—Continue to maintain and update the Hazus-MH model constructed to support the development of this plan, in order to make flood risk information available to property owners.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Funding Source:** FEMA; Cal EMA; Public Works | Low | Ongoing | 1, 3 | No |
| 35—Continue County coordination with other agencies and stakeholders on issues of flood control.<br>**Lead Agency:** Public Works (Watershed Management Division)<br>**Funding Source:** Public Works | Low | Ongoing | 1, 3, 9 | No |

a. Numbering of initiatives is for identification only and does not indicate rank or priority. See Section 11.5 for prioritization
b. See Section 11.4 for description of estimated project cost.

## 11.3 STATUS OF ACTIONS FROM PREVIOUS PLAN

All actions listed as ongoing from the 2009 Los Angeles County Floodplain Management Plan are carried over to the current plan except for the following:

- Ensure awareness of repetitive loss property owners on environmental sensitivities specific to their area: This action was removed because the intent of the action is ambiguous. Additional actions more aptly address both repetitive loss areas and environmental concerns.
- Identify possible sources of funding and provide this information to repetitive loss property owners: This action was removed because it was determined to redundant with Action 1.
- Distribute information regarding flood prevention and flood insurance at emergency operations and emergency preparedness events: This action was deleted because it was determined to be redundant with Action 21.

## 11.4 BENEFIT/COST ANALYSIS

The action plan is prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (CRS Step 8). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program and Pre-Disaster Mitigation grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Cost ratings were defined as follows:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases). Costs are estimated to be greater than $5 million.
- **Medium**—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years. Costs are estimated to be between $500,000 and $5 million.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program. Costs are estimated to be less than $500,000.

Benefit ratings were defined as follows:

- **High—**Project will provide an immediate reduction of risk exposure for life and property.
- **Medium—**Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- **Low—**Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

For many of the strategies identified in this action plan, Los Angeles County may seek financial assistance under the FEMA Hazard Mitigation Grant Program or Hazard Mitigation Assistance programs, both of

which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, Los Angeles County reserves the right to define "benefits" according to parameters that meet the goals and objectives of this plan.

## 11.5 ACTION PLAN PRIORITIZATION

Table 11-2 lists the priority of each initiative as assigned by the planning team, using the same parameters used in selecting the initiatives. A qualitative benefit-cost review was performed for each of these initiatives. The priorities are defined as follows:

- **High Priority**—A project that meets multiple objectives, has benefits that exceed cost, has funding secured or is an ongoing project and meets eligibility requirements for a grant program. High priority projects can be completed in the short term (1 to 5 years). The key factors for high priority projects are that they have funding secured and can be completed in the short term.
- **Medium Priority**—A project that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible. Project can be completed in the short term, once funding is secured. Medium priority projects will become high priority projects once funding is secured. The key factors for medium priority projects are that they are eligible for funding, but do not yet have funding secured, and they can be completed within the short term.
- **Low Priority**—A project that will mitigate the risk of the flood hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for FEMA grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority projects may be eligible for grant funding from other programs. Low priority projects are "blue-sky" projects. How they will be financed is unknown, and they can be completed over a long term.

**TABLE 11-2.**
**PRIORITIZATION OF MITIGATION INITIATIVES**

| Initiative | # of Objectives Met | Benefits | Costs | Do Benefits equal or exceed Costs? | Is project Grant eligible? | Can Project be funded under existing programs/ budgets? | Priority (High, Med., Low) |
|---|---|---|---|---|---|---|---|
| 1 | 3 | Medium | Low | Yes | Yes | Yes | High |
| 2 | 2 | Medium | Low | Yes | No | Yes | High |
| 3 | 2 | High | Low | Yes | No | Maybe | High |
| 4 | 4 | High | Low | Yes | No | Yes | High |
| 5 | 3 | High | Low | Yes | Yes | Yes | High |
| 6 | 3 | Medium | Low | Yes | No | Yes | High |
| 7 | 6 | Medium | Low | Yes | No | Yes | High |
| 8 | 3 | Medium | Low | Yes | Yes | Maybe | High |
| 9 | 3 | Medium | Low | Yes | Yes | Yes | High |
| 10 | 3 | Medium | Low | Yes | No | Yes | High |
| 11 | 2 | Low | Low | Yes | No | Yes | High |
| 12 | 2 | Medium | Low | Yes | No | Yes | High |
| 13 | 3 | Low | Low | Yes | No | Yes | High |
| 14 | 2 | Medium | Low | Yes | No | Yes | High |
| 15 | 3 | Low | Low | Yes | No | Yes | High |
| 16 | 3 | Medium | Medium | Yes | Yes | Yes | High |
| 17 | 4 | Medium | Low | Yes | No | Maybe | Medium |
| 18 | 3 | Medium | Low | Yes | No | Yes | High |
| 19 | 3 | Medium | Low | Yes | No | Maybe | High |
| 20 | 3 | Low | Low | Yes | Yes | Yes | High |
| 21 | 5 | Medium | High/ Medium | No | Yes | No | Medium |
| 22 | 3 | Medium | Low | Yes | Yes | Yes | High |
| 23 | 3 | Medium | Low | Yes | Yes | Yes | High |
| 24 | 4 | Medium | Low | Yes | No | Yes | High |
| 25 | 2 | Medium | Low | Yes | No | Yes | High |
| 26 | 3 | High | Low | Yes | Yes | Yes | High |
| 27 | 3 | Low | Low | Yes | No | Yes | High |
| 28 | 6 | Medium | Low | Yes | No | Yes | High |
| 29 | 4 | Medium | Low | Yes | Yes | Maybe | High |
| 30 | 3 | Medium | Low | Yes | Yes | Maybe | Medium |
| 31 | 2 | Medium | Medium/ Low | Yes | Yes | Maybe | High |
| 32 | 3 | Medium | Low | Yes | No | Yes | High |
| 33 | 3 | Low | Medium/ Low | No | Yes | Maybe | Medium |
| 34 | 2 | Medium | Low | Yes | Yes | Maybe | High |
| 35 | 3 | Low | Low | Yes | No | Yes | Medium |

## 11.6 ANALYSIS OF MITIGATION INITIATIVES

Each recommended initiative was classified based on the type of mitigation it involves. Mitigation types used for this categorization are as follows:

- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness**—Actions to inform citizens and elected officials about flood hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.

Table 11-3 presents the results of this analysis.

**TABLE 11-3.**
**ANALYSIS OF MITIGATION INITIATIVES**

| Mitigation Type | Applicable Mitigation Initiatives |
|---|---|
| Prevention | 1, 3, 4, 5, 7, 8, 15, 17, 18, 19, 22, 23, 27, 28, 29, 31, 32, 33, 34, 35 |
| Property Protection | 2, 3, 5, 11, 12, 13, 18, 19, 24, 26, 32 |
| Structural Projects | 11, 12, 13, 14, 15, 16, 17, 19, 20, 22, 24, 25, 26, 28, 30, 32 |
| Natural Resource Protection | 16, 20, 22, 21, 24, 25 |
| Public Education and Awareness | 1, 2, 3, 4, 5, 6, 8, 9, 10, 17, 18, 28, 34, 35 |
| Emergency Services | 3, 5, 9, 10, 23, 30, 31 |

# PART 4 —
# PLAN MAINTENANCE

# CHAPTER 12.
# PLAN ADOPTION

This chapter documents formal adoption of the *Los Angeles County Comprehensive Floodplain Management Plan* by the Los Angeles County Board of Supervisors (CRS Step 9). This plan will be submitted for a pre-adoption review to the Insurance Services Office (ISO) prior to adoption. Once pre-adoption approval has been provided, Los Angeles County will formally adopt the plan. A copy of the resolution is provided in Figure 12-1.

Insert Plan Adoption Resolution

*Figure 12-1. Resolution Adopting Comprehensive Floodplain Management Plan*

# CHAPTER 13.
# PLAN MAINTENANCE STRATEGY

This chapter presents a plan maintenance process (CRS Step 10) that includes the following:

- Implementing the recommended action plan
- Monitoring, evaluating and updating the floodplain management plan over a 5-year cycle
- Maintaining public participation in the plan maintenance process
- Incorporating the requirements of the floodplain management plan into other local government planning mechanisms, such as comprehensive, capital improvement or all-hazard mitigation plans, when appropriate.

The plan maintenance strategy is the formal process that will ensure that the floodplain management plan remains active and relevant and that Los Angeles County maintains its eligibility for applicable funding. The *Los Angeles County Repetitive Loss Area Analysis*, prepared in conjunction with this plan, also outlines procedures for maintaining its recommendations into the future.

## 13.1 IMPLEMENTING THE PLAN

The effectiveness of the floodplain management plan depends on its implementation and incorporation of its action items into existing local plans, policies and programs. The action items provide a framework for activities that Los Angeles County can implement over the next five years. The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation initiatives that will be implemented through existing plans, policies, and programs.

The Los Angeles County Department of Public Works Watershed Management Division will have lead responsibility for overseeing the plan implementation and maintenance. Plan implementation and evaluation will be a shared responsibility among all agencies identified as lead agencies in the mitigation action plan. Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

## 13.2 MONITORING, EVALUATING AND UPDATING THE PLAN

### 13.2.1 Steering Committee

The Steering Committee is a total volunteer body that oversaw the development of the plan and made recommendations on key elements of it, including this maintenance strategy (see Section 2.3). It was the Steering Committee's position that an oversight committee with representation similar to that of the Steering Committee should have an active role in the plan maintenance strategy. Therefore, it is recommended that a steering committee remain a viable body involved in key elements of the plan maintenance strategy. The new steering committee should include representation from stakeholders in the planning area.

The principal role of a steering committee in this plan maintenance strategy will be to review the annual progress report and provide input to the Los Angeles County Department of Public Works Watershed Management Division on possible enhancements to be considered at the next update. Future plan updates

will be overseen by a steering committee similar to the one that participated in this plan development process, so keeping an interim steering committee intact will provide a head start for future updates. It will be the new steering committee's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates.

### 13.2.2 Annual Progress Report

The minimum task of the ongoing annual steering committee meeting will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any flood hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The planning team has created a template for preparing a progress report (see Appendix H). The plan maintenance steering committee will provide feedback to the planning team on items included in the template. The planning team will then prepare a formal annual report on the progress of the plan. This report should be used as follows:

- Posted on the Department of Public Works website page dedicated to the floodplain management plan
- Provided to the local media through a press release
- Presented to the County Executive to inform them of the progress of mitigation initiatives implemented during the reporting period
- Provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit. To meet this recertification timeline, the planning team will strive to complete progress reports between June and September each year.

Annual progress reporting is credited under CRS Step 10.

### 13.2.3 Plan Update

The information on flood hazard, risk, vulnerability, and mitigation contained in this floodplain management plan is based on the best science and technology available at the time this plan was prepared. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant. Los Angeles County intends to update the floodplain management plan on a 5-year cycle from the date of initial plan adoption (CRS Step 10). This cycle may be accelerated to less than 5 years based on the following triggers:

- A federal disaster declaration that impacts the planning area
- A flood event that causes loss of life
- A comprehensive update of Los Angeles County general plan, which is considered to be an integral part of this plan.

It will not be the intent of future updates to develop a complete new floodplain management plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The flood hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the general plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The Los Angeles County Board of Supervisors will adopt the updated plan.

It is Los Angeles County's intention to fully integrate this floodplain management plan into the All-Hazards Mitigation Plan for Los Angeles County. This will allow for a uniform update cycle for both plans and eliminate redundant planning.

## 13.3 MAINTAINING PUBLIC INVOLVEMENT

The public will continue to be informed of the plan's progress through the floodplain management plan website and by copies of annual progress reports provided to the media. The website will not only house the final plan, it will become the one-stop shop for information regarding the plan and plan implementation. Copies of the plan will be distributed to the Los Angeles County library system. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new steering committee. This strategy will be based on the needs and capabilities of Los Angeles County at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

## 13.4 INCORPORATING THE PLAN INTO OTHER MECHANISMS

Los Angeles County, through adoption of a general plan and zoning ordinance, has planned for the impacts of flooding. The floodplain management plan development process provided the opportunity to review and expand on policies in these planning mechanisms. The Los Angeles County General Plan and the floodplain management plan are complementary documents that work together to achieve the goal of reducing risk exposure. Los Angeles County has created a linkage between the floodplain management plan and the general plan by identifying a mitigation initiative as such and giving that initiative a high priority. Other planning processes and programs to be coordinated with the recommendations of the floodplain management plan include the following:

- Local all-hazards mitigation plan
- Emergency response plans
- Capital improvement programs
- Municipal codes

- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments

As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

# CHAPTER 14.
# PROGRAM FOR PUBLIC INFORMATION

The Community Rating System (CRS) describes a program for public information (PPI) as an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities that meet specific local needs. The CRS awards credit for implementing public outreach projects that are identified in a community's PPI. Los Angeles County elected to develop a PPI, using the seven-step planning process required by CRS:

- Step 1. Establish a committee
- Step 2. Assess the community's public information needs
- Step 3. Formulate messages
- Step 4. Identify outreach projects to convey the messages
- Step 5. Examine other public information initiatives
- Step 6. Prepare a PPI document
- Step 7. Implement, monitor and evaluate the PPI.

The following sections describe the process in more detail.

## 14.1 ESTABLISH A COMMITTEE

The planning team established the PPI committee by soliciting volunteers and recommendations from the floodplain management plan steering committee and from Los Angeles County staff. The resulting committee meets the requirements set forth by CRS. The committee is a robust team able to identify and evaluate a comprehensive range of activities for flood-related outreach in the planning area.

PPI committee members are listed in Table 14-1. The committee met three times in April, May and June 2015 to discuss and develop the PPI. Meeting summaries are available in Appendix I.

**TABLE 14-1.**
**PPI COMMITTEE MEMBERS**

| Name | Affiliation |
|---|---|
| Angel Barnuevo[a] | Public Information Officer, Montebello Unified School District |
| Debbie Sharpton[a] | Executive Director, Mountains Restoration Trust |
| Edgar Cisneros | Public Information Officer, Los Angeles County Department of Public Works |
| George De La O | Floodplain Manager, Los Angeles County Department of Public Works |
| Kerjon Lee | Public Information Officer, Los Angeles County Department of Public Works |
| Tom Delmore[a] | CERT member and repetitive loss area representative |

a. Stakeholder representative

## 14.2 ASSESS THE COMMUNITY'S PUBLIC INFORMATIONAL NEEDS

According to CRS, before a community can develop a local program for raising public awareness about flood-related issues, the PPI committee needs to assess the flood problems in the community, identify those who need to be informed about these flood problems, and determine what projects are underway. The following sections describe the PPI committee's assessments of these factors.

### 14.2.1 Delineate Target Areas

The PPI committee identified four target areas for flood problems in the unincorporated areas of Los Angeles County. These areas were determined through a review of the risk assessment presented in Chapter 6 through 8 of this plan, through a review of the repetitive loss areas analysis conducted as a companion process during the floodplain management plan development, and through discussion among PPI committee members. The sections below describe the identified target areas.

#### *FEMA-Designated Floodplains*

The September 26, 2008, Los Angeles County DFIRMs are FEMA's official delineation of Special Flood Hazard Areas for the County of Los Angeles. Identified SFHAs include shallow flooding, floodway, alluvial fans, and coastal areas. The DFIRMs drew upon the following information:

- Statistical analysis of records of river flow, storm tides, and rainfall
- Information obtained through consultation with the City of Los Angeles and the County of Los Angeles
- Floodplain topographic surveys
- Hydrologic and hydraulic analyses.

FEMA's mapped flood zones for the County are shown on maps provided in Appendix F. According to the risk assessment presented in Chapter 7 of this document, there are estimated to be 1,759 structures in the 100-year floodplain and 11,681 in the 500-year floodplain.

#### *County Floodways*

The floodway is an area immediately adjacent to a water course where floodwaters during a flood are deepest and fastest-moving. It is the most dangerous part of the floodplain, and its hazardous nature requires that development in this area be carefully managed. The floodway must remain free of obstruction and construction unless engineering analysis demonstrates that the flood hazard on adjoining properties will not be increased. Ideally, development in the floodway should be restricted to uses that do not interrupt the natural flow of the water (tennis courts, swimming pools, etc.).

The limits of the floodway are defined as the point where the velocity of flood flow is 10 feet per second or the water surface elevation is 1 foot above the floodplain water surface elevation. The first of either criteria reached controls the floodway width. Where the flow velocity exceeds 10 feet per second for the entire width of the floodplain, the floodplain lines and floodway lines are the same. Los Angeles County Department of Public Works Capital Flood Protection requirements apply to all unincorporated areas mapped as floodways. The Capital Flood is the flood produced by a 50-year storm falling on a saturated watershed.

The County's mapped floodways are shown in Appendix G. There are estimated to be 947 structures within the mapped floodways.

### *Repetitive Loss Areas*

A repetitive loss property is one for which two or more claims of $1,000 or more have been paid by the NFIP within any given 10-year period since 1978. Repetitive loss areas include these repetitive loss properties and nearby properties with the same or similar flooding conditions. As of this plan's development there are 54 repetitive loss properties in the unincorporated areas of Los Angeles County, which have been used to delineate 22 unique repetitive loss areas. Within these areas, 192 properties have been identified as at risk to similar flooding conditions. More detailed information on flood conditions in these areas can be found in the Los Angeles County Repetitive Loss Area Analysis plan.

### *Gaps in the Maps*

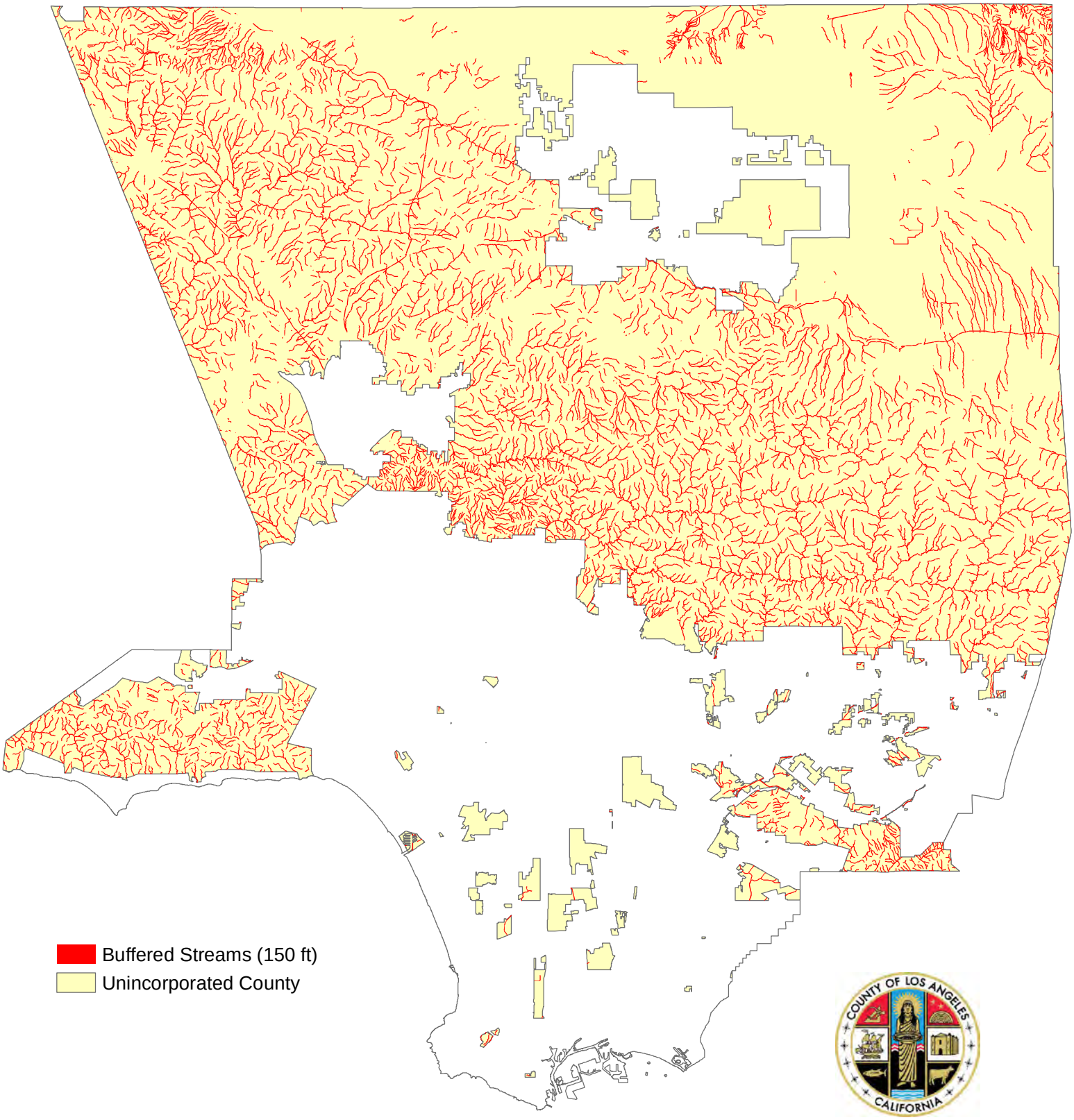
In the unincorporated areas of the County, there are many stream segments that do not intersect with FEMA or County-mapped floodplains. Buffers extending 150 feet on each side of these segments were delineated in order to identify potential at risk properties. It is estimated that there are 9,527 structures within these areas. This methodology likely overestimates the number of properties at risk as it does not take elevation into account. A more detailed assessment of the number of properties likely to be impacted should be conducted as time and resources allow. The location of gaps in the maps are shown in Figure 14-1.

## 14.2.2 Determine Target Audiences

After identifying the target areas, the PPI committee brainstormed and identified the following target audiences that need to be informed of flood hazards within the planning area:

- Residents, property owners and businesses in the regulated floodplains
- Residents, property owners and businesses in repetitive loss areas
- Property owners that need to maintain channels or other conveyance systems
- Residents and property owners along creeks
- Homeowners who have paid off mortgages or who did not have a mortgage
- Lake Los Angeles floodplain property owners and those with localized flood hazards
- Renters in flood-prone areas
- Property owners near recently burned areas
- Residents, property owners and businesses in 500-year floodplains
- Owners of properties with identified flood hazards on the County Assessor's parcel maps
- Homeowners applying for permits
- Countywide audience for a disaster preparedness message
- Countywide audience for a climate change message
- Drivers (sub-population may be in Antelope Valley, Topanga, Old Topanga and Agoura Hills)
- Cub Scouts or Boy Scouts
- Hikers
- Beachgoers near the mouths of rivers/creeks

**Figure 14-1.**
**Stream Segments with No FEMA or Los Angeles County Flood Mapping**




Data Sources: Los Angeles County

- Hospitals, doctors' offices and other public health facilities within the floodplain (critical facility operators)
- Populations who are camping or residing in channels
- Populations who are camping or residing near streams in areas such as the Santa Monica Mountains
- People/children who bike through channels
- Antelope Valley Residents
- Realtors, lenders and insurance agents
- Areas where there are significant instances of illegal dumping in conveyance systems.

Not all target audiences will have specific outreach projects identified in the first year of the PPI implementation, but all are included to inform the annual review and update of the PPI. The committee also identified influencers and means of message delivery, as follows:

- Influencers:
  - Public libraries
  - County events (where the County is staffing a booth)
  - Equestrian centers, feed stores and associations
  - Trails Council
  - Sierra Club
- Means of message delivery:
  - School districts, for providing information to parents and students
  - The Los Angeles County embedded network
  - Private news agencies, for coverage of storms or swift-water rescues
  - Soup kitchens, the Salvation Army
  - Communities with active Nextdoor networks
  - Environmental consultants, building contractors and others involved in the permitting process, particularly in the Santa Monica Mountains
  - California Regional Environmental Education Community (CREEC) or other organizations that can disseminate information to teachers.

## 14.2.3 Inventory Other Public Information Efforts

In order to build on, rather than duplicate, what County departments and other stakeholders in the planning area are already doing for flood-related outreach, the PPI committee developed a list of other public information efforts in the County (see Table 14-2). The list was used throughout the remaining steps in the PPI development process.

**TABLE 14-2.**
**INVENTORY OF PUBLIC INFORMATION EFFORTS**

| Program | Outreach Effort | Frequency | Notes |
|---|---|---|---|
| **Los Angeles County Department of Public Works** | | | |
| Public Information | Public Works Website and NewsWorks | Year Round | |
| | Public Works YouTube Channel www.youtube.com/user/LAPublicWorks | Year Round | |
| | Los Angeles County "The Works" App for mobile phones | Year Round | |
| | Twitter Feeds @LAPublicWorks, @CleanLA, @LACoWater, @dpwCARE | Year Round | |
| Community Rating System (CRS) | Letter to Insurance Agents and Mortgage Lenders Regarding Flood Zone Determinations, Elevation Certificates, and other information | Annually | Announcing availability of County flood information |
| | Letter with disk on flood protection and retrofitting of structures to property owners | Annually | To Repetitive Loss Areas |
| | "Are You Prepared For A Flood?" Brochure to properties with structures in the flood zone | Annually | |
| | Flood Protection Information available through County libraries in Rosemead, Castaic, and Malibu | Year Round | Includes FIRMs and 10 FEMA publications |
| | Mudflow advice to properties impacted by wildfires in nearby hillsides | As Needed | |
| | Press Release regarding flood risk, preparedness, mudflow advice, and flood insurance | Annually | Released to various Media |
| | County's NFIP Website http://dpw.lacounty.gov/WMD/NFIP/ | Year Round | |
| Clean LA/ Project Pollution Prevention | Smart Gardening Program Workshops | Year Round | |
| | CleanLA website www.dpw.lacounty.gov/epd/cleanla | Year Round | |
| | Stormwater Pollution Prevention Outreach and Illegal Dumping Prevention | As Needed | General outreach including brochures, mailings, and events |
| | Household Hazardous Waste Collection Program http://www.lacsd.org/solidwaste/swfacilities/recyclecontact/hhw_e_waste/ | Events on Weekends | Outreach through various means |
| | Environmental Youth Education at Elementary Schools: Environmental Defenders Program http://dpw.lacounty.gov/epd/defenders/index.asp | Year Round | |
| | Environmental Youth Education at Secondary Schools: Generation Earth http://dpw.lacounty.gov/prg/generationearth/about.cfm | Year Round | |

**TABLE 14-2.**
**INVENTORY OF PUBLIC INFORMATION EFFORTS**

| Program | Outreach Effort | Frequency | Notes |
|---|---|---|---|
| **Chief Executive Office** | | | |
| | Office of Emergency Management – outreach for all hazards preparation through the Emergency Survival Program, expos, public venues, and presentations | Year Round | |
| | Coordinated Agency Response Effort (CARE) and El Nino Websites | Year Round | |
| **Los Angeles County Sheriff's Department** | | | |
| | AlertLA – Emergency mass notification system using recorded phone messages, text messages, and emails. | Year Round | |
| **Los Angeles County Department of Parks and Recreation** | | | |
| General Outreach | Twitter @lacountyparks | Year Round | |
| | Instagram "lacountyparks" | Year Round | |
| | Facebook www.facebook.com/parks.lacounty.gov | Year Round | |
| | YouTube www.youtube.com/user/LACountyParks | Year Round | |
| | Flickr www.flickr.com/photos/lacountyparks/ | Year Round | |
| | Press Releases and Newsletters (Green Scene) http://parks.lacounty.gov/wps/portal/dpr/Newsroom | Year Round | |
| | Special Events, such as sports, fitness, hobbies, outdoor classes, holiday celebrations, summer camp, lunch programs, etc. | Year Round | |
| **Los Angeles County Waterworks District** | | | |
| Water Quality and Conservation Awareness | Newsletters in "Splash" http://dpw.lacounty.gov/wwd/web/Publications/Splash.aspx | Quarterly | A variety of articles about water conservation, floodplains, river habitat, restoration, and flooding. Videos about drought tolerant landscaping for water conservation. |
| **National Park Service** | | | |
| Santa Monica Mountains National Recreation Area | Malibu Creek State Park events http://www.nps.gov/samo/planyourvisit/ | Year Round | Special events include talks about native creek habitat, protecting the floodplain, and what wildlife uses creeks. |
| **Heal the Bay** | | | |
| Healthy Neighborhoods, Healthy Environment | Creek Week Education http://www.healthebay.org/our-work/healthy-neighborhoods | Year Round | High school age program for water quality testing and bio assessments in Compton Creek |

**TABLE 14-2.**
**INVENTORY OF PUBLIC INFORMATION EFFORTS**

| Program | Outreach Effort | Frequency | Notes |
|---|---|---|---|
| Education and the Environment Initiative (EEI) | Curriculum Units and Environmental Literacy Guides<br>http://www.healthebay.org/educators | Year Round | Curriculum and training guides available online. |
| **Tree People** | | | |
| | Environmental Education Resources for Teachers<br>https://www.treepeople.org/action/for-schools/teachers | Year Round | Curriculum for elementary, middle and high school students and in-service training for teachers. |
| | Workshops, Tours, Classes<br>https://www.treepeople.org/calendar | Year Round | Events Calendar with variety of topics on water conservation, native plants, drought, stormwater pollution prevention. |
| **Santa Monica Mountains Resource Conservation District** | | | |
| | Outdoor Environmental Education Programs for Students<br>http://www.rcdsmm.org/outdoor-environmental-education-programs-students | Year Round | |
| | Environmental Educator Training for Adults<br>http://www.rcdsmm.org/environmental-educator-training-adults | Year Round | |
| | Environmental Education Resources and Materials<br>http://www.rcdsmm.org/environmental-education-resources-and-materials | Year Round | |
| **Mountains Recreation and Conservation Authority** | | | |
| | Symbiosis Newsletter<br>http://issuu.com/lamountains/docs/symbiosisspring2015v2_490569dabfb569 | | |
| **Mountains Restoration Trust** | | | |
| | Adopt a Creek: Creek Crayfish Removal<br>http://www.mountainstrust.org/restoration/adoptacreek.html | Year Round | |
| | Discovery Nature Camp | Year Round | |
| | Youth Naturalist Program | Year Round | |
| | Headwaters Corner<br>www.mountainstrust.org/about/headwaters.html | Year Round | |
| | Mountain Restoration Trust News<br>http://www.mountainstrust.org/newsletters/mrtnews.html | | |

## 14.3 FORMULATE MESSAGES

CRS identifies six priority floodplain management topics that should be addressed by messages developed and implemented in the PPI. The PPI committee elected to include an additional topic area to meet the needs of the local communities and target audiences. The seven topics are as follows:

- Know your flood hazard.
- Insure your property against your flood hazard.
- Protect people from the hazard.
- Protect your property from the hazard.
- Build responsibly.
- Protect natural floodplain functions.
- General preparedness.

Using the information developed in Step 2, the PPI committee identified more specific messages for each of these topic areas to meet the needs of the community, as shown in Table 14-3.

**TABLE 14-3.**
**PRIORITY TOPICS AND MESSAGES**

| Topic | Message[a] |
|---|---|
| Know your flood hazard | Know your flood zone<br>You are in a repetitive flood area<br>Your property may be subject to flooding or flood-related hazards |
| Insure your property against your flood hazard | Take advantage of a low-cost, preferred-risk policy<br>You need flood insurance<br>Renters can buy flood insurance |
| Protect people from the hazard | Avoid swift water<br>Move to high ground<br>Turn around, don't drown<br>Know the signs of flash flooding<br>Know what flood warning means<br>Teach school children about flooding |
| Protect your property from the hazard | Flooding affects more than homes<br>Your actions impact others<br>Illegal activities may lead to fines<br>Need advice for protecting your property from flood? |
| Build responsibly | A little investment now could save you money later<br>Just because it is not mapped does not mean you are not at risk<br>Get a permit before you build |
| Protect natural floodplain functions | Share the floodplains<br>No dumping<br>Protect these areas<br>Floodplains help us<br>These areas are habitat |
| General preparedness | Sign up for Alert LA<br>Develop a family disaster plan<br>Know your risk |

a. All identified messages may not be utilized during the first year of the PPI implementation. All messages identified by the PPI committee are included to inform the annual review and update of the PPI.

## 14.4 IDENTIFY OUTREACH PROJECTS TO CONVEY THE MESSAGES

After the audiences and needed messages were agreed upon, the PPI committee developed projects to convey each message. These projects and their implementation details are shown in Table 14-2. Projects have been identified so far only for the first year of PPI implementation. Appendix I includes the catalog of outreach efforts from which these actions were selected.

## 14.5 EXAMINE OTHER PUBLIC INFORMATION INITIATIVES

In addition to outreach projects, the PPI committee reviewed and considered related CRS activities and some of the messages that these activities could convey. These activities are included in Table 14-2 as the committee deemed appropriate.

## 14.6 PREPARE THE PPI DOCUMENT

The planning team responsible for the preparation of the floodplain management plan and PPI committee facilitation prepared the PPI document for inclusion as a chapter in the floodplain management plan. The plan document was reviewed by the PPI committee as well as the steering committee overseeing the development of the floodplain management plan.

## 14.7 IMPLEMENT, MONITOR AND EVALUATE THE PPI

The PPI outlines public outreach over a one-year time span. It was critical that a plan be developed for implementing, monitoring and evaluating the PPI. Implementation details are included in Table 14-4. County staff will collect data on project implementation over the course of the public information year in order to evaluate progress and to suggest changes to the PPI framework to the PPI committee.

The PPI implementation and evaluation schedule will correspond with the rainy season in Los Angeles County. The public information year will begin on September 1 of each year and the annual review will be conducted prior to October 1 of each year, likely during the dry, summer months. The PPI evaluation will be coordinated by County Watershed Management Division staff. The staff will inform the PPI committee about implementation progress and will suggest changes to the PPI framework. Table 14-4 will form the basis of this review and discussion, with additional columns to be added allowing for staff to report on the following items (see example progress report in Appendix H):

- The target audiences, the messages, and the desired outcomes.
- The projects in the PPI used to convey the messages.
- Which projects were implemented.
- Why some projects were not implemented.
- What progress was made toward the desired outcomes.
- What should be changed.

The PPI committee will review progress and discuss and approve suggested changes. The results of this discussion will be compiled into an annual evaluation report to the Los Angeles County Executive and included in the County's annual CRS recertification. This report will be reviewed and approved by the PPI committee to ensure consistency with discussion and changes agreed to at the annual PPI evaluation. In addition to the annual evaluation report, the meeting summary, sign-in sheets and any other materials documenting PPI participation in the evaluation will be submitted to ISO, the review agency.

**TABLE 14-4.**
**PPI IMPLEMENTATION PLAN**

| Message | Target Audiences | Outcomes | Projects | Assignment | Schedule | Stakeholder (Element STK) |
|---|---|---|---|---|---|---|
| **Topic 1: Know Your Flood Hazard** | | | | | | |
| Know Your Flood Zone<br>www.dpw.lacounty.gov/wmd/floodzone/index.cfm | Residents, property owners and businesses in the regulated floodplains<br>Renters in flood-prone areas<br>Critical Facility Operators in the regulated floodplains<br>Realtors, Lenders and Insurance Agents | Increase in hits to flood zone determination website | Mailing of outreach brochure "Are You Prepared for a Flood?" to target audiences | DPW | Annually prior to rainy season; October | No |
| | | | Annual notice of map information services pursuant to Activity 320 publicity requirements to local Realtors/ lenders/ insurance agents | DPW | Annually; October | Yes |
| You Are In A Repetitive Flood Area | Residents, property owners and businesses in repetitive loss areas | Increase in inquiries to Public Works regarding flood hazards from repetitive loss property owners<br>Property owners implementing temporary or permanent flood mitigation projects<br>Increased demand for sandbags during the storm season | Annual mailing to Repetitive Loss Area properties | DPW | Annually; October | No |
| **Topic 2: Insure Your Property For Your Flood Hazard** | | | | | | |
| You Need Flood Insurance | Residents, property owners, and businesses in the 100 year floodplain<br>Homeowners who do not have a mortgage | Increase in flood insurance policy holders in the 100 year floodplain | Mailings to property owners in the flood zone and repetitive loss areas. | DPW | Annually; October | No |

**TABLE 14-4.**
**PPI IMPLEMENTATION PLAN**

| Message | Target Audiences | Outcomes | Projects | Assignment | Schedule | Stakeholder (Element STK) |
|---|---|---|---|---|---|---|
| Renters Can Buy Flood Insurance | Renters in flood prone areas | Increase in flood insurance purchase by renters in the 100 year floodplain | Mailings to renters in the flood zone. | DPW | Annually; October | No |
| **Topic 3: Protect People From The Hazard** | | | | | | |
| Avoid Swift Water! | People/children who hike or bike through channels and streams<br>People who are camping/residing in channels and streams | Decrease in swift water rescues<br>Decrease in observed camping/residing in the channels and streams | YouTube video - NO WAY OUT The Dangers of Flood Control Channels, Flood Control Channel Memo www.ladpw.org/services/water/nowayout.pdf | DPW | Year Round on YouTube | No |
| **Topic 4: Protect Your Property From The Hazard** | | | | | | |
| Need Advice for Protecting Your Property From Flood Hazards? Please Call Us or Visit Website.<br>http://dpw.lacounty.gov/wmd/HomeOwners/index.cfm<br>and<br>https://dpw.lacounty.gov/wrd/Fire/display.cfm?product=file/faq.htm | Residents, property owners and businesses in the regulated floodplains<br>Residents, property owners and businesses in repetitive loss areas<br>Environmental consultants/building contractors or others involved in the permitting process<br>Gaps in the Maps identified properties<br>Lake Los Angeles property owners with creeks thru property<br>Property owners near recently burned areas | Increase in requests for assistance/advice. | YouTube Video | DPW | Available year round online | No |
| | | | Twitter reminder | DPW | Prior to and during rainy season | No |
| | | | Distribute mailer to affected properties. | DPW | Prior to and during rainy season and as needed. | No |
| | | | Facebook message | DPW | Prior to and during rainy season | No |

**TABLE 14-4.**
**PPI IMPLEMENTATION PLAN**

| Message | Target Audiences | Outcomes | Projects | Assignment | Schedule | Stakeholder (Element STK) |
|---|---|---|---|---|---|---|
| **Topic 5: Build Responsibly** | | | | | | |
| A Little Investment Now, Could Save You Money Later | Environmental consultants/building contractors or others involved in the permitting process<br>Homeowners applying for permits | Increase in protection of structures | Promote on social media (Twitter) and NFIP website | DPW | Year Round; Revisions to website by October | No |
| **Topic 7: General Preparedness** | | | | | | |
| Sign Up For Alert LA<br>www.lacounty.gov/emergency/alert-la/ | Countywide<br>Residents, property owners and businesses in the regulated floodplains<br>School Districts | Increase number of residents that register their mobile number for Alert LA. | Promote Alert LA on County Website. | DPW<br>Sheriff's Department | Available online year round | No |
| | | | Provide Alert LA County Brochure<br>http://www.lacoa.org/pm_pub.html | CEO Office of Emergency Management | Available online year round | No |
| Develop a Family Disaster Plan<br>http://www.lacoa.org/pm_pub.html<br>and<br>http://www.lacoa.org/PDF/EmergencySurvivalGuide-LowRes.pdf | Countywide<br>Residents, property owners and businesses in the regulated floodplains<br>School Districts | Increase preparedness by residents | Promote on social media (Twitter) and website | DPW | Quarterly | No |
| Know Your Risk | Countywide<br>Residents, property owners and businesses in the regulated floodplains<br>School Districts | Increased visits to the Flood Zone Determination Website | Mailer to all properties with structures in the floodplain. | DPW | Annual mailing; October | No |
| | | | Promote on social media (Twitter) | DPW | Annually | No |

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