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IN REPLY PLEASE
REFER TO FILE

September 06, 2016

The Honorable Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall of Administration
500 West Temple Street
Los Angeles, California 90012

Dear Supervisors:

ADOPTED

BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

63 September 6, 2016

LORI GLASGOW
EXECUTIVE OFFICER

**ADOPT THE FLOODPLAIN MANAGEMENT PLAN
AND REPETITIVE LOSS AREA ANALYSIS
(ALL SUPERVISORIAL DISTRICTS)
(3 VOTES)**

SUBJECT

This action is to seek adoption of the Los Angeles County Comprehensive Floodplain Management Plan and the Los Angeles County Repetitive Loss Area Analysis by the Board to enable the County of Los Angeles to retain its eligibility in the National Flood Insurance Program's Community Rating System.

IT IS RECOMMENDED THAT THE BOARD:

1. Find that the adoption of the Comprehensive Floodplain Management Plan dated July 2016 and the Repetitive Loss Area Analysis dated July 2016 is exempt from the California Environmental Quality Act for the reasons stated in this letter and in the record of the project.
2. Approve and adopt the Los Angeles County Comprehensive Floodplain Management Plan dated July 2016.
3. Approve and adopt the Los Angeles County Repetitive Loss Area Analysis dated July 2016.

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

The County of Los Angeles has been a participant in the National Flood Insurance Program (NFIP) since 1980, which enables the County to obtain Federal assistance and make flood insurance

available for property owners in the County unincorporated areas. Since 1990, the County has also participated in the NFIP's Community Rating System (CRS) Program, which enables property owners in County unincorporated areas to qualify for discounted flood insurance premiums. The County currently has a CRS Class 7 Rating, resulting in an up to 15 percent reduction in flood insurance premiums for property owners in the unincorporated areas.

To retain eligibility in the NFIP's CRS Program, the County is required to develop a Floodplain Management Plan and to update and readopt it every 5 years. The County must also identify and analyze properties that have suffered recurring flood damage (repetitive loss properties). These updates are being provided in the enclosed Repetitive Loss Area Analysis.

Both documents were developed following the prescribed steps in the NFIP's 2013 Community Rating System Coordinator's Manual, which required more community input and involvement than past years. Consequently, a steering committee was established for the development of the Floodplain Management Plan, comprised of seven government and six nongovernment representatives. Other County departments participating in the steering committee included the Department of Regional Planning and the Fire Department. In addition, seven community meetings were held, six presentations were conducted to Town Councils, and the documents were available for public review and comment.

Implementation of Strategic Plan Goals

The Countywide Strategic Plan directs the provisions of Community Support and Responsiveness (Goal 2). The Comprehensive Floodplain Management Plan and the Repetitive Loss Area Analysis identify mitigation measures that can be implemented by the County, property owners, and organizations to improve the community's emergency preparedness.

FISCAL IMPACT/FINANCING

There will be no impact to the County General Fund.

Funding for typical annual CRS activities is included in the Flood Fund Fiscal Year 2016-17 Budget. The adoption of the plans will have no binding funding obligation on the County or the Los Angeles County Flood Control District (LACFCD), but future actions in the Floodplain Management Plan undertaken will be appropriately budgeted in future fiscal years.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

The Comprehensive Floodplain Management Plan is an overall strategy of programs, projects, and measures that will reduce the adverse impacts of flooding on the community. It includes a risk assessment for all properties subject to flood hazard, mitigation initiatives that may be implemented, and flood risk outreach to be conducted annually.

The Repetitive Loss Area Analysis addresses 55 repetitive loss properties in the unincorporated areas plus adjacent properties that may be subjected to the same flood hazards. This document describes the source of the flood problems, provides a list of mitigation measures that can be implemented to prevent future flood damage, and identifies the annual outreach to be conducted by the County.

The Board adopted the previous Floodplain Management Plan on May 11, 2010. The Federal Emergency Management Agency (FEMA) has reviewed the updated Comprehensive Floodplain

Management Plan and the Repetitive Loss Area Analysis and has determined that both plans meet the NFIP requirements, pending adoption by the Board.

ENVIRONMENTAL DOCUMENTATION

The recommended actions are exempt from the California Environmental Quality Act pursuant to Section 15262 of the State California Environmental Quality Act Guidelines and Section 21102 of the Public Resources Code relating to planning and feasibility studies for possible future actions, which the Board has not adopted, approved, or funded.

IMPACT ON CURRENT SERVICES (OR PROJECTS)

There will be no adverse impact on any other current services and/or projects as a result of this action.

If the plans are not adopted, the County's CRS Class Rating will drop to Class 10, resulting in the loss of the discounted flood insurance premiums.

CONCLUSION

Upon approval, please return three adopted copies of this letter to the Department of Public Works, Watershed Management Division.

Respectfully submitted,



GAIL FARBER

Director

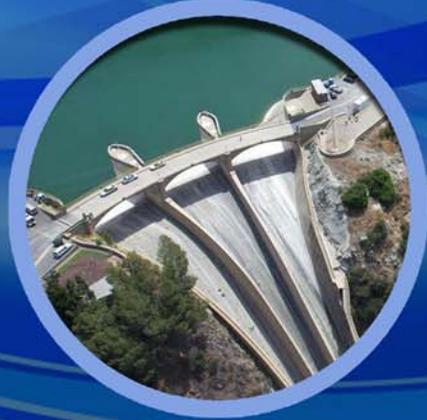
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c: Chief Executive Office (Rochelle Goff)
County Counsel
Executive Office



Comprehensive Floodplain Management Plan

Final Draft
July 2016



TETRA TECH

**Los Angeles County
COMPREHENSIVE FLOODPLAIN MANAGEMENT PLAN**

FINAL DRAFT

JULY 2016

Prepared for:

Los Angeles County Department of Public Works
Watershed Management Division
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Los Angeles County
Comprehensive Floodplain Management Plan

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Special Acknowledgments

Members of the Steering Committee for the *Los Angeles County Comprehensive Floodplain Management Plan*—from government, commercial, and non-profit agencies across the County—provided valuable input and assistance for development of the plan. Los Angeles County libraries, the Malibou Lake Association and several town councils helped to facilitate public meetings. Community Emergency Response Team volunteers aided public outreach efforts through their attendance at the public meetings. Members of the general public who completed surveys and attended public outreach events provided input that helped shape the final content of the floodplain management plan. Members of the Program for Public Information committee provided valuable input into the development of the public information framework. A particular appreciation is given to PPI committee member Tom Delmore for his contribution to this project before he passed away during the course of the plan's development.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

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: <ul style="list-style-type: none"> • Annually notify owners regarding local flood hazards and proper protection activities • Provide technical advice regarding flood protection and flood preparedness • 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 <i>Los Angeles County Comprehensive Floodplain Management Plan</i> and the <i>Los Angeles County Hazard Mitigation Plan</i> 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 this chapter. A section at the end of the chapter 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. In addition, the floodplain management plan was submitted for review to the Los Angeles County Access and Functional Needs Committee, in order to ensure compliance with the federal Americans with Disabilities Act.

- 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.

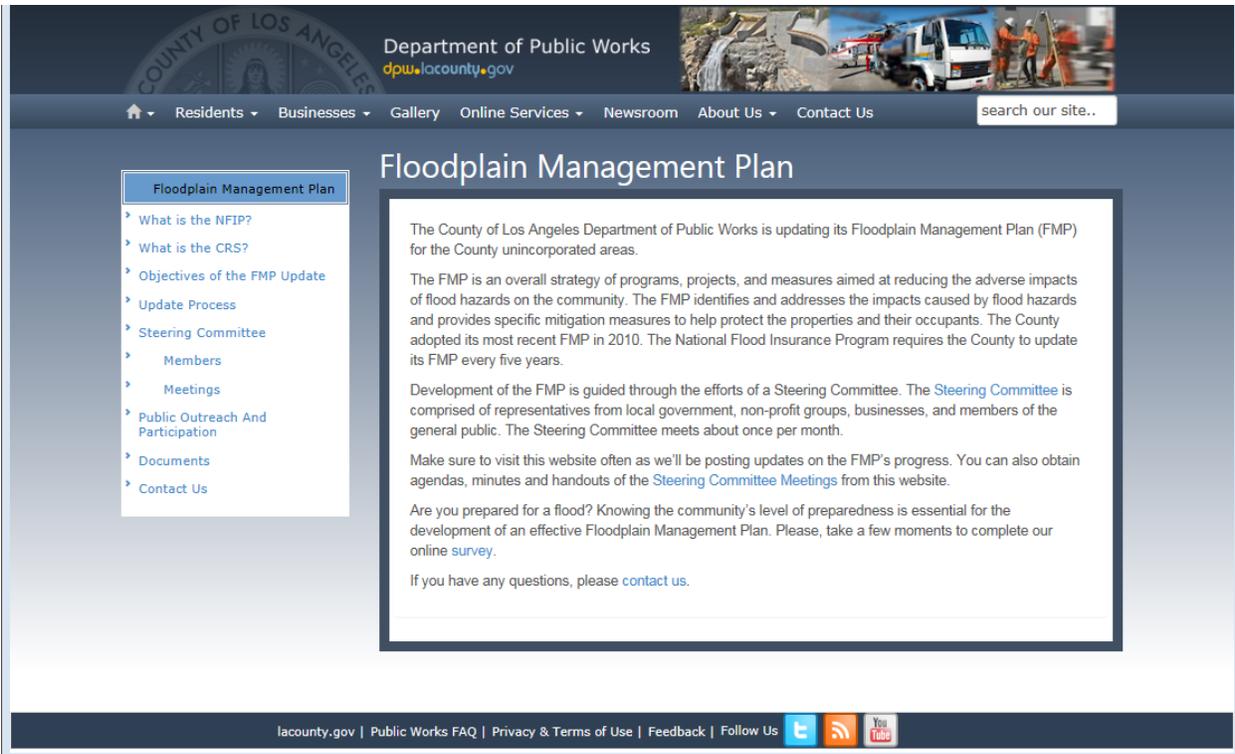


Figure 2-1. Sample Page from Floodplain Management Plan Web Site

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

 **LA Co Public Works**  **Following**

@LACoWater

Are you prepared for a flood? Please take a short survey to find out & help protect lives & prop. from potential harm

svy.mk/1BZGusE

9:40 AM - 26 Feb 2015

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 29033 Lake Vista Drive, Agoura, CA 91301
January 10, 2015, 2:00 pm to 5:00 pm	Altadena: Altadena Community Library 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 18601 Soledad Canyon Road, Santa Clarita, CA 91351
February 21, 2015, 12:00 pm to 3:00 pm	Lancaster: Lancaster Public Library 601 West Lancaster Boulevard, Lancaster, CA 93534
April 2, 2015, 5:00 pm to 7:00 pm	Lynwood: Lynwood Library 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 complete flooding incident information during open house events on December 3, from 4-7 p.m., at the Malibu 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/index.htm 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*

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



Public Open House

Wednesday December 3, 2014*

4:00pm – 7:00pm

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



*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



Figure 2-7. Example Printout from Hazus Workstation



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



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

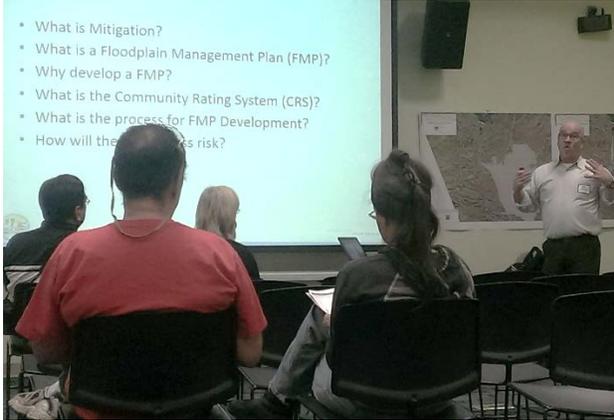


Figure 2-10. Informational Presentation, Santa Clarita Meeting, January 24, 2015



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 47707 90th Street West, Lancaster, CA 93536
March 24, 2015, 7:00 pm	Palmdale— Lake Los Angeles Town Council Meeting: Stephen Sorensen Park Gymnasium 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 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 June 2, 2016 to July 7, 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	0	0
June 15, 2016	Lynwood Library	0	0
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	13^a
a. Three comments on the draft plan were received via email.			

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)	<ul style="list-style-type: none"> • Review purposes for update • Organize Steering Committee • Discuss goal setting • Develop public involvement strategy 	17
9/23/2014	Steering Committee Meeting #2	<ul style="list-style-type: none"> • Review and approve ground rules • Identify a mission statement • Review and discuss plan goals • Define Phase 1 public involvement 	25
10/28/2014	Steering Committee Meeting #3	<ul style="list-style-type: none"> • Confirm mission statement and goals • Introduce objective development exercise • Discuss critical facilities definition • Discuss and affirm questionnaire • 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	<ul style="list-style-type: none"> • Confirm objectives • 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	<ul style="list-style-type: none"> • Review mission statement, goals, and objectives • Review informational open house information • Discuss the plan maintenance strategy • 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	<ul style="list-style-type: none"> • Review and discuss the public involvement strategy • Review the mitigation catalog • 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	<ul style="list-style-type: none"> Review and discuss the public involvement strategy Discuss the program for public information 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	<ul style="list-style-type: none"> Introduce the Program for Public Information Discuss and define target areas (Step 2) Discuss and define target audiences (Step 2) 	7
4/28/2015	Steering Committee Meeting #8	<ul style="list-style-type: none"> Review progress on the Program for Public Information Review and discuss results from the questionnaire Review and discuss the draft action plan Discuss next steps for the planning process 	16
5/21/2015	PPI Committee Meeting #2	<ul style="list-style-type: none"> Review and revise target areas and audiences (Step 2) Discuss and define priority topics (Step 3) Discuss and define messages, audiences and outcomes (Step 3) 	7
6/10/2015	PPI Committee Meeting #3	<ul style="list-style-type: none"> Review and revise messages, audiences and outcomes (Step 3) Discuss and define outreach projects (Step 4) 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	<ul style="list-style-type: none"> Review and discuss the draft plan Discuss next steps for the planning process 	14
6/2/2016	Coordinating Agency Review	Los Angeles County Access and Functional Needs Committee	--
6/2/2016	Public Comment Period	Public comment period of draft plan opens. Draft plan posted on plan website with flyers notifying public of plan availability	N/A
6/14/2016	Public Outreach	Final public meeting on draft plan (Agoura Hills Library)	0
6/15/2016	Public Outreach	Final public meeting on draft plan (Lynwood Library)	0
7/7/2016	Public Comment Period	Public comment period of draft plan closes	N/A
__/__/2016	Adoption	Public notice published advertising the __/__/2016 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 draft plan submitted to Insurance Services Office (ISO) for review and approval	N/A
__/__/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



Unincorporated Los Angeles County
Incorporated Cities

0 10 20 Miles

Data Sources: Los Angeles County



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 known 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.

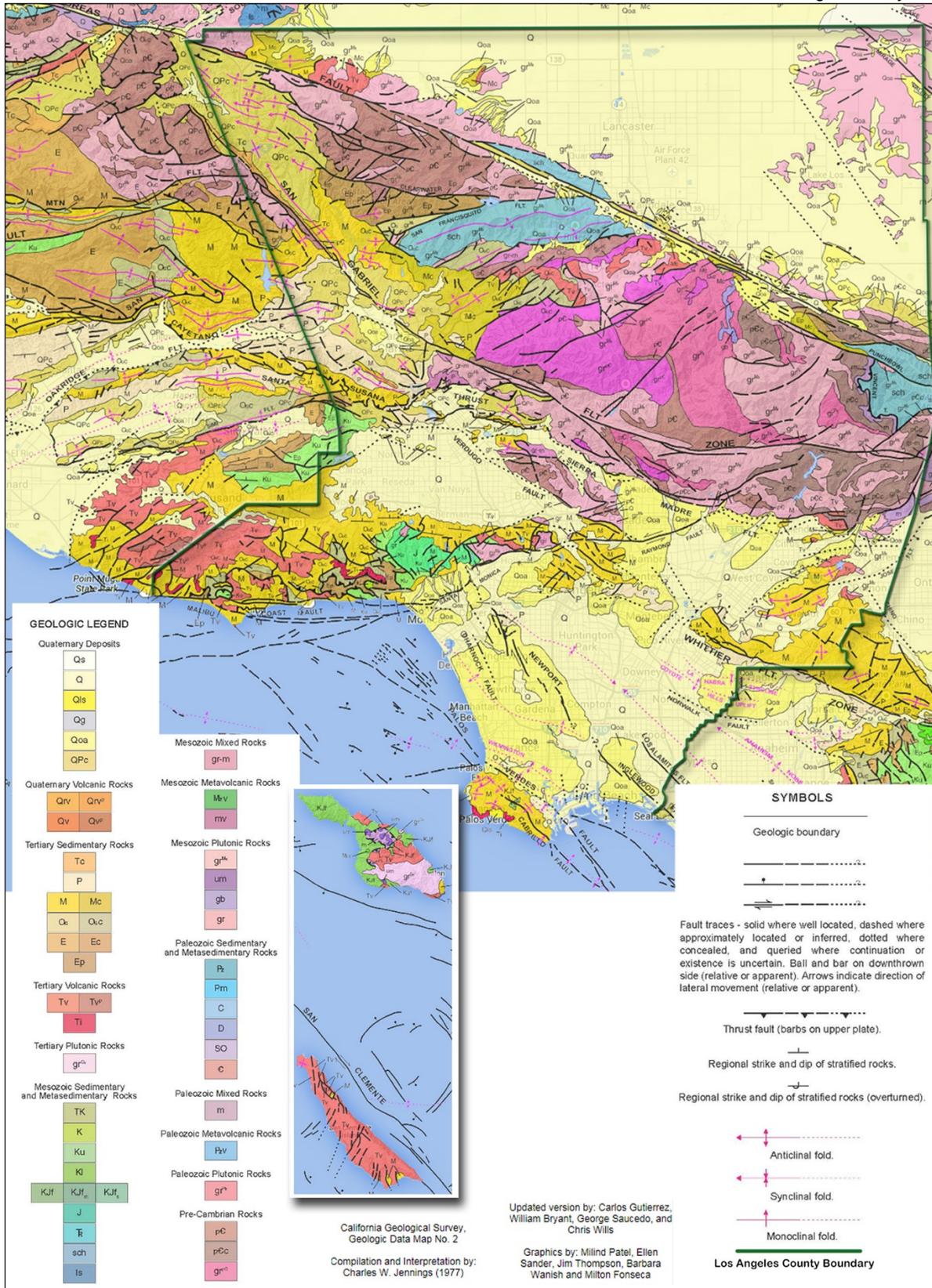


Figure 3-2. Los Angeles County Geologic Features

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.

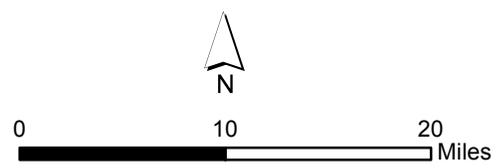
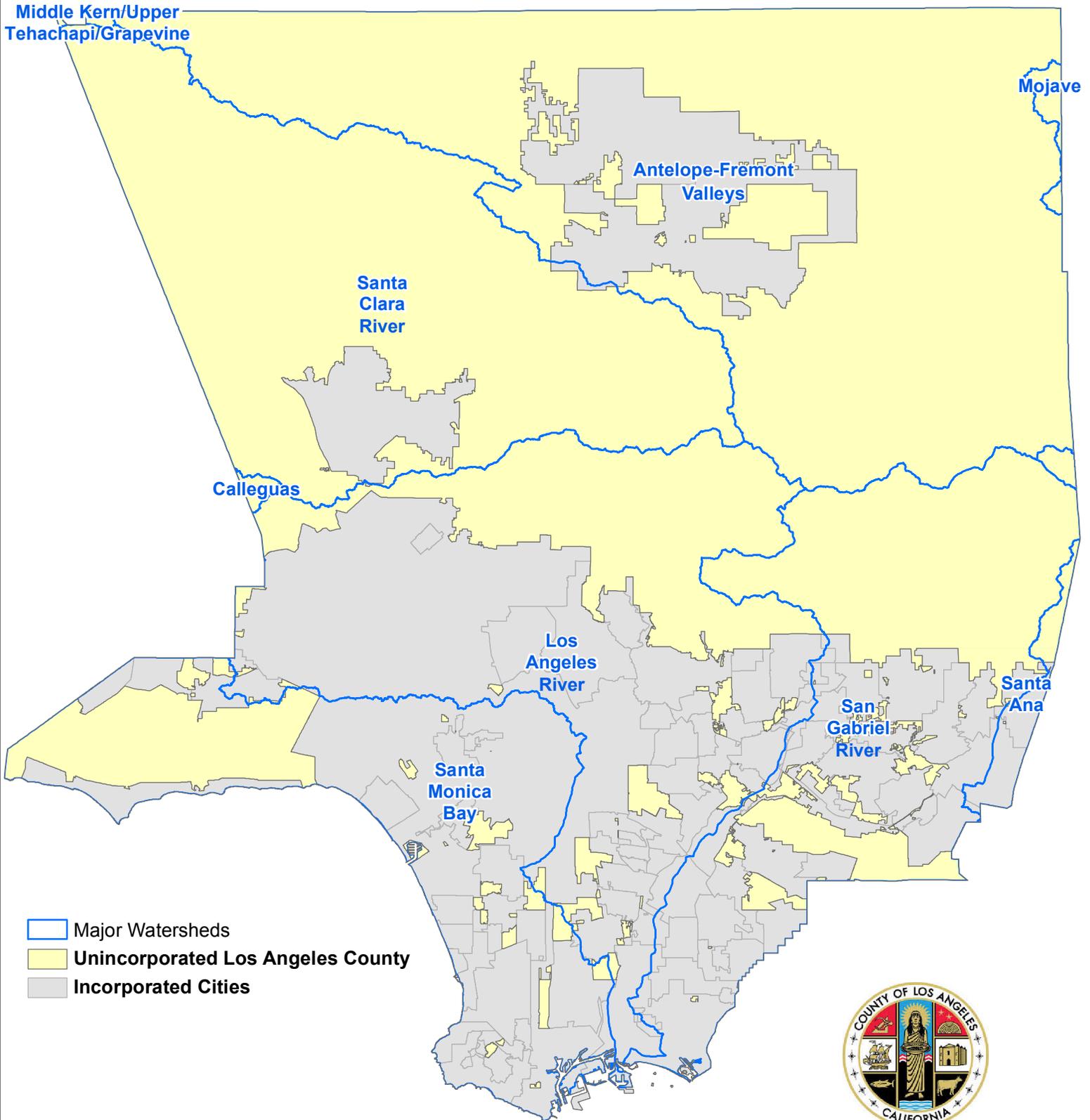
**TABLE 3-2.
NRCS WATERSHEDS IN UNINCORPORATED LOS ANGELES COUNTY**

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



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 75°F, but the average increases to 95°F 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.

	L.A. International Airport	Downtown Los Angeles	Lancaster
Average Annual Minimum Temperature	56.1°F	56.6°F	46.6°F
Average Annual Maximum Temperature	70.6°F	75.6°F	75°F
Average Annual Mean Temperature	63.3°F	66.2°F	60.8°F
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
Sacatarra 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	Communica tions	Bridges	Transporta- tion	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
Sacatar 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	Communica tions	Bridges	Transporta- tion	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

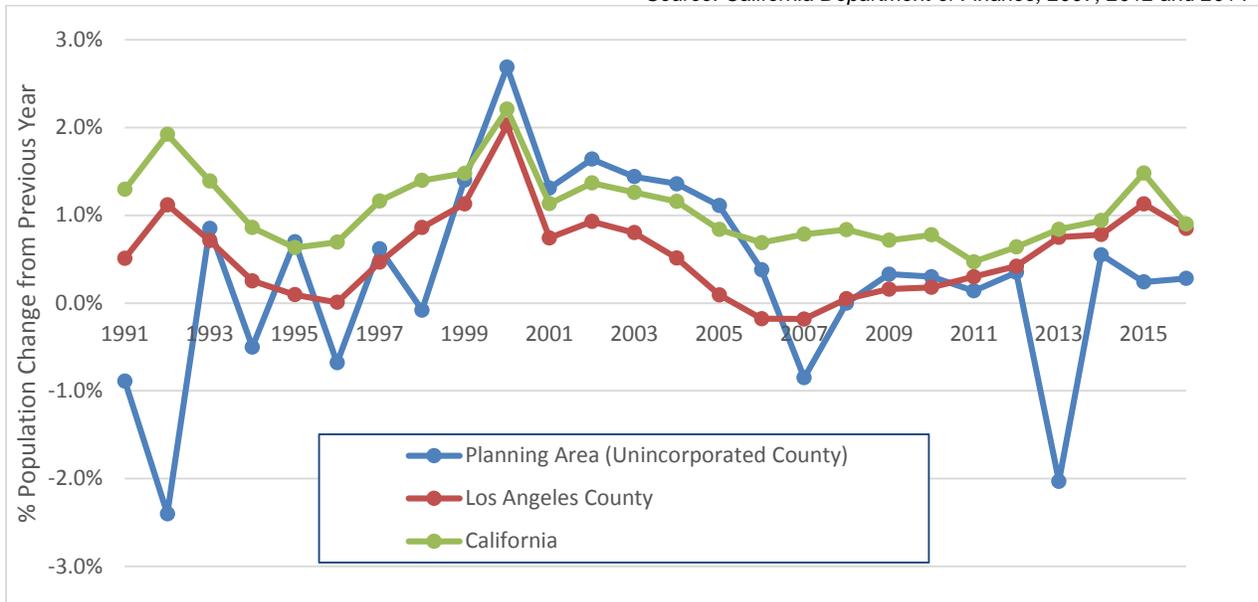


Figure 3-5. California and Los Angeles County Population Growth

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

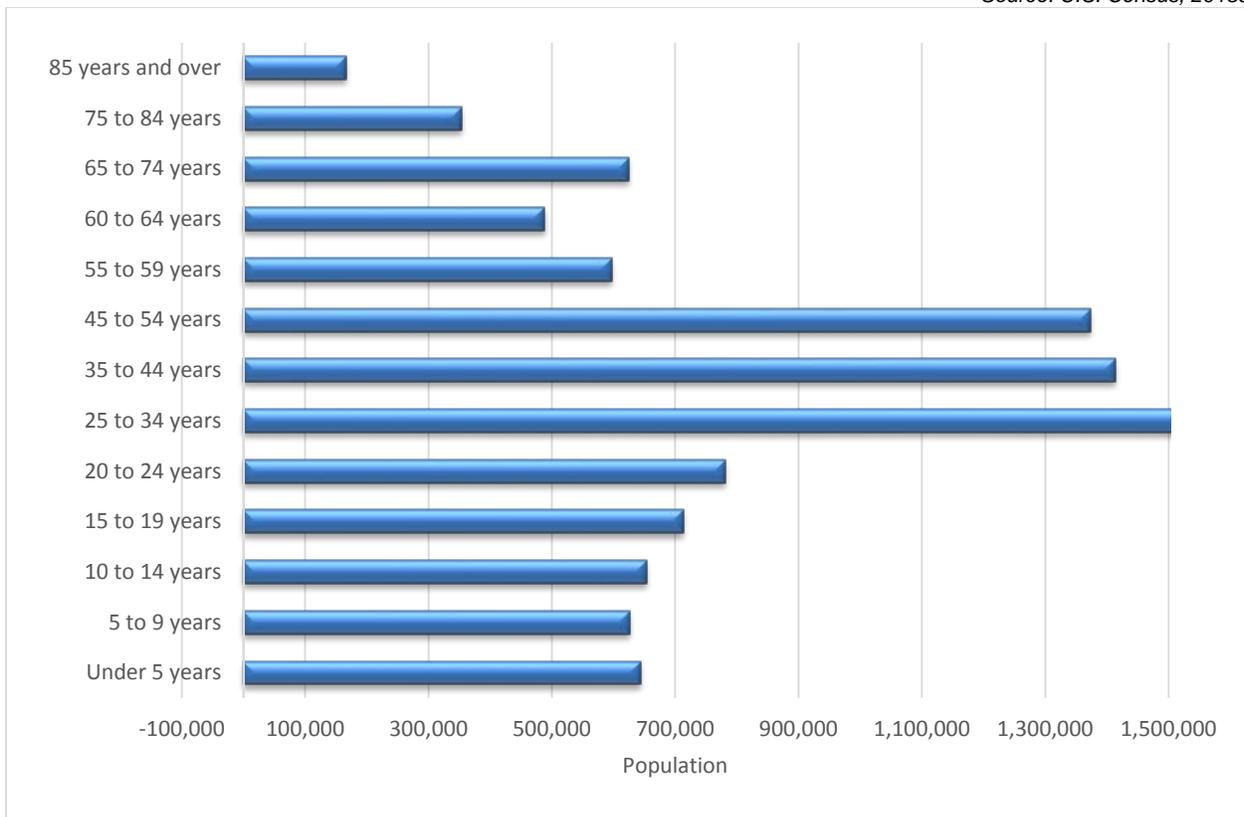


Figure 3-6. Los Angeles County Age Distribution

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

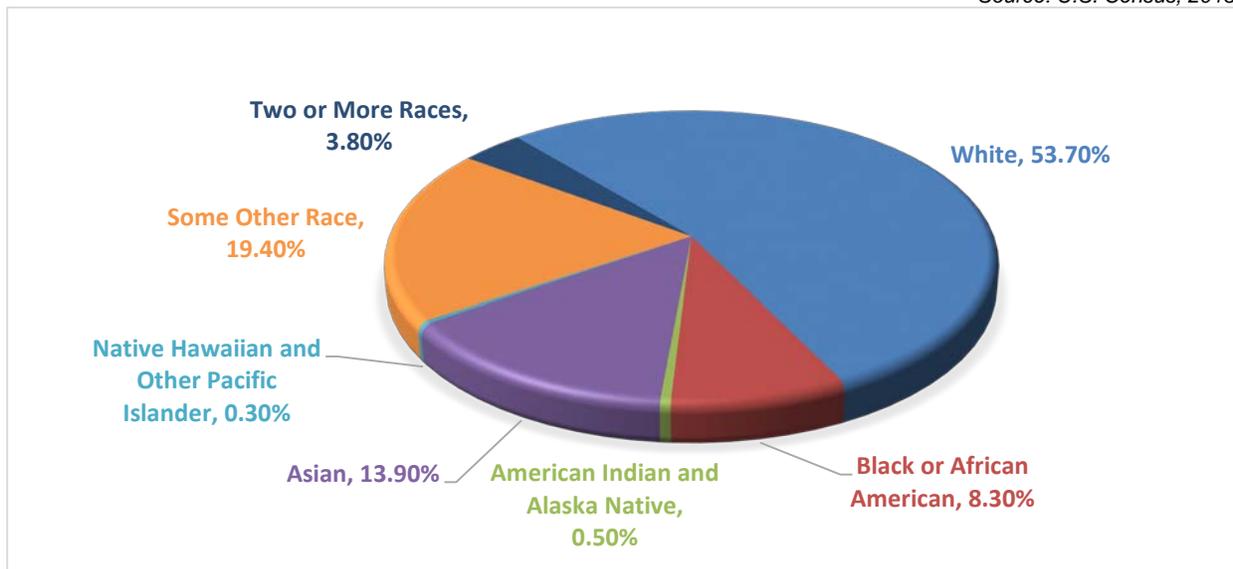


Figure 3-7. Los Angeles County Race Distribution

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

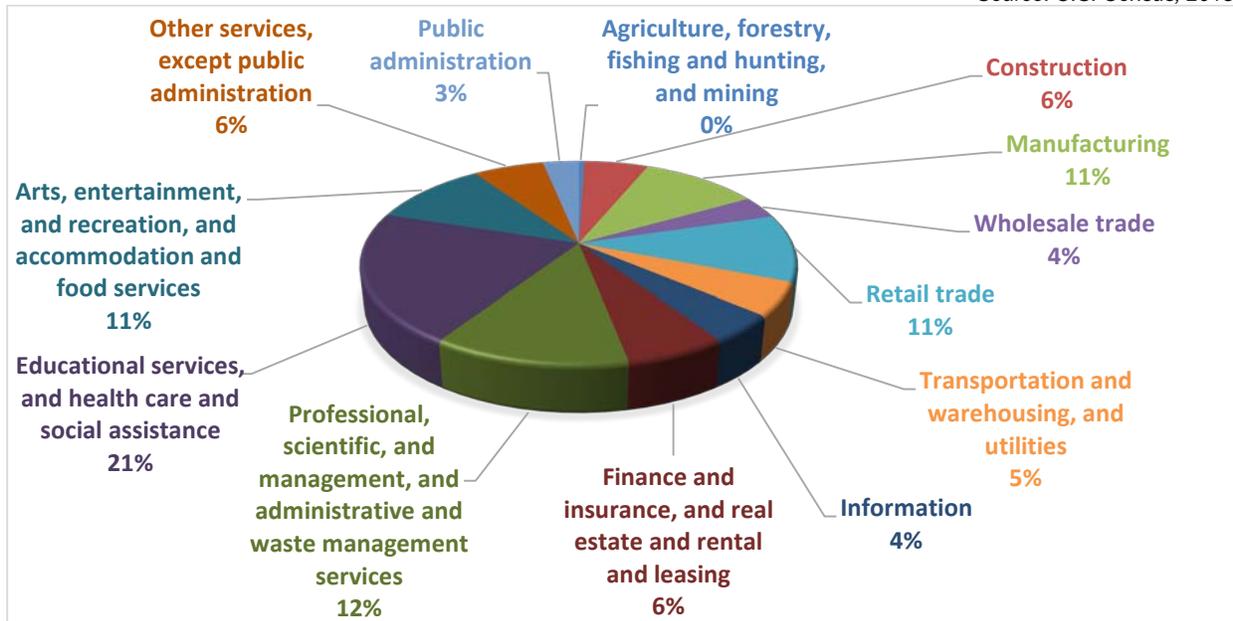


Figure 3-8. Industry in Los Angeles County

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

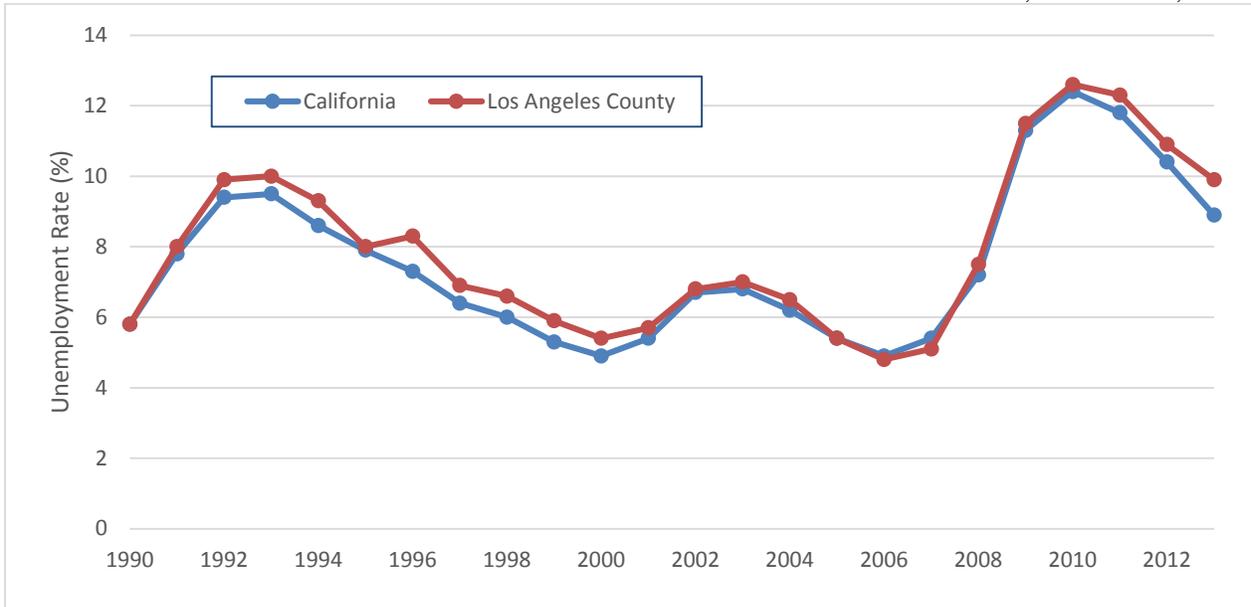


Figure 3-9. California and Los Angeles County Unemployment Rate

Source: U.S. Census, 2013b

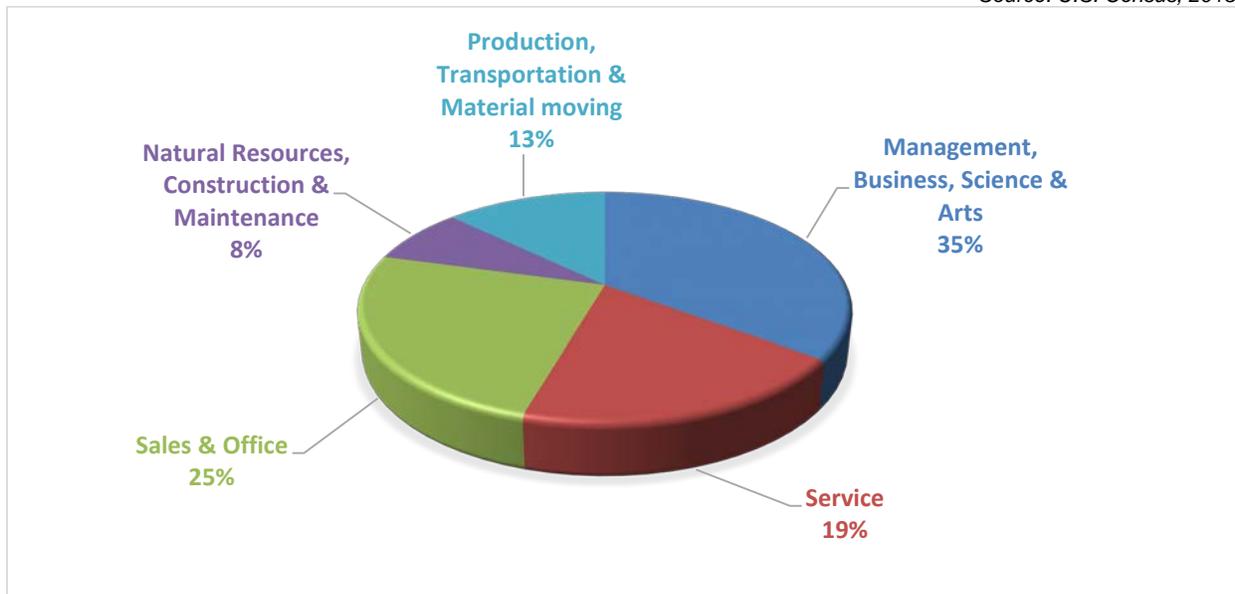


Figure 3-10. Occupations in Los Angeles County

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).

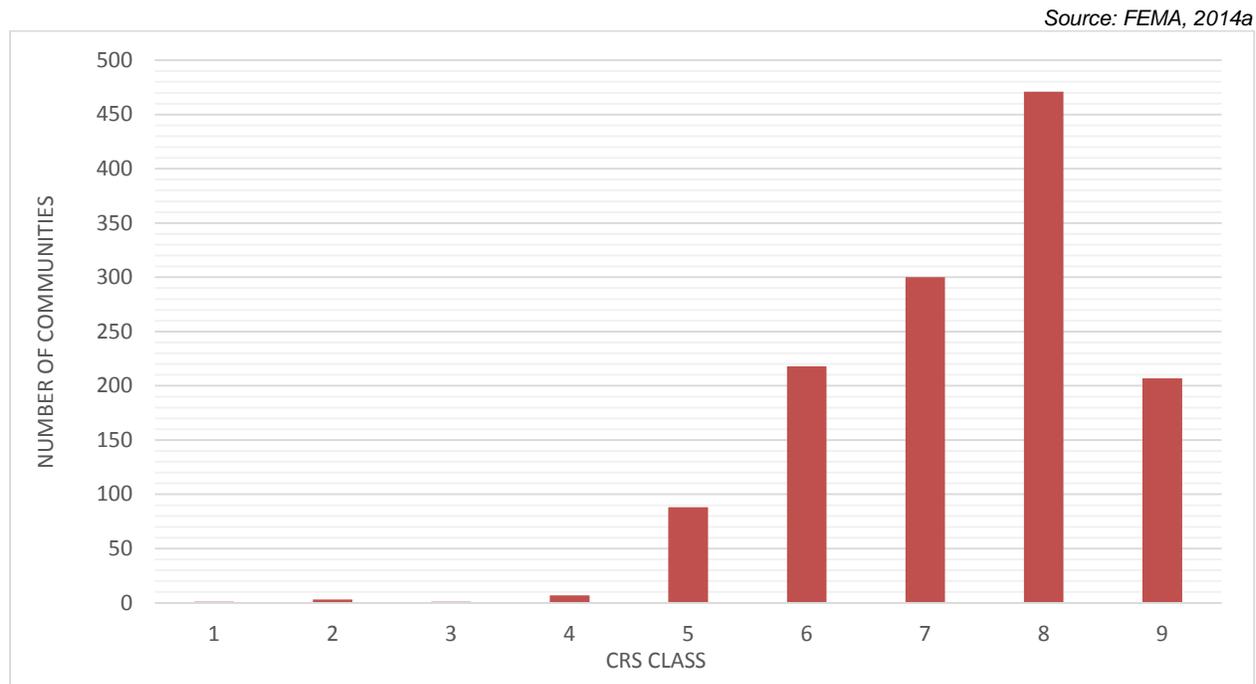


Figure 4-1. CRS Communities by Class Nationwide as of May 2014

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 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 than 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 Area 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 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 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
<i>Comment:</i> County of Los Angeles County Code, Title 26 – Building Code				
Zoning Code	Yes	No	No	Yes
<i>Comment:</i> County of Los Angeles County Code, Title 22 – Planning and Zoning				
Subdivisions	Yes	No	No	No
<i>Comment:</i> County of Los Angeles County Code, Title 21 – Subdivision Code				
Post-Disaster Recovery	Yes	No	No	No
<i>Comment:</i> 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
<i>Comment:</i> County of Los Angeles County Code: Title 26, Chapter 1, Section 110 – Prohibited Uses of Building Sites Title 11, Division 3, Chapter 11.60 – Floodways and Water Surface Elevations Title 21, Chapter 21.44.320 – Land subject to flood hazard, inundation, or geological hazard Title 21, Chapter 21.44.330 – Flood-hazard area, floodway or natural watercourse designation Title 20, Division 5, Chapter 20.94 – Channels Title 22, Division 1, Chapter 22.52, Part 5 – Flood Control				
Low-Impact Development Standards	Yes	No	No	Yes
<i>Comment:</i> County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.84 Low Impact Development Standards				
Real Estate Disclosure	No	No	No	Yes
<i>Comment:</i> State of California Natural Hazards Disclosure Act, effective June 1, 1998 (California Civil Code Section 1103.2)				
Growth Management	No	No	Yes	Yes
<i>Comment:</i> 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
<i>Comment:</i> County of Los Angeles County Code, Title 26 – Building Code, Chapter 1 – Administration, Inspections.				
Special Purpose (flood management, critical areas)	—	—	—	—
<i>Comment:</i> County of Los Angeles County Code, Title 11 – Health and Safety, Division 2 – General Hazards, Chapter 11.52 – Water Hazards. County of Los Angeles County Code, Title 11 – Health and Safety, Division 3 – Miscellaneous Regulations, Chapter 11.60 – Floodways and Water Surface Elevations. County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.80 – Stormwater and Runoff Pollution Control Angeles County Code, Title 12 – Environmental Protection, Chapter 12.20 – Depositing Petroleum Products on Beaches or into Pacific Ocean County of Los Angeles County Code, Title 20 – Utilities, Division 5 – Flood Control District Property and Facilities County of Los Angeles County Code, Flood Control District Code, Chapter 21 – Stormwater and Runoff Pollution Control 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) <ul style="list-style-type: none"> • 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 <i>Comment:</i> 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.	Yes	No	No	Yes
Water Resource Management Plan <i>Comment:</i> 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	Yes	No	Yes	Yes
Best Management Practices <i>Comment:</i> 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: <ul style="list-style-type: none"> • Title 26, Chapter 1, Section 110 – Prohibited Uses of Building Sites, last amended by ordinance 2013-0048 § 2, effective 2013 • Title 11, Division 3, Chapter 11.60 – Floodways and Water Surface Elevations, last amended by ordinance 2011-0039 § 2, effective 2011 • Title 21, Chapter 21.44.320 – Land subject to flood hazard, inundation, or geological hazard, last amended by ordinance 11665 § 38, effective 1978 • Title 21, Chapter 21.44.330 – Flood-hazard area, floodway or natural watercourse designation, last amended by ordinance 11665 § 39, effective 1978 • 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 Community Assistance Visit Report: November 3, 2010 Community Assistance Visit Closed: November 3, 2010 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.

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.

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.

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

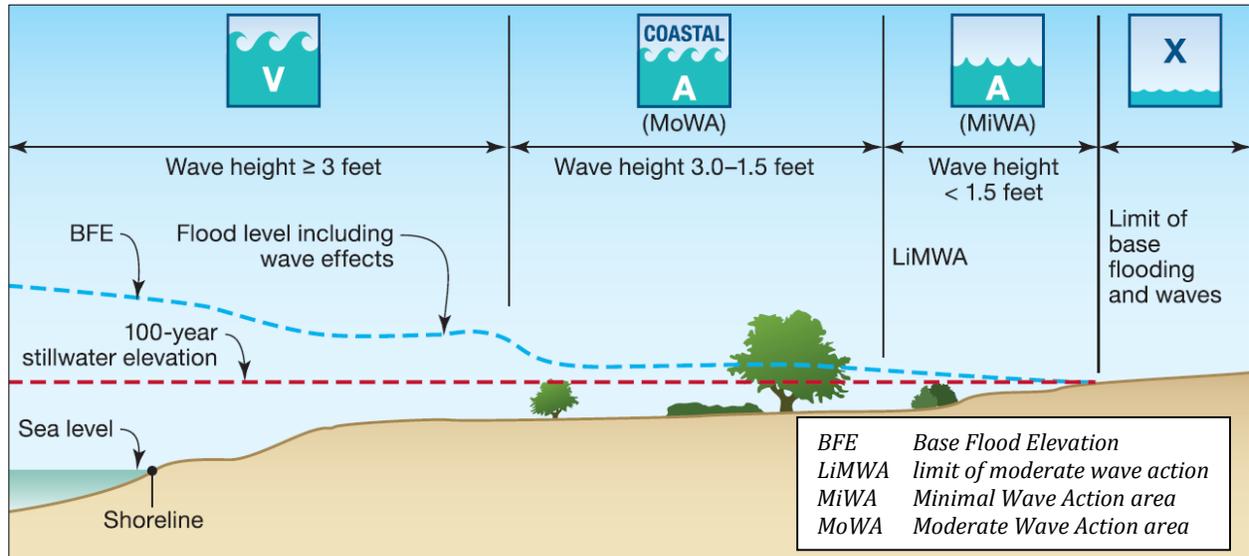


Figure 6-1. Coastal Hazard Zones

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 greater 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:

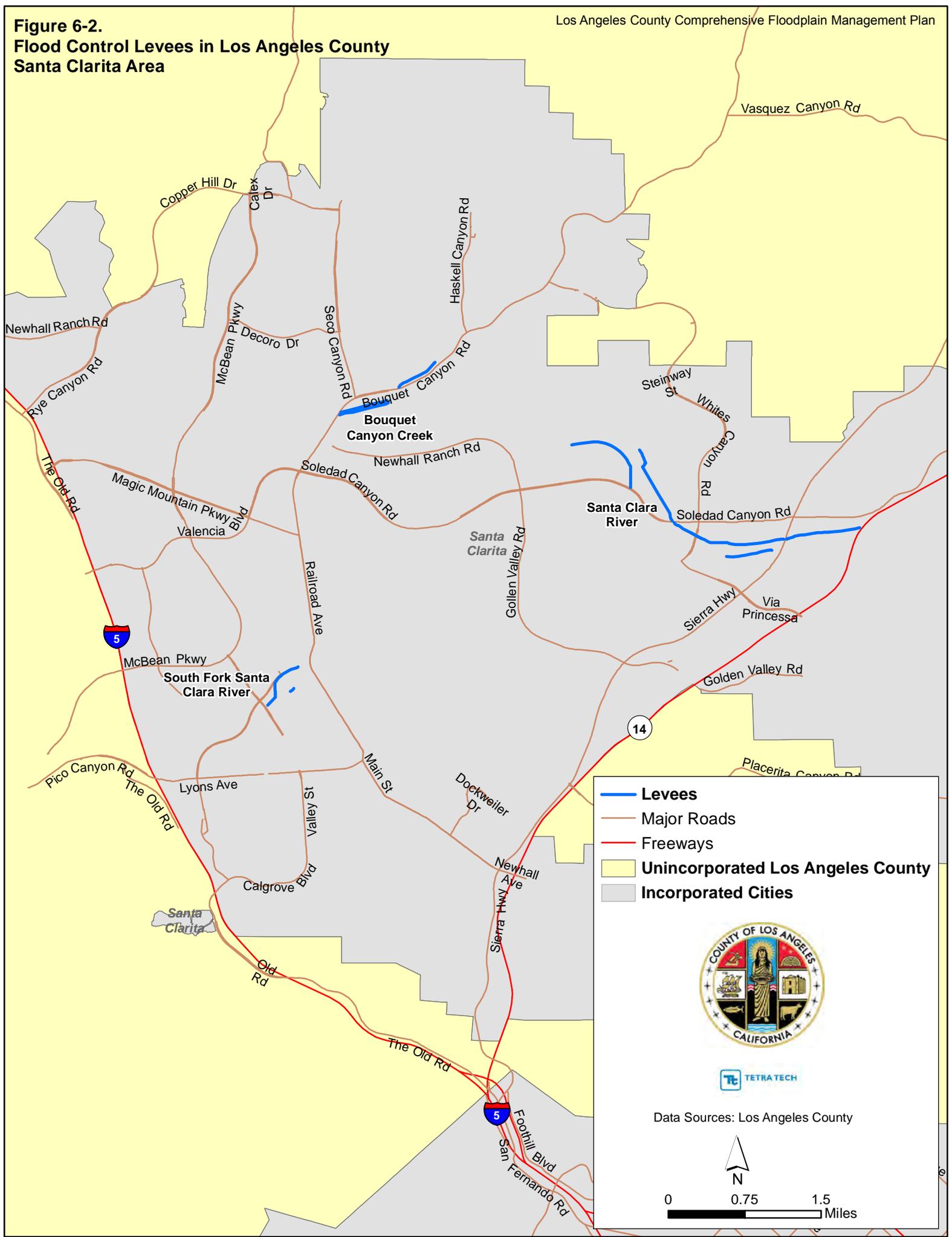
- Dominguez Channel Levee
- Compton Creek Levee
- Bouquet Canyon Creek Levees (ID Nos. 13 and 15)
- Santa Clara River Levees Nos. 4, 7, 10, and
- South Fork Santa Clara River Levee No. 26.

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



- Levees
- Major Roads
- Freeways
- Unincorporated Los Angeles County
- Incorporated Cities



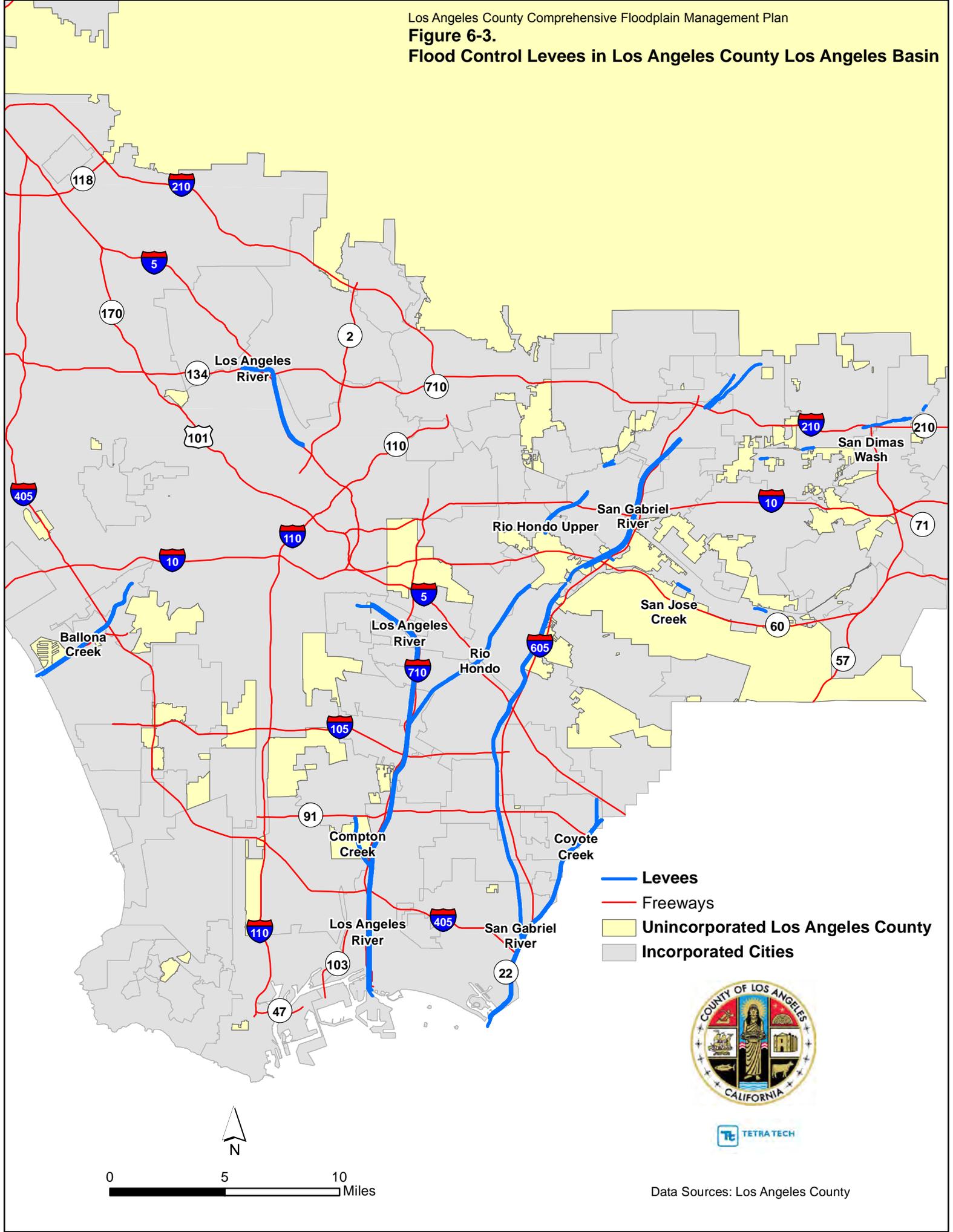
Data Sources: Los Angeles County



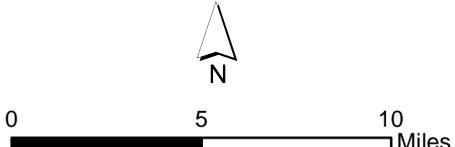
0 0.75 1.5 Miles

Figure 6-3.

Flood Control Levees in Los Angeles County Los Angeles Basin



- Levees
- Freeways
- Unincorporated Los Angeles County
- Incorporated Cities



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)

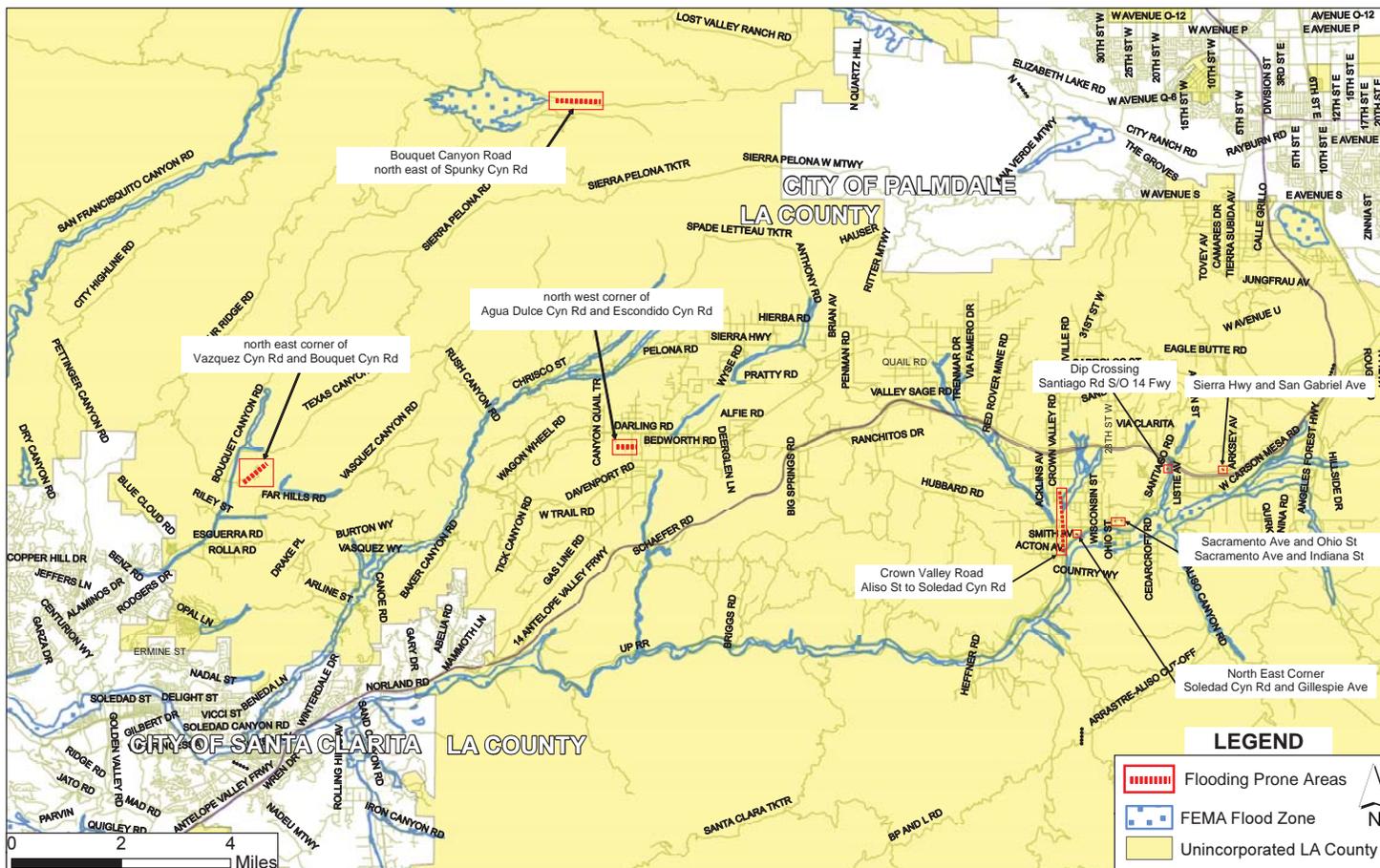
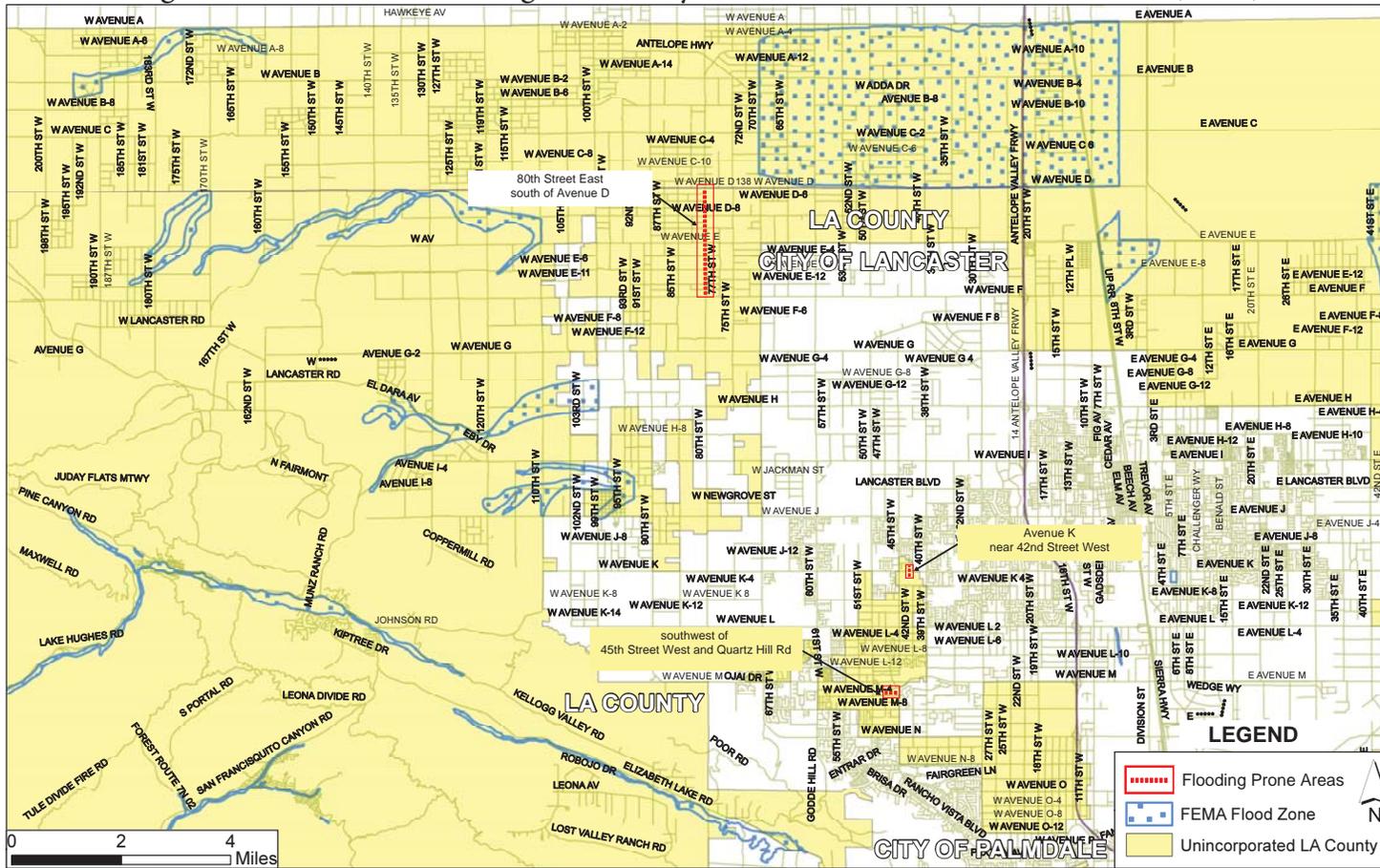
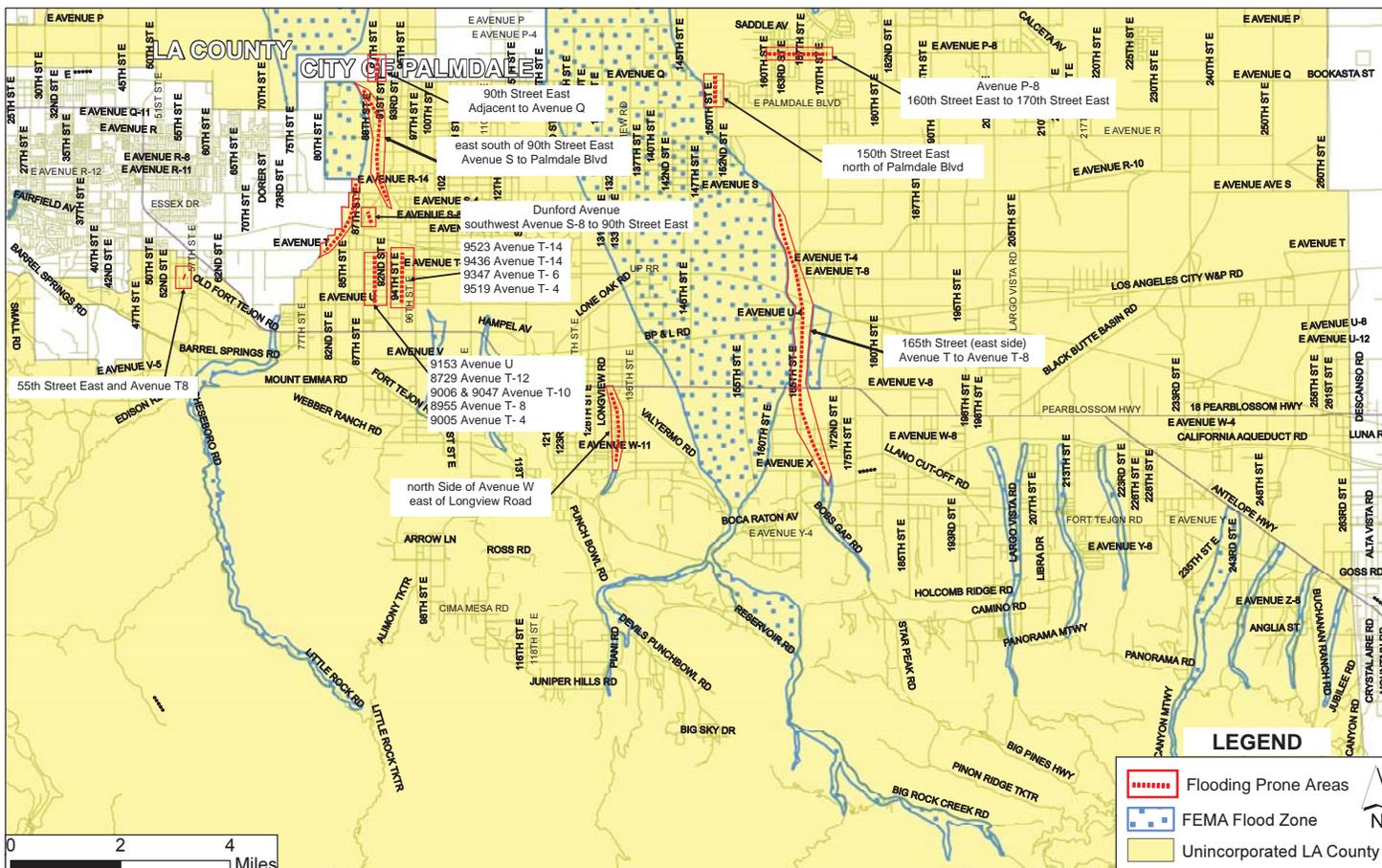
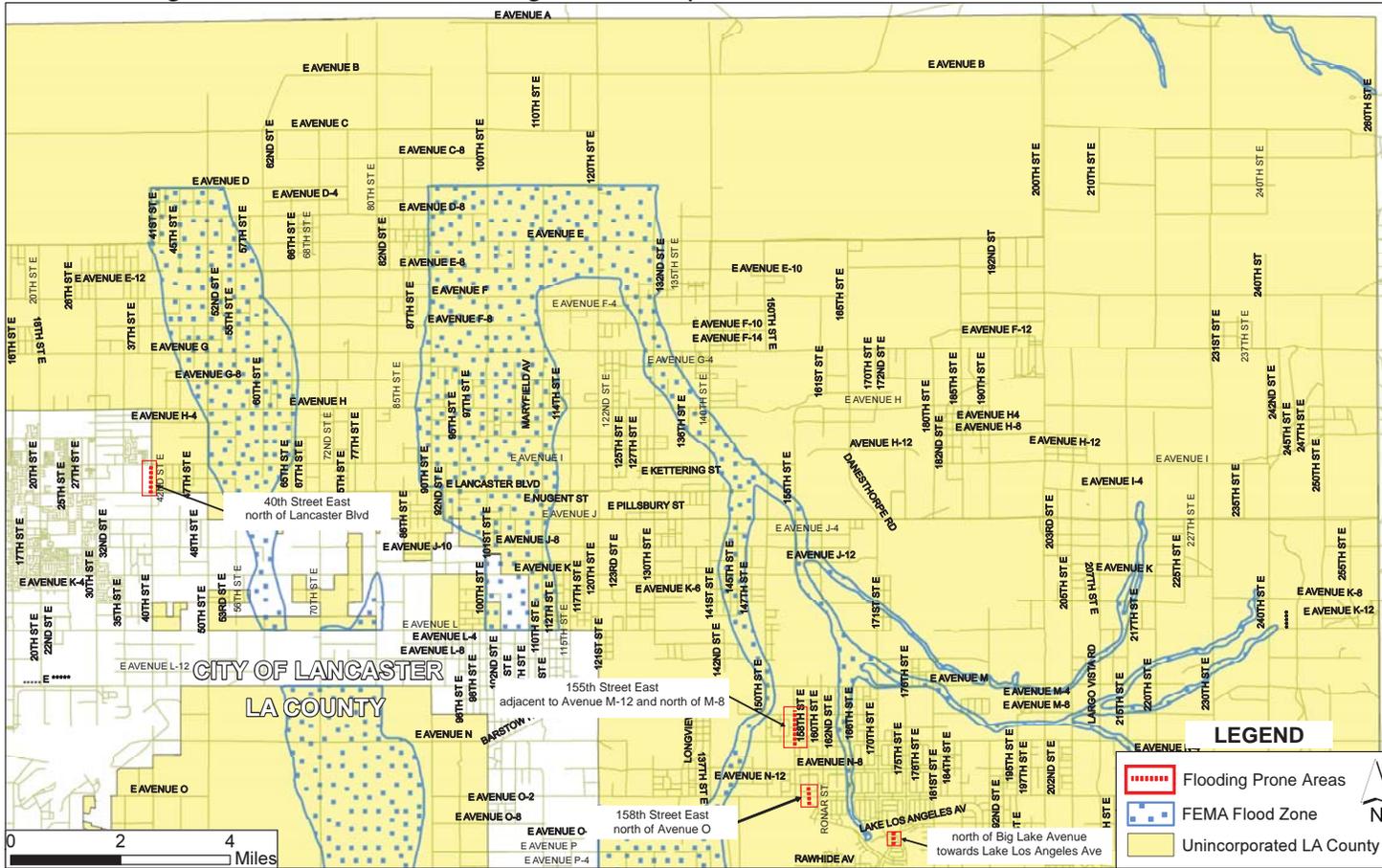


Figure 6-5. Northern Los Angeles County Flood-Prone Areas Outside SFHA (East)



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).

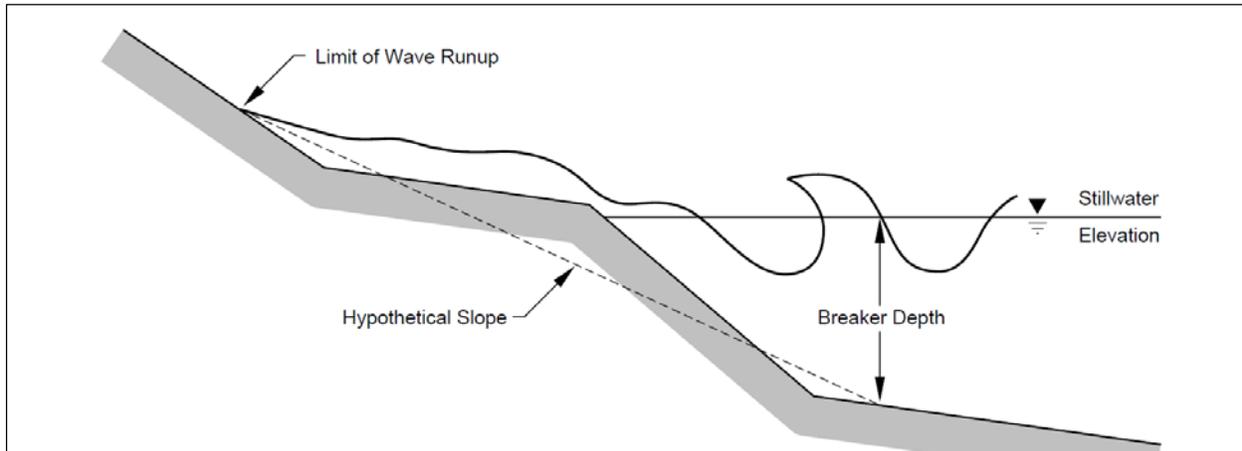


Figure 6-6. Wave Run-Up

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.

	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

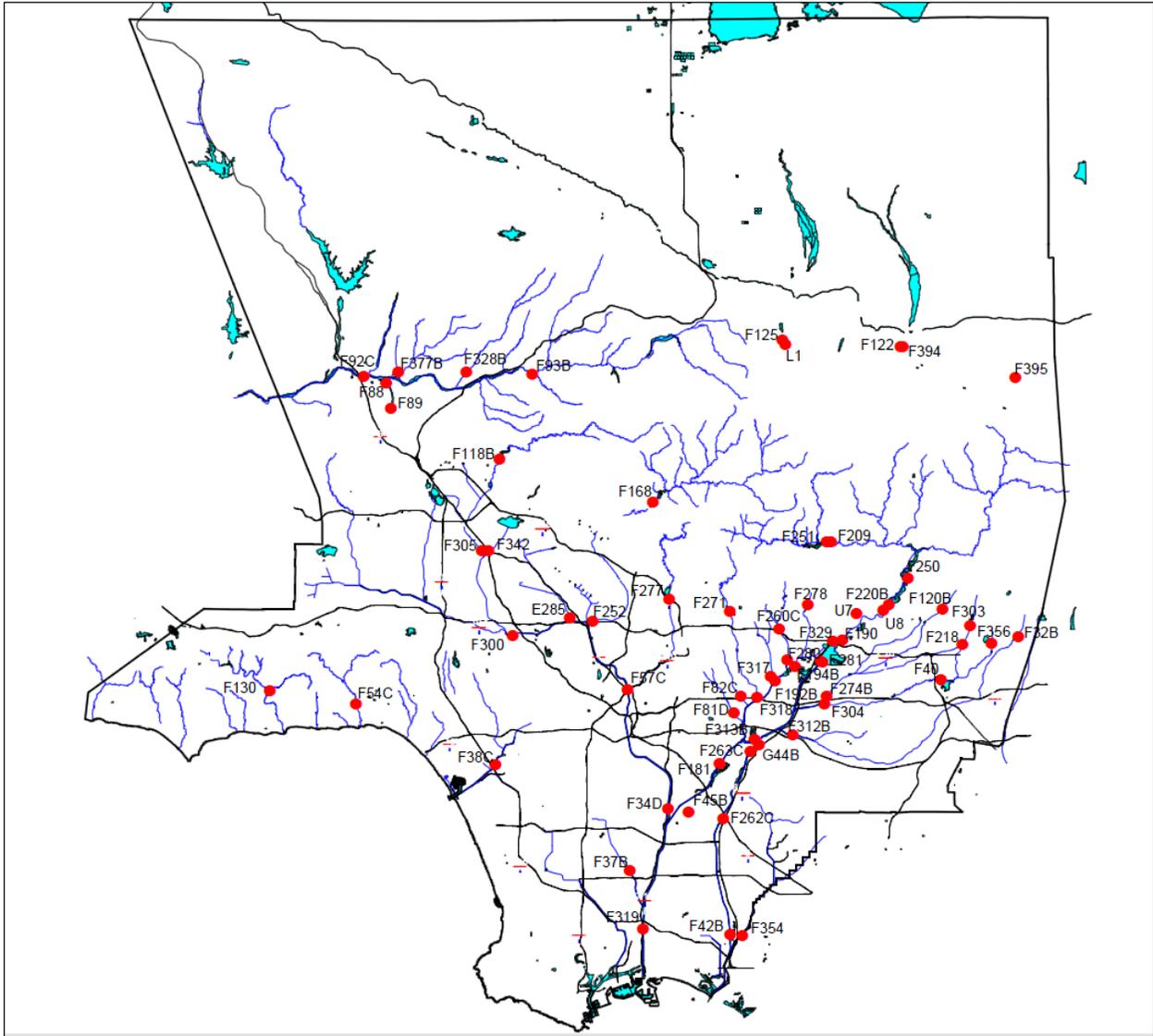


Figure 6-7. Stream Gage Locations in Los Angeles County

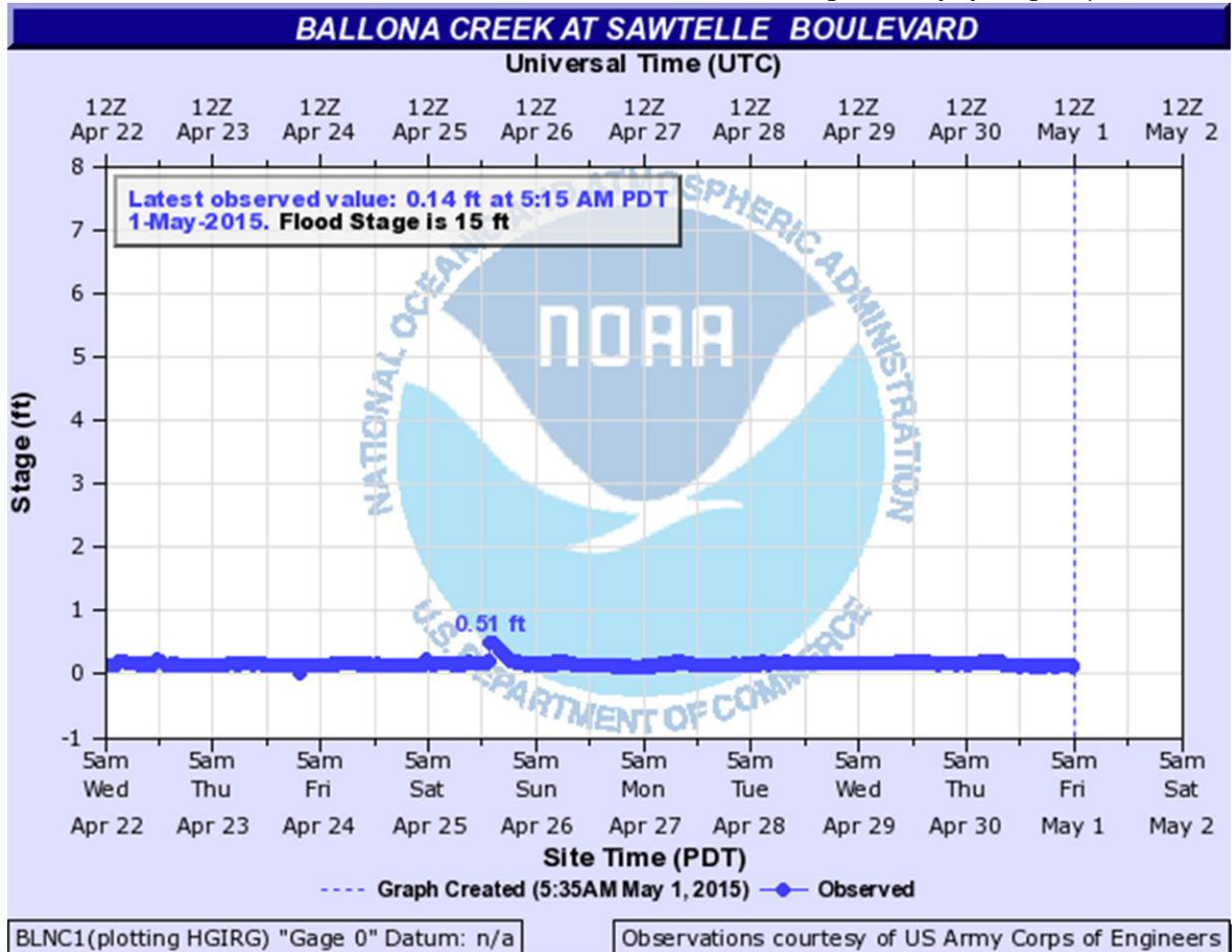


Figure 6-8. Ballona Creek Hydrograph at Sawtelle Boulevard

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 than 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**

	Area (acres)	Number of Structures							Total
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	
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**

	Area (acres)	Number of Structures							Total
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	
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		500-Year Floodplain	
	Area (acres)	% of Total Area	Area (acres)	% 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 Alamos 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).

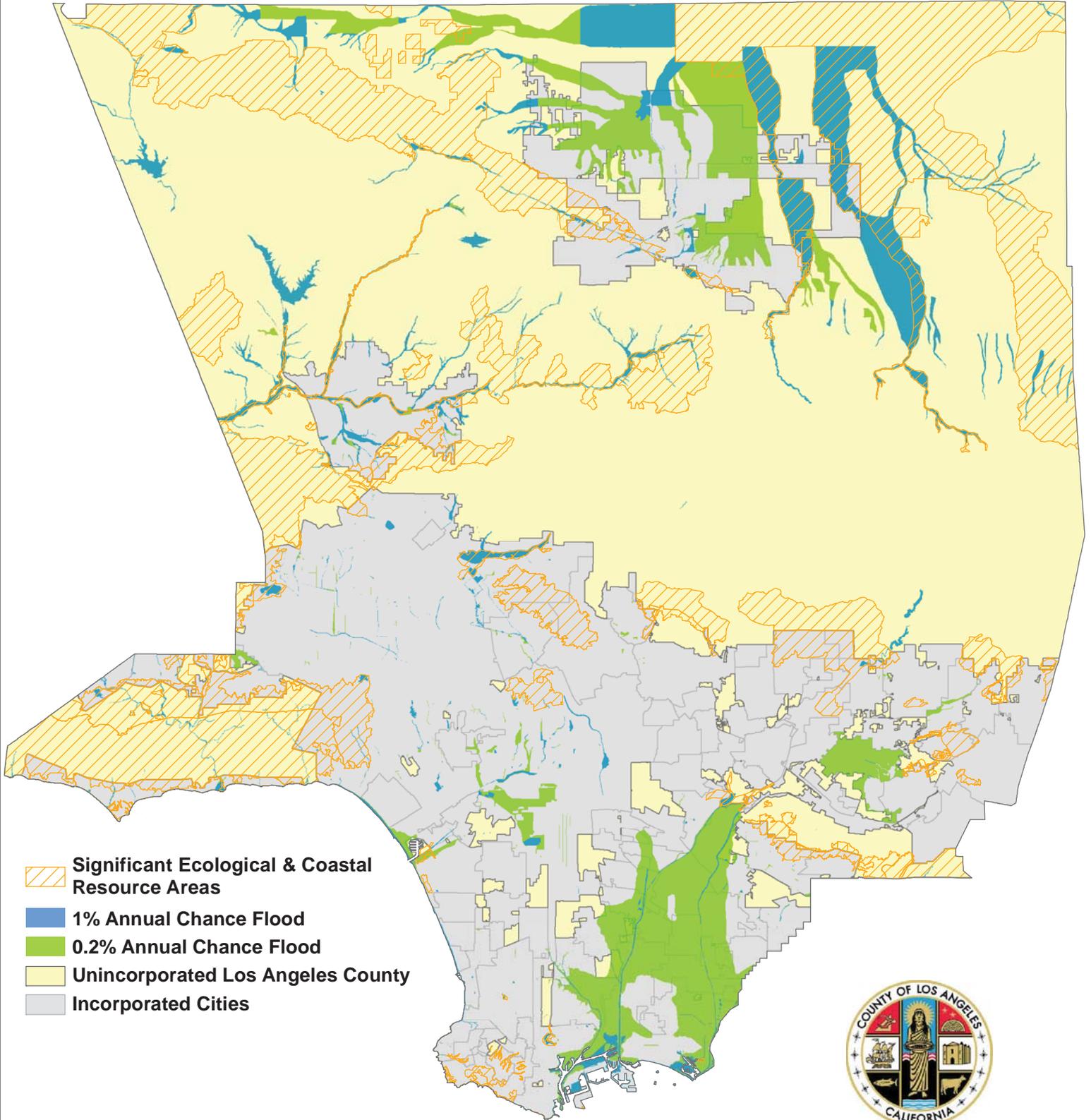
Santa Felicia SEA

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.

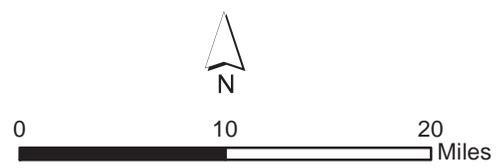
Antelope Valley SEA

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



-  Significant Ecological & Coastal Resource Areas
-  1% Annual Chance Flood
-  0.2% Annual Chance Flood
-  Unincorporated Los Angeles County
-  Incorporated Cities



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.

	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 area 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 Replacement 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 Replacement 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 Replacement 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%
Sacatar 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 Replacement 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%
Sacatar 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 Replacement 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%
Sacatarra 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 1.4°F 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.

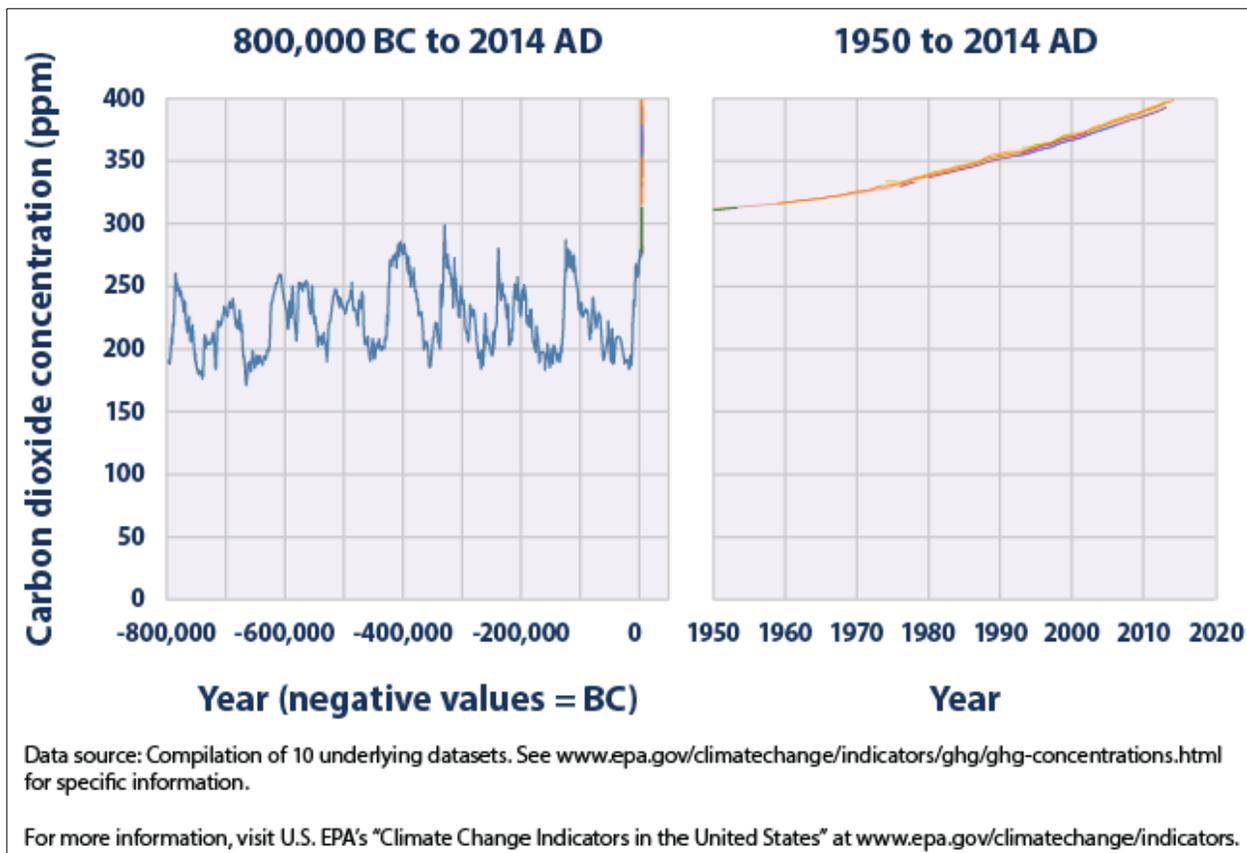


Figure 9-1. Global Carbon Dioxide Concentrations Over Time

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 1.4°F 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 0.5°F and 8.6°F by 2100 (IPCC, 2014). Some research has concluded that every increase of 2°F 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 95°F) 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 7°F by 2100 (C-Change.LA, 2015).

Source: C-Change.LA, 2014

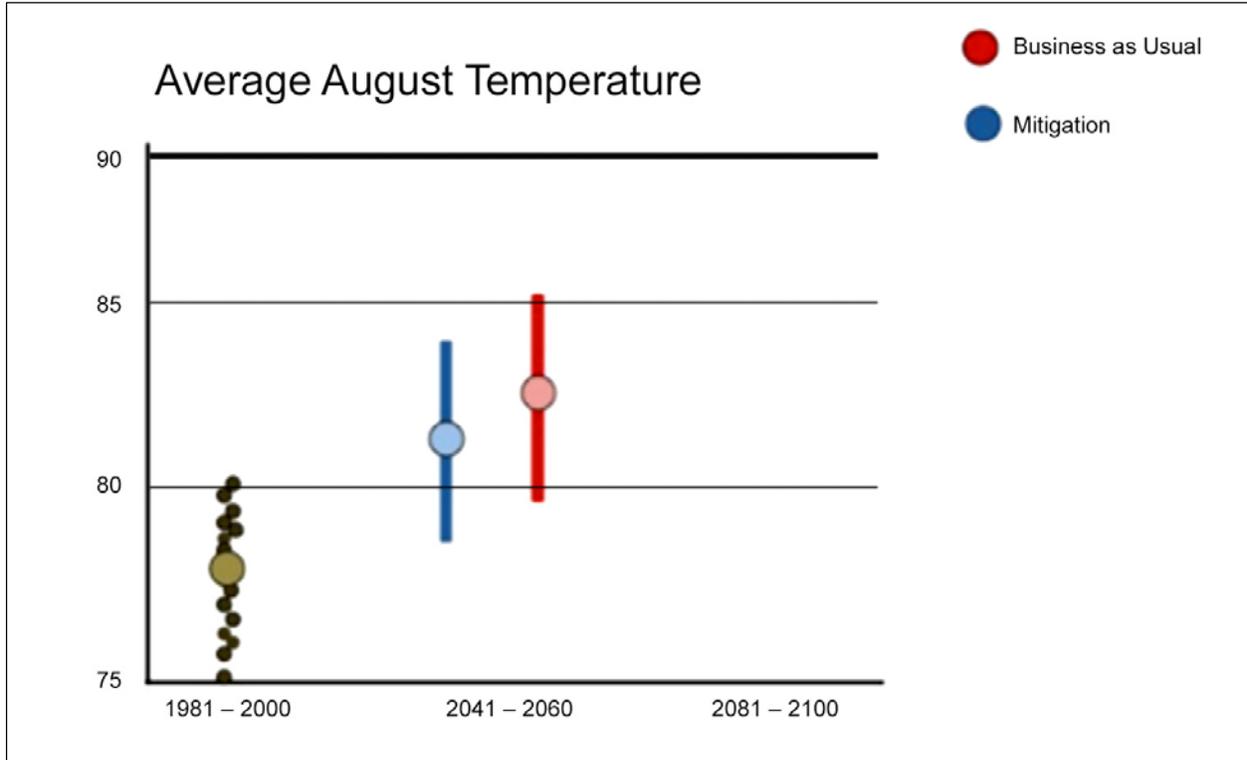


Figure 9-2. Current and Predicted Rising Temperatures in the Los Angeles Region

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).

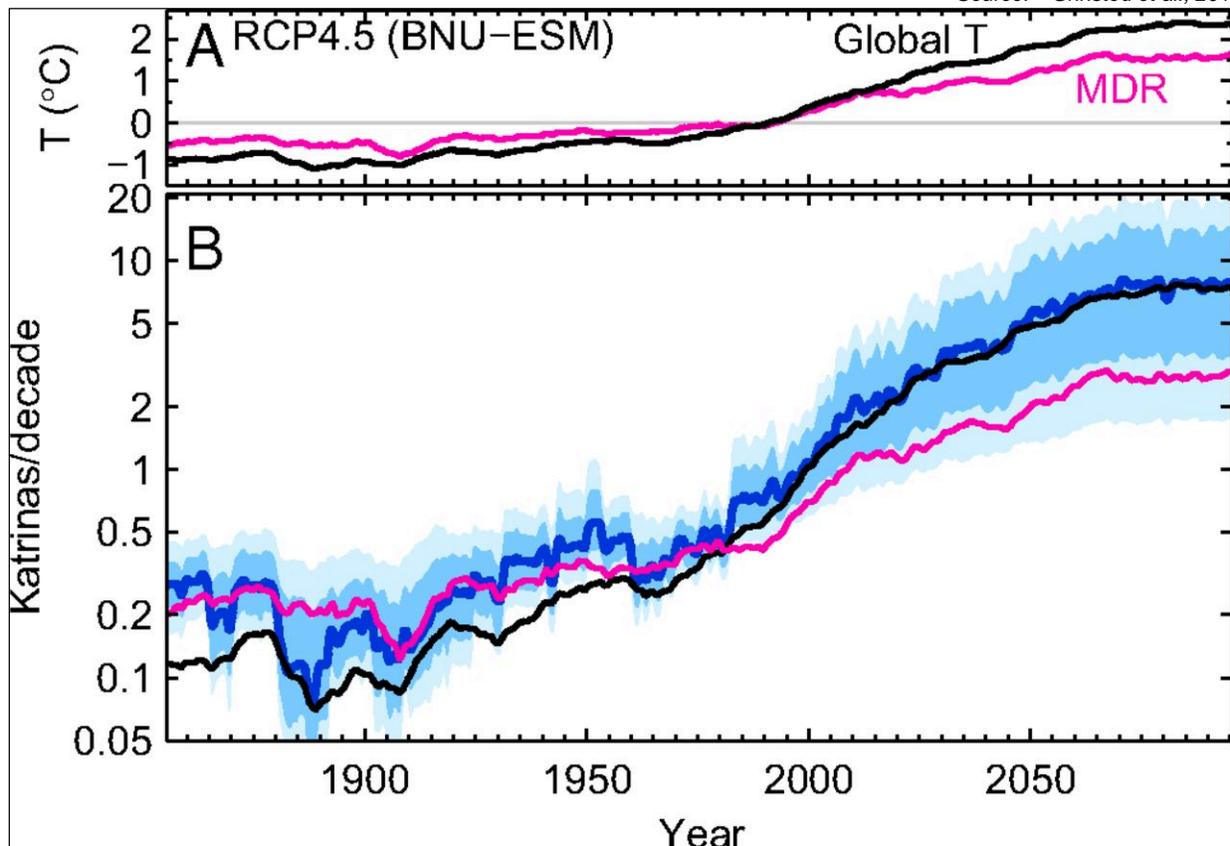


Figure 9-3. Surge Event Frequency over Time and Climate Changes

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 #
<p>1—Promote awareness of flood hazards to residents in flood hazard areas. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Public Works (Building and Safety Division) Funding Source: FEMA; Cal EMA; Public Works; County Regional Planning Department</p>	Low	Ongoing	1, 3, 4	Yes-3
<p>2—Develop and distribute flood protection information and materials to property owners, renters, and developers in high-risk areas. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Public Relations Group, Building and Safety Division, Land Development Division, Program for Public Information) Funding Source: Public Works</p>	Low	Ongoing	3, 4	Yes-21
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Los Angeles County Chief Executive Office Office of Emergency Management (CEO OEM), Public Works (Disaster Services Group) Funding Source: Public Works; CEO OEM</p>	Low	Ongoing	1, 3	No
<p>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:</p> <ul style="list-style-type: none"> • Annually notify owners regarding local flood hazards and proper protection activities • Provide technical advice regarding flood protection and flood preparedness • Distribute a revised questionnaire to new Repetitive Loss Properties. <p>Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Program for Public Information) Funding Source: Public Works</p>	Low	Ongoing	1, 2, 3, 4	Yes-12, 20
<p>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. Lead Agency: Fire Department, Public Works (Administrative Services Division, Watershed Management Division) Support Agencies: Public Works (Public Relations Group) Funding Source: FEMA; Cal EMA; Fire Department; Public Works</p>	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 #
<p>6—Provide public education about maintaining the stormwater system free of debris. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Public Relations Group, Flood Maintenance Division, Road Maintenance Division, Program for Public Information) Funding Source: Public Works</p>	Low	Ongoing	1, 4, 10	Yes-22
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Public Works (Flood Maintenance Division, Water Resources Division, Program Development Division, Public Relations Group, Program for Public Information) Funding Source: Public Works</p>	Low	Ongoing	1, 3, 4, 5, 7, 9	No
<p>8—Implement the Program for Public Information (PPI) protocol identified in this plan including appropriate messaging for compliance with ADA. Lead Agency: Public Works (Watershed Management Division, Public Relations Group) Funding Source: FEMA; Cal EMA; Public Works</p>	Low	Ongoing	1, 3, 4	No
<p>9—Provide emergency preparedness and flood protection information to the general public. Lead Agency: CEO OEM Support Agencies: Public Works (Watershed Management Division, Program for Public Information, Water Resources Division, Public Relations Group) Funding Source: FEMA; Cal EMA; CEO OEM; Public Works; USC Sea Grant</p>	Low	Ongoing	1, 4, 10	Yes-23
<p>10—Distribute information regarding flood prevention and flood insurance at emergency operations and emergency preparedness events. Lead Agency: CEO OEM Support Agencies: Public Works (Watershed Management Division, Water Resources Division, Public Relations Group, Program for Public Information) Funding Source: FEMA; Cal EMA; CEO OEM; Public Works</p>	Low	Ongoing	1, 4, 10	Yes-24
<p>11—Develop and maintain a list of priority maintenance-related problem sites. Lead Agency: Public Works (Flood Maintenance Division) Support Agencies: Public Works (Watershed Management Division, Water Resources Division, Road Maintenance Division) Funding Source: Public Works</p>	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. Lead Agency: Public Works (Flood Maintenance Division, Road Maintenance Division) 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. Lead Agency: Public Works (Flood Maintenance Division) Support Agencies: Public Works (Watershed Management Division, Water Resources Division) 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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Design Division, Flood Maintenance Division, Water Resources Division) Stakeholders Funding Source: Public Works	Low	Ongoing	2, 9	Yes-18
15—Pursue appropriate flood hazard mitigation grant funding. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Programs Development Division, Disaster Services Group), CEO OEM Funding Source: Public Works; CEO OEM	Low	Ongoing	1, 8, 9	Yes-1
16—Consider the conversion of high-risk properties into open space. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Parks and Recreation 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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Land Development Division) 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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division) 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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Information Technology Division) Funding Source: Public Works	Low	Ongoing	1, 2, 5	No
20—Evaluate opportunities for incorporating watershed ecosystem restoration into projects. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Public Works (Water Resources Division), Stakeholders 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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Programs Development Division) 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. Lead Agency: Fire Department, Public Works (Building and Safety Division, Design Division, Land Development Division) Support Agencies: Regional Planning Department, Public Works (Environmental Programs Division, Watershed Management Division, Project Management Division, Water Resources Division) 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. Lead Agency: CEO OEM Support Agencies: Public Works (Disaster Services Group, Watershed Management Division) 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. Lead Agency: Public Works (Building and Safety Division, Design Division, Land Development Division) Support Agencies: Public Works (Watershed Management Division) 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 #
<p>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. Lead Agency: Regional Planning Department Support Agencies: Public Works (Watershed Management Division, Programs Development Division, Land Development Division) Funding Source: Public Works; County Regional Planning Department</p>	Low	Ongoing	5, 7	Yes-15
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Parks and Recreation, Public Works (Building and Safety Division, Programs Development Division) 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</p>	Low	Ongoing	5, 6, 8	Yes-13
<p>27—Use risk-based information from the <i>Los Angeles County Comprehensive Floodplain Management Plan</i> and the <i>Los Angeles County Hazard Mitigation Plan</i> to update the Safety Element of the County's General Plan. Lead Agency: Regional Planning Department Support Agencies: Public Works (Watershed Management Division) Funding Source: County Regional Planning Department; Public Works</p>	Low	Short term	1, 2, 3	No
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Land Development Division, Flood Maintenance Division, Water Resources Division), Regional Planning Department Funding Source: Public Works</p>	Low	Ongoing	1, 3, 4, 5, 7, 9	No
<p>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. Lead Agency: Public Works (Watershed Management Division) Funding Source: FEMA; U.S. EPA; Cal EMA; Cal EPA; Public Works; USC Sea Grant</p>	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 #
<p>30—Identify flood-warning systems for properties where such systems can be beneficially employed. Lead Agency: Public Works (Watershed Management Division) Support Agencies: CEO OEM, Sheriff’s Department, Public Works (Flood Maintenance Division, Disaster Services Group, Water Resources Division) Funding Source: FEMA Hazard Mitigation Grant Program , Pre-Disaster Mitigation Grant Program, and Flood Mitigation Act; Cal EMA; Public Works; CEO OEM</p>	Low	Ongoing	1, 9, 10	Yes-6
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: CEO OEM, Public Works (Disaster Services Group) Funding Source: FEMA; Cal EMA; Public Works; CEO OEM</p>	Medium/ Low	Long term	1, 10	No
<p>32—Continue to enforce the County’s development regulations to prevent increases of the flood hazard on adjacent properties. Lead Agency: Public Works (Building and Safety Division, Land Development Division) Support Agencies: Public Works (Watershed Management Division) Funding Source: Public Works</p>	Low	Ongoing	1, 5, 9	No
<p>33—Conduct an evaluation of FEMA-designated flood zones and revise/update them to reflect current conditions. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Water Resources Division) Funding Source: FEMA; Cal EMA; Public Works</p>	Medium/ Low	Ongoing	1, 2, 3	No
<p>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. Lead Agency: Public Works (Watershed Management Division) Funding Source: FEMA; Cal EMA; Public Works</p>	Low	Ongoing	1, 3	No
<p>35—Continue County coordination with other agencies and stakeholders on issues of flood control. Lead Agency: Public Works (Watershed Management Division) Funding Source: Public Works</p>	Low	Ongoing	1, 3, 9	No
<p>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.</p>				

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 be 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
<hr style="width: 20%; margin-left: 0;"/> 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

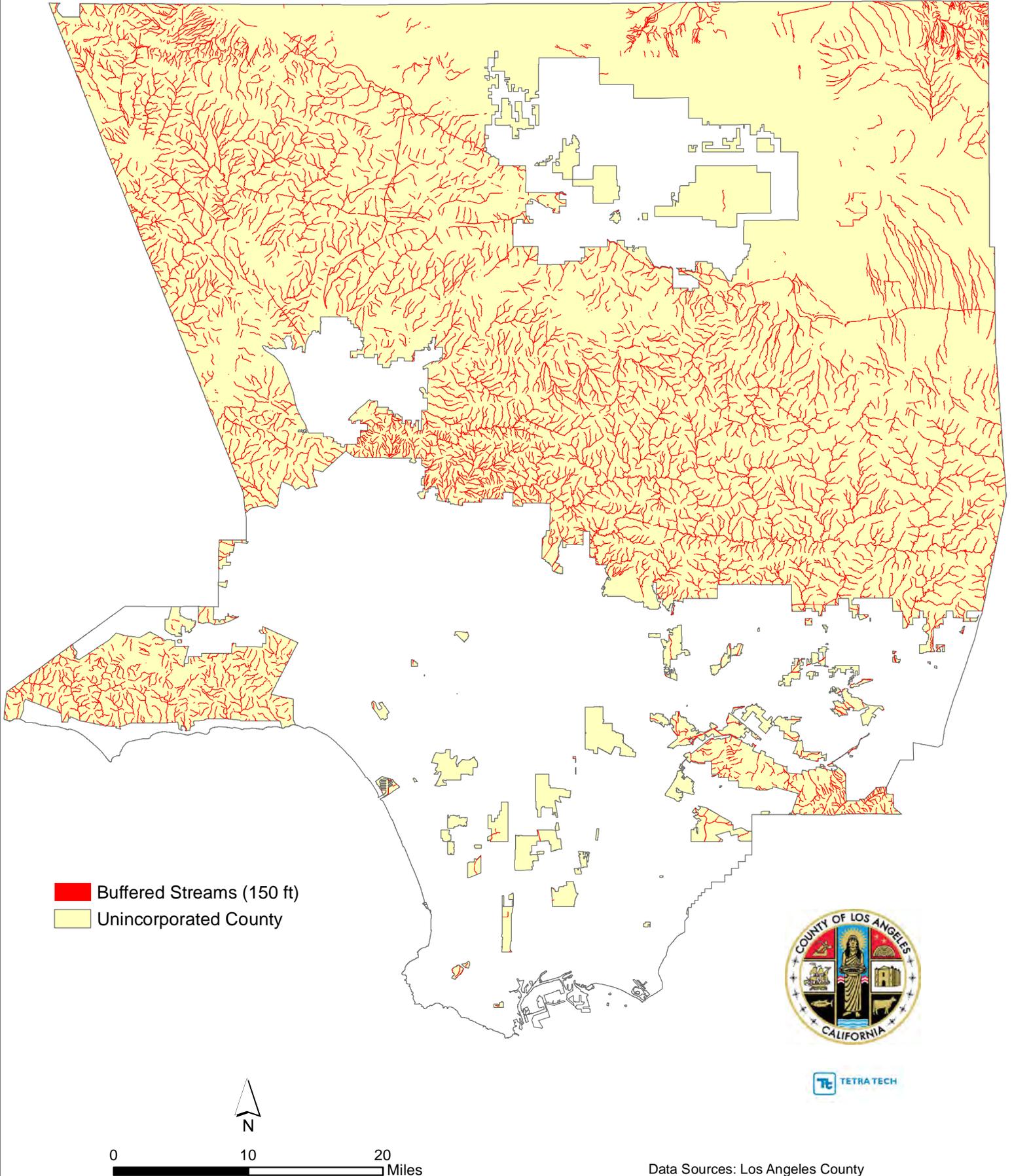
In the unincorporated areas of the County, there are many stream segments that do not intersect with FEMA or County-mapped floodplains. Buffers extending 150 feet on each side of these segments were delineated in order to identify potential at risk properties. It is estimated that there are 9,527 structures 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



- 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 http://www.healthebay.org/educators	Year Round	Curriculum and training guides available online.
Tree People			
	Environmental Education Resources for Teachers 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 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 http://www.rcdsgmm.org/outdoor-environmental-education-programs-students	Year Round	
	Environmental Educator Training for Adults http://www.rcdsgmm.org/environmental-educator-training-adults	Year Round	
	Environmental Education Resources and Materials http://www.rcdsgmm.org/environmental-education-resources-and-materials	Year Round	
Mountains Recreation and Conservation Authority			
	Symbiosis Newsletter http://issuu.com/lamountains/docs/symbiosisspring2015v2_490569dabfb569		
Mountains Restoration Trust			
	Adopt a Creek: Creek Crayfish Removal http://www.mountainstrust.org/restoration/adoptacreek.html	Year Round	
	Discovery Nature Camp	Year Round	
	Youth Naturalist Program	Year Round	
	Headwaters Corner www.mountainstrust.org/about/headwaters.html	Year Round	
	Mountain Restoration Trust News 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 You are in a repetitive flood area 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 You need flood insurance Renters can buy flood insurance
Protect people from the hazard	Avoid swift water Move to high ground Turn around, don't drown Know the signs of flash flooding Know what flood warning means Teach school children about flooding
Protect your property from the hazard	Flooding affects more than homes Your actions impact others Illegal activities may lead to fines Need advice for protecting your property from flood?
Build responsibly	A little investment now could save you money later Just because it is not mapped does not mean you are not at risk Get a permit before you build
Protect natural floodplain functions	Share the floodplains No dumping Protect these areas Floodplains help us These areas are habitat
General preparedness	Sign up for Alert LA Develop a family disaster plan Know your risk
<p>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.</p>	

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 www.dpw.lacounty.gov/wmd/floodzone/index.cfm	Residents, property owners and businesses in the regulated floodplains Renters in flood-prone areas Critical Facility Operators in the regulated floodplains 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
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 Property owners implementing temporary or permanent flood mitigation projects 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 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 People who are camping/residing in channels and streams	Decrease in swift water rescues 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. http://dpw.lacounty.gov/wmd/HomeOwners/index.cfm and https://dpw.lacounty.gov/wrd/Fire/display.cfm?product=file/faq.htm	Residents, property owners and businesses in the regulated floodplains	Increase in requests for assistance/advice.	YouTube Video	DPW	Available year round online	No
	Residents, property owners and businesses in repetitive loss areas		Twitter reminder	DPW	Prior to and during rainy season	No
	Environmental consultants/building contractors or others involved in the permitting process Gaps in the Maps identified properties Lake Los Angeles property owners with creeks thru property Property owners near recently burned areas		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 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 www.lacounty.gov/emergency/alert-la/	Countywide Residents, property owners and businesses in the regulated floodplains School Districts	Increase number of residents that register their mobile number for Alert LA.	Promote Alert LA on County Website.	DPW Sheriff's Department	Available online year round	No
			Provide Alert LA County Brochure http://www.lacoa.org/pm/pub.html	CEO Office of Emergency Management	Available online year round	No
Develop a Family Disaster Plan http://www.lacoa.org/pm_pub.html and http://www.lacoa.org/PDF/EmergencySurvivalGuide-LowRes.pdf	Countywide Residents, property owners and businesses in the regulated floodplains School Districts	Increase preparedness by residents	Promote on social media (Twitter) and website	DPW	Quarterly	No
Know Your Risk	Countywide Residents, property owners and businesses in the regulated floodplains 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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Los Angeles County
Comprehensive Floodplain Management Plan

**APPENDIX A.
ACRONYMS AND DEFINITIONS**

APPENDIX A. ACRONYMS AND DEFINITIONS

ACRONYMS

ADA—Americans with Disabilities Act

BLS—(U.S.) Bureau of Labor Statistics

CEO OEM—(Los Angeles County) Chief Executive Office Office of Emergency Management

CCR—California Code of Regulations

CEQ—Council on Environmental Quality

CEQA—California Environmental Quality Act

CFR—Code of Federal Regulations

CRS—Community Rating System

DMA—Disaster Mitigation Act

DFIRM—Digital Flood Insurance Rate Map

DPW—(Los Angeles County) Department of Public Works

DWR—(California) Department of Water Resources

EDD—(California) Employment Development Department

EMA—(California) Emergency Management Agency

EPA—(California) Environmental Protection Agency

ERP—Emergency Response Plan

ESA—Endangered Species Act

FEMA—Federal Emergency Management Agency

FIRM—Flood Insurance Rate Map

GIS—Geographic Information System

Hazus-MH—Hazards, United States-Multi Hazard

HUC—Hydrologic unit code

IPCC—Intergovernmental Panel on Climate Change

IRWM—Integrated Regional Water Management

LACDA— Los Angeles County Drainage Area (Study)

LACEDC—Los Angeles County Economic Development Corporation

LCP—Local Coastal Program

LiMWA—Limit of moderate wave action

MS4—Municipal separate storm sewer system

MT CO₂e—Metric tons of carbon dioxide equivalent

NFIP—National Flood Insurance Program

NIMS—National Incident Management System

NOAA—National Oceanic and Atmospheric Administration

NRCS—Natural Resources Conservation Service

NWS—National Weather Service

PPI—Program for Public Information

SEA—Significant Ecological Area

SFHA—Special Flood Hazard Area

USGCRP—U.S. Global Change Research Program

WRCC—Western Regional Climate Center

DEFINITIONS

100-Year Flood: The term “100-year flood” can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program.

Access and functional needs: Additional needs before, during, and after an incident in functional areas, including but not limited to maintaining independence, communication, transportation, supervision, and medical care. Individuals in need of additional response assistance may include those who have disabilities; who live in institutionalized settings; who are elderly; who are children; who are from diverse cultures; who have limited English proficiency or are non-English speaking; or who are transportation disadvantaged.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the “100-year” or “1% chance” flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as “watersheds” and “drainage basins.”

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation initiatives, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Capability Assessment: A capability assessment provides a description and analysis of a community’s current capacity to address threats associated with flooding. The assessment includes two components: an inventory of an agency’s mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community’s actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Facility: 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. For the purposes of this floodplain management plan, the following types of systems and assets are defined as critical facilities:

- 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.

Economically Disadvantaged Populations: Households with household incomes of \$20,000 or less.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a hazard event.

Federal Disaster Declaration: Declarations typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. No specific dollar loss threshold has been established for such declarations. A federal disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Flash Flood: 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.

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency has delineated the Special Flood Hazard Area.

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance Rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Freeboard: The height to which a water-containing structure, such as a dam or levee, is built above the expected highest water elevation.

Frequency: How often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a floodplain management plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program: Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act and administered by FEMA, the Hazard Mitigation Grant Program provides grants to states, tribes, and local governments to implement hazard mitigation initiatives after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (Hazus-MH) Loss Estimation Program: Hazus-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus-MH software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. Hazus-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Initiatives: Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Program for Public Involvement (PPI): A program developed for maintaining public involvement in implementation of the floodplain management plan and all other floodplain management activities to be carried out by the County of Los Angeles. The PPI is separate from the public involvement strategy that was used to develop the floodplain management plan.

Public Involvement Strategy: A set of tools and practices used to ensure that all interested stakeholders had opportunities to learn about the development of this floodplain management plan and provide input for its development. The public involvement strategy is separate from the PPI that will be used to implement the floodplain management plan.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of \$1000.00; or
- Two paid flood losses in excess of \$1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Riverine: Of or produced by a river or stream. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Significant Ecological Area: Designated land in Los Angeles County that contains irreplaceable biological resources

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and Zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damage, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains down-gradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX B.
CRS GUIDELINES FOR FLOOD PLANNING



OMB No. 1660-0022
Expires: December 31, 2016

National Flood Insurance Program
Community Rating System

Coordinator's Manual (Excerpt)

FIA-15/2013



FEMA

510 FLOODPLAIN MANAGEMENT PLANNING—Summary

Maximum credit: 622 points

512 Elements

- a. **Floodplain management planning (FMP):** 382 points for a community-wide floodplain management plan that follows a 10-step planning process:
 - Step 1. Organize
 - Step 2. Involve the public
 - Step 3. Coordinate
 - Step 4. Assess the hazard
 - Step 5. Assess the problem
 - Step 6. Set goals
 - Step 7. Review possible activities
 - Step 8. Draft an action plan
 - Step 9. Adopt the plan
 - Step 10. Implement, evaluate, revise.
- b. **Repetitive loss area analysis (RLAA):** 140 points for a detailed mitigation plan for a repetitive loss area.
- c. **Natural floodplain functions plan (NFP):** 100 points for adopting plans that protect one or more natural functions within the community's floodplain.

Credit Criteria

Each element has a separate section discussing credit criteria.

Impact Adjustment

The impact adjustments for FMP and RLAA are described in separate sections. There is no impact adjustment for NFP.

Documentation Provided by the Community

Each element has a separate section describing needed documentation.

510 FLOODPLAIN MANAGEMENT PLANNING

The OBJECTIVE of this activity is to credit the production of 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.

511 Background

Too often flood protection decisions are made quickly, with inadequate or outdated information or without considering all possible mitigation alternatives or the consequences of those alternatives. As a result, the community's resources are not allocated most appropriately, flood problems may not be fully addressed, and natural floodplain functions may suffer.

To remedy this situation, a careful, systematic process of planning is recommended, and may be credited by this activity. The Community Rating System (CRS) does not specify what activities a plan must recommend; rather, it recognizes plans that have been prepared according to the standard planning process explained in this activity.

Benefits: A well-prepared plan will

- Identify existing and future flood-related hazards and their causes;
- Ensure that a comprehensive review of all possible activities and mitigation measures is conducted so that the most appropriate solutions will be implemented to address the hazard;
- Ensure that the recommended activities meet the goals and objectives of the community, are in coordination with land use and comprehensive planning, do not create conflicts with other activities, and are coordinated so that the costs of implementing individual activities are reduced;
- Ensure that the criteria used in community land use and development programs account for the hazards faced by existing and new development;
- Educate residents and property owners about the hazards, loss reduction measures, and the natural and beneficial functions of floodplains;
- Build public and political support for activities and projects that prevent new problems, reduce losses, and protect the natural and beneficial functions of floodplains; and
- Build a constituency that wants to see the plan's recommendations implemented.

Types of plans: This activity credits three kinds of plans:

- Floodplain management planning (FMP): The most credit is for the first element, a community-wide floodplain management plan, but the element can also credit multi-hazard mitigation plans, multi-jurisdictional floodplain management and hazard mitigation plans, and floodplain management plans prepared for the U.S. Army Corps of Engineers.

- Repetitive loss area analyses (RLAA): The second element credits more detailed, site-specific plans to reduce flood losses in repetitively flooded areas. It has a narrower scope than a floodplain management plan, and receives fewer credit points.
- Natural floodplain functions plan (NFP): The third element provides credit for plans that address natural floodplain functions in the community.

A Category C repetitive loss community (defined in Section 502) must prepare either a FPM or RLAA area analysis that covers at least all of its repetitive loss areas.

Implementation: Credit is not provided for simply preparing a plan. Continued credit is dependent upon plan implementation. To maintain the credit for Activity 510, every year the community must evaluate its progress toward implementing the projects and programs in the plan, area analysis, or natural floodplain functions plan, and submit a report of that evaluation with its annual CRS recertification. It must update the background information and the recommendations in its floodplain management plans and repetitive loss area analyses at least every five years and in its natural floodplain functions plan(s) every 10 years.

Other plans: A plan by another name, such as a post-flood or multi-hazard mitigation plan, could receive credit under this activity if it was prepared in accordance with the process explained here. Hazard mitigation plans prepared to qualify for FEMA’s hazard mitigation grants that are accepted by FEMA will receive some credit under this activity.

By their very nature as overall guidance for a community’s program, plans should be coordinated with other plans and programs as well as the activities of other agencies or offices that have authority over the same area. It is recommended that communities also contact state and regional offices and agencies to review their plans and planning criteria. For example, state planning agencies have requirements for some kinds of plans and state emergency management agencies may have additional elements they would like to see included in a mitigation plan.

NOTE: An ordinance is NOT a plan. *An ordinance sets standards for land development and other activities. Planning may include a review of land development standards and procedures, but it should also cover a much broader range of activities, as noted in Figure 510-4.*

Class 9 Prerequisite: A Category C repetitive loss community (see Section 502) must receive credit under either Section 512.a, FMP or Section 512.b, RLAA with a plan that covers its repetitive loss areas.

A separate CRS publication, *CRS Credit for Floodplain Management Planning*, has a detailed discussion of the requirements of this section and of multi-hazard mitigation plans, as well as model plans and CRS credit documentation.

Communities are encouraged to read this and additional FEMA guidance on mitigation planning before beginning their floodplain management planning. These documents can be found at www.CRSresources.org/500.

512 Elements

512.a. Floodplain management planning (FMP)

The maximum credit for this element is 382 points.

FMP credit is provided for a community-wide floodplain management plan that was prepared by following a standard planning process. To receive any credit under this activity, the planning process must receive some credit under each of the 10 steps listed below. If the plan was approved by FEMA as a multi-hazard mitigation plan and one step is missing, the mitigation plan may receive credit, but FMP credit will be limited to 50 points. If two steps are missing, there is no credit for a multi-hazard mitigation plan.

For some steps, such as Step 1, the community may show that it implemented at least one of the listed credit items. For other steps, specific items are required as a minimum. Required items are noted with “(REQUIRED)” after them.

FEMA’s multi-hazard mitigation planning regulations pursuant to the Disaster Mitigation Act of 2000 are explained at www.fema.gov/plan/mitplanning. The 10-step CRS planning process is consistent with those regulations, which identify four phases of hazard mitigation planning. The 10 CRS steps are aligned with the four phases of mitigation planning requirements in Table 510-1.

The CRS-credited planning process must follow the 10 steps. Although the plan document must discuss and document all 10 steps, the written plan does not need to be organized by these 10 steps. To document CRS credit, the community must identify where these steps were covered in its plan, using the CRS planning credit activity checklist (see Figure 510-1).

Documentation or discussion of all but Steps 3 and 9 must be presented in the plan document. Steps 3 and 9 may be in the plan document or they may be explained in a separate memo from the community or the plan’s author as explained in the documentation section at the end of each step. The community must update the plan at least every five years and document the update by October 1, five years after the plan was adopted.

Note: It is recommended that the planner review all state and FEMA planning program guidelines, including the CRS planning credit checklist for Activity 510. Doing so will ensure that the planning effort will meet all state, FEMA, and CRS criteria. It is the community’s option, but with proper planning, one plan document can fulfill the planning criteria of several FEMA and state programs.

Table 510-1. Planning steps for mitigation and for the CRS.		
Multi-hazard Mitigation Planning	CRS	Maximum
Phase I – Planning process		
§201.6(c)(1)	1. Organize	15
§201.6(b)(1)	2. Involve the public	120
§201.6(b)(2) & (3)	3. Coordinate	35
Phase II – Risk assessment		
§201.6(c)(2)(i)	4. Assess the hazard	35
§201.6(c)(2)(ii) & (iii)	5. Assess the problem	52
Phase III – Mitigation strategy		
§201.6(c)(3)(i)	6. Set goals	2
§201.6(c)(3)(ii)	7. Review possible activities	35
§201.6(c)(3)(iii)	8. Draft an action plan	60
Phase IV – Plan maintenance		
§201.6(c)(5)	9. Adopt the plan	2
§201.6(c)(4)	10. Implement, evaluate, revise	26
Total		382

512.a Floodplain management planning (FMP):	
<input checked="" type="checkbox"/>	(1) Attached is the floodplain management or hazard mitigation plan to be credited.
<input checked="" type="checkbox"/>	Check here if the plan was also approved by FEMA as a hazard mitigation plan
<input checked="" type="checkbox"/>	(2) This CRS planning credit worksheet, completed.
CRS Planning Step	Page/Section
Step 1. Organize to prepare the plan	
(a) Involvement of the office responsible for community planning	Ch. 6, p. 6-2
(b) Planning committee of department staff	Ch. 1, p. 1-3
(c) Process or committee formally created by the community's governing board	
<input checked="" type="checkbox"/>	(1) Mark the plan document to show how it was prepared and who was involved in the planning process. Show which people or offices implement which of the six mitigation categories.
<input type="checkbox"/>	(2) [For item 1.(c)] Attach a copy of the governing body's action or resolution.

Figure 510-1. An excerpt from a floodplain management planning credit checklist.

Credit Points for FMP

FMP = the total of points credited for Step 1 through Step 10, up to the maximum of 382 points

There are no credit formulae for this activity. The credits for each step are simply added together.

Note that the points listed (Step 1 to Step 10) are maximum possible points. The ISO/CRS Technical Reviewer may determine that one or more items do not warrant full credit.

Step 1. Organize to prepare the plan

The credit for this step is based on how the community organizes to prepare its floodplain management plan.

Credit Points for FMP Step 1

Credit for Step 1 is the total of the following points. (Maximum credit: 15 points)

- (a) 4 points, if the office responsible for the community's land use and comprehensive planning is actively involved in the floodplain management planning process. The "office" may be the community's planning or community development department, a consulting firm, or a regional planning agency, provided that it performs regular land use or comprehensive planning duties for the community. This office is usually not the floodplain management or mitigation planner or consultant, because the intention of this credit is to incorporate the floodplain management or mitigation plan into the rest of the community's planning activities. "Actively involved" means that staff regularly attend meetings, assist in the coordination (Step 3), and either write or review draft sections of the plan.
- (b) 9 points, if the planning process is conducted through a committee composed of staff from those community departments that implement or have expertise in the activities that will be reviewed in Step 7. One point is provided for each office represented. Divisions of departments can be counted as separate offices. For smaller communities with fewer departments, full credit is provided if the committee has representation from all offices with expertise in all six categories of activities credited in Step 7.

A planning committee is strongly recommended. By involving those who can contribute and will be most affected when the recommendations are carried out, the community will get a more realistic product that will have a much better chance of being adopted and implemented. Community

Step 7 Categories

- Preventive measures (e.g., codes)
- Property protection (e.g., elevation)
- Natural resource protection
- Emergency services
- Structural flood control projects
- Public Information

Also see Figure 510-4.

departments that could be represented on the committee include, but are not limited to

- Building department/code enforcement,
- Engineering,
- Land use planning/zoning,
- Public works,
- Emergency management/public safety,
- Public information,
- Environmental protection/public health,
- Parks/recreation,
- A city manager or council member, and
- Housing/community development.

If the planning committee includes representatives from the public and other stakeholders (with no attachment to local government), additional credit is provided in Step 2. Note that there is extra credit in Step 10 if the committee continues to meet after the plan is adopted in order to evaluate progress and recommend changes.

No credit is provided for the creation of a planning committee if the committee only meets once or twice. It must meet a sufficient number of times to involve the members in the following key steps of the planning process (e.g., at least one meeting on each step):

- Step 4. Assess the hazard,
- Step 5. Assess the problem,
- Step 6. Set goals,
- Step 7. Review possible activities, and
- Step 8. Draft an action plan.

If the community wants credit for participating in a multi-jurisdictional floodplain management or hazard mitigation planning committee,

- The community must send at least two representatives to the planning committee;
- At least half of the community's representatives must attend all the meetings of the planning committee. In effect, there must be a quorum from each community. Remote attendance, e.g., via a webinar that allows for everyone to talk, is permissible; and
- CRS credit for the multi-jurisdictional planning committee will be based on the representation from offices that implement the activities in Step 7.

Examples

- a. A community has a planning committee with representatives from its planning, zoning, building, emergency management, code enforcement, and public works departments, as well as the city manager's public information person. There is no one at the community level that deals with natural floodplain functions. The community's committee would receive six points, one for each representative.
- b. A county is preparing a multi-jurisdictional plan for the county and 10 participating cities. This planning committee has 30 members, including two from each city. Among the members are representatives of all six Step 7 categories, e.g., a city engineer, a city public works person, the county planner, and the county soil and water conservation district. The county's committee would receive the full nine points, provided there was a quorum from each community seeking credit.

- (c) 2 points, if the planning process and/or the committee are formally created or recognized by action of the community's governing body.

Two points are provided if the community's governing body (e.g., the city council) formally recognizes the planning process. The preferred method is a formal resolution that designates who is responsible for preparing the plan and specifies a completion deadline. If a committee credited under Step 1(b) or 2(a) is used, the resolution should identify the members and the chair (or how the chair is selected) and how staff support is provided.

If a community participates in a multi-jurisdictional committee, its governing body must act in order for the community to receive this credit. A city will not receive this credit for a county council resolution. Conversely, a city can receive this credit even if there is no county credit.

Step 2. Involve the public

The planning process must include an opportunity for the public to comment on the plan during its development and before its approval. Members of the public may be part of the planning committee created under Step 1 or they may be organized as a separate committee.

For this credit, the term “public” includes residents, businesses, property owners, and tenants in the floodplain and other known hazard areas as well as other stakeholders in the community, such as developers and contractors, civic groups, environmental organizations, academia, non-profit organizations, major employers, and staff from other governmental agencies, such as a levee district, housing authority, Natural Resources Conservation Service, or the National Weather Service.

Members of an advisory body to the community that does not have any regulatory authority, such as a stormwater advisory board, can be counted as representatives of the public. Community employees and members of a regulatory body, such as a zoning board of appeals that makes final decisions, are not considered “public” or stakeholders and are counted as representatives of the community departments credited under Step 1(b).

As with staff, involving the public and stakeholders brings them fully into the planning process, provides input on the viability of options being considered, and helps them to become concerned about the outcome. The largest number of points is provided for Step 2(a) because a planning committee with public membership has the following advantages:

- The committee can be a forum to both educate the public and also provide a means for public input into the plan.
- The participants recognize that they are involved and will be more willing to commit themselves to the process.
- The participants can do some of the work, especially data gathering, thereby reducing the overall cost of preparing the plan.
- A committee can be an effective forum for discussing alternatives, debating goals and objectives, and matching the technical requirements of a program to local situations.
- The committee members will provide information on the plan and process to their respective constituencies.
- The participants gain a feeling of “ownership” of the plan and its recommendations, which helps build public support for it.
- Committee members form a constituency that will have a stake in ensuring that the plan is implemented.

Note that 50% of the maximum credit for this planning step is a prerequisite for Class 4 or better communities.

The most important partners to assist in the plan development are already within your community: local government officials, community planning and design professionals, business leaders, civic and volunteer groups, emergency services personnel, and interested residents.

... Ensuring that your team has an equitable and diverse representation will enhance your planning efforts and help build support for mitigation.

—*Planning for a Sustainable Future*, FEMA-364

Credit Points for FMP Step 2

The credit for this step is the total of the following points based on how the community involves the public during the planning process. (Maximum credit: 120 points)

- (a) Up to 60 points, if the planning process is conducted through a planning committee that includes members of the public and meets the following criteria:
- (1) If the committee includes community staff (e.g., the planning committee credited under Step 1(b)), then at least one-half of the members must be representatives of the public or stakeholders for full credit. The credit is prorated for lower levels of public or stakeholder representation. Note that receiving 50% of the maximum credit for this planning step is a prerequisite for Class 4 or better communities and item (a) is one-half of the credit for Step 2.
 - (2) It must meet a sufficient number of times to involve the members in the key steps of the planning process, i.e., it must meet the same meeting criteria specified in Step 1(b).
 - (3) All meetings must be open to the public and the meeting schedule must be publicly posted (e.g., on a website).
 - (4) If the community wants credit for participating in a multi-jurisdictional floodplain management or hazard mitigation planning committee, it must meet the criteria specified in Step 1(b).
 - (5) The formalities of organizing and naming the committee are not as important as the membership and the ability of all members to participate. For example, a community may augment an existing committee with an advisory body of stakeholders. Such an arrangement would be credited, provided the stakeholders were treated as full committee members during the meetings, i.e., they can speak up, vote, and receive all the materials that regular members do.

Note that this planning committee can be (and it is recommended that it be) the same committee that prepares a Program for Public Information for credit under Activity 330 (Outreach Projects). The floodplain management plan document can also be or include the Program for Public Information document and/or the flood insurance coverage improvement plan credited under Activity 370 (Flood Insurance Promotion).

There is extra credit in Step 10 if the committee continues to meet after the plan is adopted in order to evaluate progress and recommend changes, provided that the committee continues to meet the above criteria. Such annual evaluations by a committee are required for some of the credits under Activities 330 and 370.

- (b) 15 points, if one or more public information meetings is held in the affected area(s) within the first two months of the planning process to obtain public input on the natural hazards, problems, and possible solutions. The meetings must be held separately from the planning committee meetings credited in item (1).

The intent of the public meeting(s) is to go out to the people to gather input. At a minimum, it must be separate from regular meetings of the planning committee or the

community's governing body. It is recommended that at least one of these public meetings be held in the affected neighborhoods.

- (c) 15 points, for holding one or more public meetings to obtain input on the recommended plan. The meeting(s) must be at the end of the planning process, at least two weeks before submittal of the recommended plan to the community's governing body.

Simply discussing the plan at a regular public meeting of the governing body, just before it is voted on, is not sufficient public input for CRS credit. To receive credit for this item, there must be at least one public meeting at the end of the planning process, at which the plan and its findings and recommendations are explained and people can ask questions and submit their comments for review, consideration, and potential modification of the plan. The CRS does not require public hearings. State and local laws take precedence, however. The community's legal counsel should determine if a public hearing is required.

- (d) 5 points, for each additional public information activity implemented to explain the planning process and encourage input to the planner or planning committee, up to a maximum of 30 points. Examples include, but are not limited to

- A website that explains the planning process and posts the time and place for its meetings, meeting agendas, status reports, and the draft plan, when it is ready for review.
- Conducting a public webcast that explains the planning process and solicits input.
- Questionnaires asking the public for information on their natural hazards, problems, and possible solutions. A questionnaire or survey that is sent to everyone in the floodplain or everyone in the community will receive double credit (10 points).
- Outreach projects, such as those credited in Activity 330 (Outreach Projects), which explain the planning effort and seek comments. These could include brochures, mailers, booths at shopping malls, presentations at civic or neighborhood organizations, etc.

Step 3. Coordinate

Most communities' flood problems have been studied already. There are likely to be existing plans, studies, and reports on flooding that need to be reviewed. There also may be flood protection activities being considered or implemented by other agencies.

This planning step credits incorporating other plans and other agencies' efforts into the floodplain management plan. Other agencies and organizations must be contacted to determine if they have studies, plans, or information pertinent to the floodplain management plan; to determine if their programs or initiatives may affect the community's program; and to see if they could support the community's efforts.

Examples of “other agencies and organizations” include neighboring communities; local, regional, state, and federal agencies; and businesses, colleges, and other private and non-profit organizations affected by the hazards or involved in hazard mitigation or floodplain management.

This credit is for coordinating with other agencies and organizations, particularly those that are not represented on the planning committee credited under Step 1(b) or Step 2(a). No special additional coordination measures are needed for the agencies and organizations on the planning committee, but the planners may want to formally contact the directors and others for the record.

Note that community needs and goals typically are developed during comprehensive planning activities. These goals should be identified in this step, reviewed, and considered during the development of the floodplain management plan. They should be taken into account when the goals for the floodplain management plan are developed in Step 6.

Credit Points for FMP Step 3

The credit for this step is the total of the following points. To receive credit for this step, the coordination must include item (a). (Maximum credit: 35 points)

- (a) 5 points, if the planning includes a review of existing studies, reports, and technical information and of the community’s needs, goals, and plans for the area. (REQUIRED)
Where the information from the existing studies and reports is used in the plan, the source(s) should be referenced.

This review needs to include a review of community needs and goals, past flood studies, disaster damage reports, natural areas plans, and other documents that will provide information for the planning process.

- (b) 30 points, for coordinating with agencies and organizations outside the community’s governmental structure. There is no credit for talking to other departments within the city or county government. For this credit, “coordinate” means to

- Contact the agency or organization and keep a record of the contact (a generic announcement or notice on a website is not sufficient);
- Ask for data or information related to the hazard;
- Ask if the agency or organization is doing anything that might affect flooding or properties in flood-prone areas; and
- Offer the agency or organization an opportunity to be involved in the planning effort, such as by attending a committee meeting or commenting on the draft plan.

One point is provided for each agency or organization that is contacted.

Two points are provided for meeting or having a telephone conversation with the agency or organization. Such a coordination meeting or conversation must be separate from attendance at a planning committee meeting.

Coordination with an agency can only be counted once. For example, if a letter to an agency results in a follow-up meeting or telephone conversation, the community receives two points.

Examples of such agencies and organizations include, but are not limited to

- Neighboring communities;
- Local and regional agencies involved in hazard mitigation activities;
- Stakeholder-type organizations that are not represented on the planning committee;
- Local drainage, levee, sanitary, and soil and water conservation districts;
- Regional and metropolitan planning agencies;
- State NFIP Coordinator;
- State water resources agency;
- State coastal zone management agency;
- State emergency management agency;
- FEMA Regional Office;
- National Weather Service;
- U.S. Army Corps of Engineers;
- Natural Resources Conservation Service;
- U.S. Bureau of Reclamation;
- U.S. Fish and Wildlife Service;
- National Oceanic and Atmospheric Administration;
- Native American tribes;
- American Red Cross;
- Local homebuilders association; and
- Local environmental groups.

If the community wants the plan to qualify as a multi-hazard mitigation plan, the plan must identify all stakeholders that are involved or given an opportunity to be involved in the planning process. At a minimum, stakeholders must include

- 1) Local and regional agencies involved in hazard mitigation activities,
- 2) Agencies that have the authority to regulate development, and
- 3) Neighboring communities.

An “opportunity to be involved in the planning process” means that the stakeholders are engaged or invited as participants and given the chance to provide input to affect the plan’s content.

—*Local Mitigation Plan Review Guide*, FEMA

Step 4. Assess the hazard

At this step in the planning process, the planner or committee reviews, analyzes, and summarizes data collected about the natural hazard(s) that the community faces. This step focuses on the sources, frequency, extent, and causes of flooding while Step 5 will address the impact of flooding on people, property, infrastructure, the local economy, and natural floodplain functions.

Under Step 3(a), the community gathers data about the flood hazard. This step involves reviewing, analyzing, and summarizing the data from existing flood studies, including the Flood Insurance Study, drainage problem studies, historical records, and the knowledge and experiences of the planning committee members.

For CRS credit, the community does not need to conduct studies to develop new flood data. However, if this process determines that new maps or data are needed, they should be described for credit under item (d).

The hazard assessment needs to describe the local flood hazard and not be a broad or generic discussion of flooding in general. It needs to discuss how often it floods, the locations of areas that flood, the depth of flooding, and the source or cause of the flooding. Because the most important readers are elected officials and flood-prone residents, the descriptions of the hazards should be in lay terms.

The CRS Community Self Assessment described in Section 240 can help with this step.

Credit Points for FMP Step 4

The credit for this step is the total of the following points based on what the community includes in its assessment of the hazard. (Maximum credit: 35 points)

- To receive CRS credit for this step, the plan must include a flood hazard assessment credited under item (1).
 - If the community is a Category B or C repetitive loss community (see Sections 502–503), this step must cover all of its repetitive loss areas.
- (a) 15 points, for including an assessment of the flood hazard in the plan. (REQUIRED) Flood hazard areas that require assessment include
- The Special Flood Hazard Area (SFHA) shown on the Flood Insurance Rate Map (FIRM),
 - Repetitive loss areas,
 - Areas not mapped on the FIRM that have flooded in the past, and
 - Other surface flooding identified in other studies.
- (1) 5 points, for a map of the flood hazard areas. Area maps are acceptable for multi-jurisdictional plans.
- (2) 5 points, for a description of the known flood hazards, including source of water, depth of flooding, velocities, and warning time.
- (3) 5 points, for a discussion of past floods.
- (b) 10 points, for including an assessment of less-frequent flood hazards in the plan. For this credit, the community must
- (1) Identify the hazard, including
- a. Preparing an inventory of levees that would result in a flood of developed areas if they failed or were overtopped during a flood, and/or
 - b. Preparing an inventory of dams that would result in a flood of developed areas if they failed, and/or

- c. Identifying any of the flood-related special hazards listed in Section 401 of the *CRS Coordinator's Manual* that are found in the community, and/or
 - d. Identifying the coastal A Zone, i.e., the area where wave heights during the 100-year flood are between 1.5 and 3 feet;
- (2) Map the area(s) affected. (For planning purposes, an approximate affected area is sufficient. No new engineering studies are needed. Area maps are acceptable for multi-jurisdictional plans.) If an engineering study is conducted, it may receive credit under Activity 410; and
- (3) Summarize the hazard(s) in lay terms.

Note that, under Activities 620 (Levees) and 630 (Dams), items (b)(1)a and (b)(1)b are prerequisites for reaching Class 4 or better. Additional guidance on inventorying and mapping the areas affected by levee and dam failures can be found in Section 621.b and Section 631.b, respectively. It is recommended that communities incorporate these inventories into their floodplain management plans.

Item (a) is prorated if part of the “flood hazard” is missing, where applicable. For example, if the community is downstream of a dam, has a levee, and has a coastal A Zone, and the assessment includes only the dam failure hazard, the credit will be less than the full 10 points. If the community does not have a levee, it is reflected in the proration.

Two points are provided if the inventory is conducted and concludes that there are no levees, dams, or special flood-related hazards that threaten the community.

- (c) 5 points, if the assessment identifies areas likely to be flooded and flood problems that are likely to get worse in the future as a result of (1) changes in floodplain development and demographics, (2) development in the watershed, and (3) climate change or sea level rise. The credit is prorated if the assessment does not include all three types of changes.
- (d) 5 points, if the plan includes a description of the magnitude or severity, history, and probability of future events for other natural hazards, such as earthquakes, wildfires, or tornados. The plan should include all natural hazards that affect the community. At a minimum, it should include hazards identified by the state's hazard mitigation plan.

NOTE: *To qualify as a multi-hazard mitigation plan, the plan must address ALL of the community's flood and other natural hazards identified in the hazard assessment. Not only does an all-hazards plan help qualify for mitigation funds, but also it will better prepare the community for hazards other than flooding. It is common for communities to focus only on mitigation of flood problems because they occur more often. However, assessing the other hazards when preparing a flood plan can help address what can be done for all hazards, some of which may occur less frequently, but have a greater impact on the community.*

Step 5. Assess the problem

Flooding can be a natural and beneficial occurrence. A floodplain is only a problem area if human development (the built environment) gets in the way of, or exacerbates, the natural flooding process.

The previous step assessed the hazards facing the community. In this step, the community planners or planning committee members collect and summarize data on what is at risk. This step looks at the impact of those hazards on the community.

Note that 50% of the maximum credit for this planning step is a prerequisite for Class 4 or better communities.

Credit Points for FMP Step 5

The credit for this step is the total of the following points, based on what is included in the assessment of the vulnerability of the community to the hazards identified in the previous, hazard assessment, step. (Maximum credit: 52 points)

- To receive credit for this step, the assessment must include item (a).
 - Each credited item must cover all relevant flood-related hazards identified in Step 4.
 - Each credited item must include a description and summary of the problem(s). Simply listing data, such as the names of the critical facilities or the number of flood insurance claims, does not suffice for credit—there must be description of the impact of flooding and what kinds of problems arise, not just raw data.
 - For a multi-jurisdictional plan, each item needs to be described for each community. Tables are acceptable to show the data by community, but there still needs to be a narrative description and summary of the problem(s).
- (a) 2 points, if the plan includes an overall summary of the jurisdiction's vulnerability to each hazard identified in the hazard assessment (Step 4) and the impact on the community. (REQUIRED)
- (b) 25 points, if the plan includes a description of the impact that the hazards identified in the hazard assessment (Step 4) have on the features listed below:
- (1) 5 points, for life safety and the need for warning and evacuating residents and visitors.
 - (2) 5 points, for public health, including health hazards to individuals from flood waters and mold.
 - (3) 5 points, for critical facilities and infrastructure.
 - (4) 5 points, for the community's economy and major employers.
 - (5) 5 points, for the number and types of affected buildings (e.g., residential, commercial, industrial, with or without basements, etc.). For this credit, the assessment must include an inventory of all buildings owned by the community that are located in flood-prone areas and that identifies which buildings are insured for flood damage.

(c) 5 points, if the assessment includes a review of historical damage to buildings, including all properties that have received flood insurance claims payments (in addition to the repetitive loss properties) and/or an estimate of the potential damage and dollar losses to vulnerable structures, including damage from mold and other flood-related hazards.

Communities must include repetitive loss areas in their problem assessment. (REQUIRED of Category B and C repetitive loss communities (see Sections 502–503))

In order to receive the full credit under item (c), the community reviews ALL the addresses of properties that have received flood insurance claims, not just the repetitive loss properties. Such a list is sent annually to all Category B and C repetitive loss CRS communities. Communities can request more recent lists through their FEMA Regional Office.

Data on building damage usually can be obtained from post-disaster damage assessment reports, flood insurance claims or disaster assistance data, and flood control studies. Particularly in areas that have experienced little or no serious flooding in recent history, a Hazus-MH flood analysis can yield valuable information about the potential for flood damage and loss (Figure 510-2). For best results, the building/structure inventory data bases in Hazus-MH should be augmented with local input.

The Privacy Act

Flood insurance data about private property, including repetitive loss properties, are protected under the Privacy Act. Personally identifiable information such as the names or addresses of specific properties, whether they are covered by flood insurance or not, whether they have received flood insurance claims, or the amounts of such claims may not be released outside of local government agencies or to the public or used for solicitation or other purposes. Such information should be marked "For internal use only. Protected by the Privacy Act of 1974."

General or aggregated information, such as total claims paid for a community or an area or data not connected to a particular property may be made public.



Hazus-MH is a software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. It can be a great help in the Step 5 vulnerability assessment.

Hazus-MH uses geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods, and earthquakes on populations.

Copies of Hazus-MH are available at no charge from the FEMA Distribution Center. Users can request that a 60-day trial/evaluation copy of ESRI's ArcGIS software be sent with Hazus-MH. Users should be familiar with GIS software. Hazus training is available at FEMA's Emergency Management Institute and elsewhere. Information is at <http://www.fema.gov/hazus/>.

Figure 510-2. About Hazus-MH.

- (d) 5 points, if the assessment describes areas within the floodplain that provide natural functions, such as wetlands, riparian areas, sensitive areas, and habitat for rare or endangered species.

Along with flood protection, comprehensive floodplain management planning should review the unique natural features, natural areas, and other environmental and aesthetic attributes that may be present in the floodplain. Protecting and preserving these natural and beneficial floodplain functions yield flood protection benefits and also help integrate floodplain management efforts with other community goals and objectives. This section should also review existing natural floodplain functions plans, such as those credited under Section 511.c.

- (e) 7 points, if the assessment includes a description of development, redevelopment, and population trends and a discussion of what the future brings for development and redevelopment in the community, the watershed, and natural resource areas.
- (f) 8 points, if the assessment includes a description of the impact of the future flooding conditions described in Step 4(c) on people, property, and natural floodplain functions.

Step 6. Set goals

The goals should set the context for the subsequent review of floodplain management activities and drafting of the action plan (Figure 510-3). They should incorporate or be consistent with other community goals for the affected areas. A multi-hazard mitigation plan should have goals that address all the major hazards that face the community.

Credit Points for FMP Step 6

The points for this step are provided if the plan includes a statement of the goals of the community's floodplain management or hazard mitigation program. The goals must address all flood-related problems identified in Step 5. (Maximum credit: 2 points)

Step 7. Review possible activities

At this step, the plan reviews different activities that could prevent or reduce the severity of the problems described in Step 5. This is a systematic review of a wide range of activities to ensure that all possible measures are explored, not just the traditional approaches of flood control, acquisition, and regulation of land use. The review, including the pros and cons of each activity, must be included in the plan document. Figure 510-4 lists some of the types of activities that could be reviewed under each of the six credited categories.

NOTE: This review is separate from Step 8, the selection of projects and activities to pursue. It includes activities that may not be selected and explains why some activities may be appropriate for the community and its flooding conditions and why some may not be appropriate.

The range of activities should be evaluated for each area affected. While some of them may be quickly eliminated as inappropriate, most deserve careful consideration, especially to ensure full understanding of their costs and benefits.

St. Tammany Parish, Louisiana, Multi-Hazard Mitigation Plan

1. Protect the lives and health of the Parish's residents from the dangers of natural hazards.
2. Ensure that public services and critical facilities operate during and after a disaster.
3. Ensure that adequate evacuation routes, streets, utilities and public and emergency communications are maintained and available during and after a disaster.
4. Protect homes and businesses from damage.
5. Use new infrastructure and development planning to reduce the impact of natural hazards.
6. Give special attention to repetitively flooded areas.

Gurnee, Illinois, Flood Mitigation Plan

1. Protect existing properties
 - a. Use the most effective approaches to protect buildings from flooding, including acquisition or relocation where warranted.
 - b. Enact and enforce regulatory measures that ensure that new development will not increase flood threats to existing properties.
 - c. Use appropriate measures to mitigate against the danger and damage posed by other natural hazards.
2. Protect health and safety
 - a. Advise everyone of the safety and health precautions to take against flooding and other natural hazards.
 - b. Improve traffic circulation, during floods and at other times.
 - c. Improve water quality and habitat.
 - d. Do something about the mosquitoes.
3. Improve the quality of life in Gurnee.
 - a. Preserve and improve the downtown core of businesses and services.
 - b. Ensure that current owners can maintain and improve their properties.
 - c. Use acquisition programs to expand open space and recreational opportunities.
 - d. Maintain an attractive riverfront and other public open spaces.
4. Ensure that public funds are used in the most efficient manner.
 - a. Prioritize mitigation projects, starting with those sites facing the greatest threat to life, health, and property.
 - b. Utilize public funding to protect public services and critical facilities.
 - c. Utilize public funding for those projects on private property where the benefits exceed the costs.
 - d. Maximize the use of outside sources of funding.
 - e. Maximize owner participation in mitigation efforts to protect their own properties.
 - f. Encourage property-owner self-protection measures.

Figure 510-3. Two examples of communities' statements of their goals.

1. **Preventive** activities keep flood problems from getting worse. The use and development of flood-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.
 - Floodplain mapping and data
 - Open space preservation
 - Floodplain regulations
 - Erosion setbacks
 - Planning and zoning
 - Stormwater management
 - Drainage system maintenance
 - Building codes

2. **Property protection** activities are usually undertaken by property owners on a building-by-building or parcel basis.
 - Relocation
 - Acquisition
 - Building elevation
 - Retrofitting
 - Sewer backup protection
 - Insurance

3. **Natural resource protection** activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations.
 - Wetlands protection
 - Erosion and sediment control
 - Natural area preservation
 - Natural area restoration
 - Water quality improvement
 - Coastal barrier protection
 - Environmental corridors
 - Natural functions protection

4. **Emergency services** measures are taken during an emergency to minimize its impact. These measures are usually the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.
 - Hazard threat recognition
 - Hazard warning
 - Hazard response operations
 - Critical facilities protection
 - Health and safety maintenance
 - Post-disaster mitigation actions

5. **Structural projects** keep flood waters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff.
 - Reservoirs
 - Levees/floodwalls
 - Diversions
 - Channel modifications
 - Storm drain improvements

6. **Public information** activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains. They are usually implemented by a public information office.
 - Map information
 - Outreach projects
 - Real estate disclosure
 - Library
 - Technical assistance
 - Environmental education

Figure 510-4. Categories of floodplain management activities.

Credit Points for FMP Step 7

The credit for this step is the total of the following points based on which floodplain management or hazard mitigation activities are reviewed in the plan. (Maximum credit: 35 points)

This step must describe those activities that were considered. There is no credit for simply listing the various types of projects under each credited category. For each activity, there must be a discussion of why the activity is or is not appropriate for the community and its flood problems.

For an activity that is determined to be appropriate,

- The discussion must also include community's capability to fund and implement the activity.
- If an activity is currently being implemented, the plan must note if it is achieving expectations and, if not, whether it should be modified.
- If the plan is an update of a previously credited plan, each activity recommended by the previous plan must be discussed, along with the status of implementation.

The discussion of each activity needs to be detailed enough to be useful to the lay reader.

Section (a) is required for any credit under this step.

(a) 5 points, if the plan reviews preventive activities, such as zoning, stormwater management regulations, building codes, subdivision ordinances, and preservation of open space, and the effectiveness of current regulatory and preventive standards and programs. (REQUIRED) For this credit, the review must include a discussion of the community's

- Comprehensive or land use plan,
- Building code,
- Zoning ordinance,
- Floodplain management regulations,
- Subdivision ordinance, and
- Stormwater management regulations.

The discussion must review

- How these tools can reduce future flood losses,
- The current standards in the community's plans and regulations, and
- Whether the community should adopt or revise such plans and regulations in light of the Step 5 problem assessment and the goals set in Step 6.

- (b) 5 points, if the plan reviews whether the community's floodplain management regulatory standards are sufficient for current and future conditions, as discussed under Steps 4(c) and 5(f).
- (c) 5 points, if the plan reviews property protection activities, such as acquisition, retrofitting, and flood insurance;
- (d) 5 points, if the plan reviews activities to protect the natural and beneficial functions of the floodplain, such as wetlands protection;
- (e) 5 points, if the plan reviews emergency services activities, such as warning and sandbagging;
- (f) 5 points, if the plan reviews structural projects, such as levees, reservoirs, and channel modifications; and
- (g) 5 points, if the plan reviews public information activities, such as outreach projects and environmental education programs.

Step 8. Draft an action plan

After the review of alternatives during Step 7, an action plan is drafted (Step 8) that selects and specifies those activities appropriate to the community's resources, hazards, and vulnerable properties. The community should strive for a balanced program, selecting measures from more than one category of floodplain management activity. In every case, the community should implement preventive activities both to keep its flood problems from getting worse and also to protect new construction from the effects of natural hazards.

There is no requirement that a floodplain management plan identify expensive or massive structural flood control projects. The plan must include activities that the community can be assured will be implemented through its own resources. If outside funding support is needed for some projects, the funding sources should be identified and researched to ensure that the projects are eligible and the community has a chance of receiving the funds. Many of the activities could receive CRS credit once they are implemented.

Note that 50% of the maximum credit for this planning step is a prerequisite for Class 4 or better communities.

Credit Points for FMP Step 8

The credit points are based on the range of actions that are recommended in the plan, subject to the criteria listed below. (Maximum credit: 60 points)

- For each recommendation, the action plan must identify
 - Who is responsible for implementing the action,
 - When it will be done, and
 - How it will be funded.

“When it will be done” can be specified in terms of a date, a set period of time after another action is complete, after the next flood, etc. “How it will be funded” could state that funding will be dependent on a grant, provided the project is eligible for the grant program.

- The actions must be prioritized. When prioritizing mitigation actions, the planners need to consider the benefits that would result from the mitigation actions and projects versus the cost of those actions. Note that this is not a requirement for a cost-benefit analysis for every action item. However, an economic evaluation is essential for selecting one or more actions from among many competing ones.
 - There must be an action item for each goal in Step 6. An example of this is in Figure 510-5.
 - Credit is provided for a recommendation on floodplain regulations, provided it recommends adopting or continuing a regulatory standard that exceeds the minimum requirements of the National Flood Insurance Program (NFIP). Simply continuing to meet the minimum criteria of the NFIP is not credited as an action item to improve the community’s floodplain management program.
 - If the plan calls for acquiring properties, there must be a discussion of how the project(s) will be managed and how the land will be used after it is acquired.
 - When a multi-jurisdictional plan is prepared, it must have action items from at least two of the six categories that directly benefit each community seeking CRS credit.
 - To qualify as a multi-hazard mitigation plan, the plan must include a “process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate” (44 *CFR* §201.6(c)(4)(ii)). The action items that relate to preventive activities should clarify how this is done. For example, an action item could recommend that the next time the zoning ordinance is revised, flood and landslide hazard areas be considered when determining allowable uses.
- (a) 45 points, depending on how many categories are covered by the action items:
- (1) 10 points, if the action plan includes flood-related recommendations for activities from two of the six categories credited in Step 7; OR
 - (2) 20 points, if the action plan includes flood-related recommendations for activities from three of the six categories credited in Step 7; OR
 - (3) 30 points, if the action plan includes flood-related recommendations for activities from four of the six categories credited in Step 7; OR
 - (4) 45 points, if the action plan includes flood-related recommendations for activities from five of the six categories credited in Step 7.

Table 9-1. Action Items, Goals, and Recommendations							
Action Item	Goal 1. Protect critical facilities and utilities	Goal 2. Protect lives and health	Goal 3. Protect homes, businesses, and schools	Goal 4. Minimize the costs to the City and property owners	Goal 5. Ensure that new construction supports these goals	Chapter – Recommendation	Deadline
9.2. Administrative Action Items							
1. <i>Plan</i> adoption	X	X	X	X	X		5/31/07
2. Monitoring and reporting	X	X	X	X	X		9/30 each year
3. Community Rating System	X	X	X	X	X	4-3, 6-5, 7-3, 8-1 - 8-8	CRS visit
9.3. Program Action Items							
4. Levee improvements	X	X	X	X		4-1	Ongoing
5. Drainage improvements	X	X	X	X		4-2	8/31/08
6. Drainage system maintenance	X	X	X			4-3	CRS visit
7. Property protection funding	X	X	X	X		5-2, 5-3	8/31/07
8. Regulatory review	X		X		X	6-5	CRS visit
9. NFIP administration	X	X	X		X	6-2	After CAC
10. CFMs	X	X	X		X	6-2, 6-3	8/31/07
11. BCEGS	X	X	X		X	6-4	5/31/07
12. Flood response plan	X	X	X			7-1 – 7-4	Ongoing
9.4. Public Information Action Items							
13. Annual mailing		X	X		X	8-1, 8-2, 8-7, 8-8	Each Spring
14. Technical references		X	X		X	8-4, 8-5	CRS visit
15. Public information projects		X	X		X	4-4, 5-1, 6-1, 6-6, 7-4, 8-1 – 8-8	Ongoing
16. Public information messages		X	X		X	4-4, 5-1, 6-1, 6-6, 7-4, 8-1 – 8-8	Ongoing
<p>This table relates the 16 action items to the 5 goals of this Plan. The goals are stated in full on pages 3-6 and 9-1. The table also shows the relation between the action items and the recommendations at the end of chapters 4 – 8. For example action item 8, Regulatory Review, implements recommendation 6-5 at the end of chapter 6. The reviews need to be completed in time for the CRS verification visit, which will be in the second half of 2007.</p>							

Figure 510-5. An excerpt from the City of Gretna, Louisiana’s Flood Hazard Mitigation Plan.

(b) 10 additional points are provided if the action plan establishes or revises post-disaster redevelopment and mitigation policies and procedures. These policies and procedures should account for the expected damage from a base flood or other disaster. For example, the action plan should identify the areas likely to be worst hit and the policies should determine whether they will be rebuilt if substantially damaged. Post-disaster mitigation procedures should assign responsibilities for public information, code enforcement, planning, and other efforts that encourage, mandate, and/or fund loss reduction activities.

Note that Activity 330 (Outreach Projects) provides credit for public information materials developed for use during and after a flood (Flood Response Preparations (FRP)). Preparation of those materials should be done when the other post-disaster policies and procedures are prepared.

(c) 5 additional points are provided if the plan includes action items (other than public information activities) to mitigate the effects of the other natural hazards identified in the hazard assessment (Step 4, item (b)).

Step 9. Adopt the plan

The points for this step are provided if the plan and later amendments are officially adopted by the community's governing body. The plan must be an official plan of the community, not an internal staff proposal. "Adopted" means that there is a resolution or other formal document that is voted on by the community's governing body. A note in the minutes or passage via a consent agenda is not credited.

When a multi-jurisdictional plan is prepared, it must be adopted by the governing body of each community seeking CRS or multi-hazard mitigation plan credit.

Step 10. Implement, evaluate, and revise

To be useful, planning must be ongoing and plans must be dynamic. The plan should not sit on a shelf gathering dust once it is completed. Therefore, the community must have an evaluation and update process.

For CRS credit, plans must be implemented. No plan is perfect. As implementation proceeds, flaws will be discovered and changes will be needed. Not only can hazard conditions change but also goals and objectives may change. If a community is hit by a tornado, for example, the short-term action items may be changed to focus attention on the newly damaged areas in the SFHA.

Changes should be made in the action plan when opportunities arise to add new activities or complete some items ahead of schedule. The plan should also be revised if it is found that some activities cannot be completed on the original timetable. At a minimum, these types of changes must be made at the required 5-year update.

The key to this step is the annual evaluation report on progress in implementing the plan. Not only are annual evaluations required with the community's annual recertification, but also the process of conducting an annual evaluation gives the community a framework for

monitoring the plan's effectiveness and the community's progress in implementing it. Failure to submit the evaluation report with the community's annual recertification will result in loss of the planning credit (i.e., FMP = 0). This can cause a Category C repetitive loss community to revert to a Class 10.

Credit Points for FMP Step 10

The credit for this step is the total of the following points, based on how the community monitors and evaluates its plan. (Maximum credit: 26 points)

- The plan document must describe how, when, and by whom the plan will be monitored, evaluated, and revised. It is recommended that these items be included in the adoption resolution as well.
 - An annual evaluation report on progress towards plan implementation must be prepared at least once each year and submitted with the community's annual CRS recertification. The report must be submitted to the governing body, released to the media, and made available to the public.
 - If a community receives credit as a result of participation in a multi-jurisdictional plan that includes action items for each community, the annual evaluation report must cover those action items. This can be done either by a multi-jurisdictional planning committee or through separate submittals by each community. However, a community will not receive credit if it did not participate in the meeting at which the annual report was prepared. Therefore, the submittal needs to show who participated in the preparation of the report.
 - The community must update the plan at least every five years. The update is due by October 1, five years after the plan was adopted (see next section).
 - Step 10(b) provides credit if the planning committee does the evaluation and revision. If the committee does not continue to meet and report or if the committee membership no longer meets the credit criteria in Step 2(a), the community will not keep the committee credits under Steps 1(b) or 2(a).
- (a) 2 points, if the community has procedures for monitoring implementation, reviewing progress, and recommending revisions to the plan in an annual evaluation report. The report must be submitted to the governing body, released to the media, and made available to the public. (REQUIRED)
- (b) 24 points, if the annual evaluation report is prepared by the same planning committee that prepared the plan that is credited in Step 2(a) or by a successor committee with a similar membership that was created to replace the planning committee and charged with monitoring and evaluating implementation of the plan. The points are based on how frequently the committee meets, since more frequent meetings yield more progress toward implementing the plan. The committee must continue to meet the representation, quorum, and other criteria that determined the credit points under Step 2(a).
- (1) 6 points, if the committee meets only once a year.
 - (2) 12 points, if the committee meets twice a year.
 - (3) 24 points, if the committee meets at least quarterly.

Five-year Update

The community must submit a copy of its plan update at least every five years. The plan update will be reviewed for CRS credit according to the *Coordinator's Manual* currently in effect, not the version used when the community originally requested this credit. The update must include the following steps:

- (a) Steps 1 and 2: If the original planning process included a committee, then in order to keep the credit provided under Step 1(b) or Step 2(a), the update must be conducted by a committee that meets the criteria identified in those steps.
- (b) Step 2: If the original planning process received credit for a public meeting credited under Step 2, item (c), then to keep this credit the community must also conduct a public meeting that reviews and receives comments on the draft update.
- (c) Step 3, item (a): The update must include a review of new studies, reports, and technical information and of the community's needs, goals, and plans for the area that have been published since the plan was prepared.
- (d) Steps 4 and 5: The hazard and problem assessments must be reviewed and brought up to date. The assessments must account for
 - New floodplain or hazard mapping,
 - Annexation of flood-prone areas,
 - Additional repetitive loss properties,
 - Completed mitigation projects,
 - Increased development in the floodplain or watershed,
 - New flood control projects,
 - Lack of maintenance of flood control projects,
 - Major floods or other disasters that occurred since the plan was adopted, and
 - Any other change in flooding conditions and/or development exposed to flooding or the other hazards covered in the plan.
- (e) Step 6: The original plan's goals must be reviewed to determine if they are still appropriate, given the revisions to Steps 4 and 5.
- (f) Step 8: The action plan must be revised to account for projects that have been completed, dropped, or changed and for changes in the hazard and problem assessments, as appropriate.
- (g) Step 9: The update must be adopted by the community's governing body.

An annual evaluation report that includes these steps may qualify as the five-year update (but may not qualify as an update for a multi-hazard mitigation plan).

Impact Adjustment for FMP

rFMP is a ratio that reflects how much of the community's flood hazard areas are covered by the floodplain management plan. Note that to qualify for a hazard mitigation plan, all of the community's flood hazards must be covered.

rFMP = EITHER

1.0, if the plan covers all of the community's known flood hazard areas. "Known flood hazard areas" means the SFHA shown on the FIRM, repetitive loss areas, areas not mapped on the FIRM that have been flooded in the past, and surface flooding identified in existing studies (see Step 4)

OR

0.25, if the planning covers either all of the community's repetitive loss areas or at least 25% of the community's known flood hazard areas.

Documentation for FMP Provided by the Community

(1) With the submittal of the plan or the five-year update to the plan,

- (a) A copy of the plan or updated plan to be credited. This can be a hard copy, digital copy, or link to a website with the full document. Either the plan is marked, or a separate document is provided, to show where each credited step and sub-step appears. There is a checklist that can be used to do this, available at www.CRSresources.org/500.
- (b) [For Step 1(b) credit for a committee of staff from different departments] The plan or a separate document must show which department representatives implement, or have expertise in, which of the six categories of mitigation measures.
- (c) [For Step 1(c) credit] A copy of the resolution or other official action taken by the governing body to create or recognize the planning process as specified in Step 1. For Step 2(a) credit for a planning committee, the resolution or action must identify the committee's membership.
- (d) [For Step 2(a) credit for a planning committee] The names of the committee members, their titles, and their represented organizations must be listed in the plan. The community may submit separate materials, such as meeting minutes and sign-in sheets, to document meeting attendance.
- (e) For Step 2(b), (c), or (d) credit for public meetings] Copies of the publicity for the public meetings. The notices of the meetings should be in the form of letters to floodplain residents, a notice sent to all residents, or a newspaper article or advertisement. An inconspicuous legal notice appearing in the classified section of the newspaper is not sufficient for CRS credit. If very few residents are affected, as may be the case for a plan that addresses only a repetitive loss area, a written record that the residents were called would be sufficient documentation.

- (f) [For Step 3(a) credit for reviewing existing studies, reports, and technical information] The plan must note where the information from the studies and reports was used, e.g., with quotations or footnotes. The plan also needs to include a list of all the documents reviewed. This is usually done in a reference section or at the end of each chapter.
- (g) [For Step 3(b) credit for coordination with other agencies and organizations] A record of the contacts and meetings. Acceptable records include letters that cover the items needed for coordination, copies of any responses that were received, follow-up memos from the meetings, notes from telephone conversations, and e-mails. These items are usually not included as a part of the plan document.
- (h) A copy of the resolution or other formal adoption action by the governing body as specified in Step 9. The resolution should identify the implementation responsibilities, describe the evaluation and revision procedures, and call for the five-year update (or adopt by reference such language that may be in the plan document).

(2) With each annual recertification,

- (a) A copy of the annual evaluation report as specified in Step 10. The report must review each action item, describe what was implemented (or not implemented), and recommend changes to the action plan as appropriate. If not in the evaluation report document, the recertification submittal must also include the minutes of the committee meeting(s) (if getting credit for Step 10(b)) and a description of how the report was submitted to the governing body, released to the media, and made available to the public.

NOTE: Failure to submit the floodplain management plan's evaluation report with the annual recertification or the five-year update will result in loss of the planning credit (i.e., FMP = 0). Loss of credit for this activity may cause a repetitive loss Category C community to revert to a Class 10.

512.b. Repetitive loss area analysis (RLAA)

The maximum credit for this element is 140 points.

A repetitive loss area analysis is a detailed mitigation plan for a repetitive loss area. It provides more specific guidance on how to reduce damage from repetitive flooding than a community-wide floodplain management or hazard mitigation plan. Mapping repetitive loss areas is discussed in Section 503.

As with a floodplain management plan, CRS credit is dependent upon the community's following an appropriate process. The five steps for an area analysis are less involved than the 10-step floodplain management planning process, but the analysis must evaluate each building in the repetitive loss area(s).

A community may receive credit for both a floodplain management plan and repetitive loss area analyses. Area analyses may be conducted during floodplain management planning or a

floodplain management plan may identify areas needing analyses, which are conducted after the plan is adopted. For CRS credit, a separate analysis must be prepared for each repetitive loss area and made available to residents of those areas.

Additional guidance and suggestions for conducting an area analysis can be found in Chapter 7 of *Reducing Damage from Localized Flooding*, FEMA-511.

Credit Criteria for RLAA

- (1) Communities with one or more repetitive loss properties on FEMA's list must have at least one repetitive loss area delineated in accordance with the criteria in Section 503. The area(s) must include at least one of the properties on FEMA's repetitive loss list.

An exception to this criterion is made for communities that have no historic repetitive flood claims, but are nevertheless working to reduce repetitive flooding. These communities may prepare area analyses for areas that have been repetitively flooded. The analyses must describe and map the repetitive flooding problem (including all past flood insurance claims, if any) and meet all the following credit criteria. If there are multiple areas, they must not be contiguous. Communities using this approach may receive 20 credit points per area.

- (2) An area analyses must have been prepared and adopted for each repetitive loss area in the community. The analyses must meet the following criteria:
 - (a) The repetitive loss areas must be mapped as described in Section 503.b.
 - (b) If the community does not conduct an analysis of all the areas, it will be reflected through the impact adjustment. A Category C community must prepare analyses for all of its repetitive loss areas if it wants to use RLAA to meet its repetitive loss planning prerequisite (see Section 502).
 - (c) A five-step process must be followed. Although all five steps must be completed, steps 2–4 do not have to be done in the order listed. For example, the planners may want to contact agencies and organizations to see if they have useful data (Step 2) after the site visit is conducted (Step 3).

Step 1. Advise all the properties in the repetitive loss areas that the analysis will be conducted and request their input on the hazard and recommended actions. The notice (or any public document) cannot identify which properties are on FEMA's repetitive loss list (see the box on flood insurance data and the Privacy Act). There are no restrictions on publicizing what properties are in repetitive loss AREAS that have more than one property and there are no restrictions on publishing aggregate data, such as how many properties received claims or the average value of those claims. Community planning staff may share insurance claims information with the owner of the property, but may not make it available to anyone else.

- The notice can be sent to owners OR residents at the community's discretion, as long as a representative of each property is notified.

The Privacy Act

Flood insurance data about private property, including repetitive loss properties, are protected under the Privacy Act. Personally identifiable Information such as the names or addresses of specific properties, whether they are covered by flood insurance or not, whether they have received flood insurance claims, or the amounts of such claims may not be released outside of local government agencies or to the public or used for solicitation or other purposes. Such information should be marked "For internal use only. Protected by the Privacy Act of 1974."

General or aggregated information, such as total claims paid for a community or an area or data not connected to a particular property may be made public.

- The notice cannot be done via a newspaper or newsletter notice or article.
- The notice must advise the recipients when and how copies of the draft report can be obtained and ask for their comments on the draft.

Step 2. Contact agencies or organizations that may have plans or studies that could affect the cause or impacts of the flooding. The agencies or organizations must be identified in the analysis report.

Step 3. Visit each building in the repetitive loss area and collect basic data.

- The site visit must collect data sufficient to do a preliminary determination of the cause of the repetitive flooding and of the mitigation measures that would be appropriate. This usually includes a review of drainage patterns around the building, the condition of the structure, and the condition and type of foundation.
- The person conducting the visit should not have to enter the property—adequate information should be collected from observations from the street.
- Floor elevations or historical flood levels are not required, but can be very helpful where available.
- The date for each building's insurance claim can help identify the cause of flooding (e.g., rainfall or overbank flooding) and the amount of the claim can help determine the amount of damage. Note that, every year, each repetitive loss community is provided with a list of its historic insurance claims. This includes single-claim properties. Non-repetitive-loss communities that elect to do an RLAA may request these data from their ISO/CRS Specialist.
- More information on appropriate data can be found in *Selecting Appropriate Mitigation Measures for Floodprone Structures*, FEMA-551.
- This step may be done using the "limited data view" of the National Flood Mitigation Data Collection Tool (Figure 510-6).

The National Flood Mitigation Data Collection Tool has been developed by FEMA to gather information related to risk, building construction, and costs in order to help make decisions about what mitigation measures are appropriate for a flood-prone property. The tool is in Microsoft Access format and is free to any public agency. See www.fema.gov/plan/prevent/floodplain/data_tool.shtm.

The tool may be populated with insurance claim data for the properties. The local planners need to remember that such information is subject to the Privacy Act, which prohibits public release of the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance. However, maps showing areas where claims have been paid can be made public. The data can be used for internal planning and can be helpful in identifying problem areas.

The tool has two levels of data collection. Limited data usually can be collected through a windshield-type survey, while completing the entire detailed data section may require elevation surveying and structural inspections inside the buildings. The detailed data are collected when the limited effort concludes that mitigation is possible and the additional data are needed to determine the most appropriate mitigation measure and its benefits and costs.

Figure 510-6. The National Flood Mitigation Data Collection Tool.

Step 4. Review alternative approaches and determine whether any property protection measures or drainage improvements are feasible. The review must look at all of the property protection measures listed in Figures 360-1 and 510-4 that are appropriate for the types of buildings affected. A review that looks only at drainage or structural flood control project alternatives is not sufficient.

Step 5. Document the findings. A separate analysis must be conducted for each area. In general, separate reports are preferred for each area, but in cases in which several areas have similar building and flooding characteristics and similar mitigation measures are appropriate, the analyses can be assembled into a single report. Each report must include

- A summary of the process that was followed, including how the property owners were involved;
- The problem statement with a map of the area affected. The statement and map may show individual properties or parcels, but cannot show which ones are on FEMA's repetitive loss list;
- A list or table showing basic information for each building, such as address, foundation type, condition, and appropriate mitigation measures. This list cannot include insurance data, such as how many claims have been paid for that property. If the property owners responded to a survey, the survey responses may be included (unless the community promised confidentiality);
- The alternative approaches that were reviewed; and

- Action items that include
 - Who is responsible for implementing the action,
 - When it will be done, and
 - How it will be funded.

“When it will be done” can be expressed in terms of a date, a set period of time after another action is complete, after the next flood, etc. “How it will be funded” could state that funding will be dependent upon receiving a grant, provided that one or more suitable grant programs are specified to which application(s) for funding will be made.

(3) The repetitive loss area analysis report(s) must be submitted to the community’s governing body and made available to the media and the public. If private or sensitive information (such as names or street addresses) is included in the report, then a summary report(s) must be prepared for the governing body, committees, media, and the public. The complete repetitive loss area analysis report(s) must be adopted by the community’s governing body or by an office that has been delegated approval authority by the community’s governing body.

(4) The community must prepare an annual evaluation report for its area analyses.

- The report must review each action item, describe what was implemented (or not implemented), and recommend changes to the action items as appropriate.
- One annual report can cover some or all of the area analyses that were prepared.
- The report must be made available to the media and the public (including the property owners and residents of the repetitive loss areas).
- The report is submitted with the community’s annual recertification.

(5) The community must update its repetitive loss area analyses in time for each CRS cycle verification visit.

- The update must review the flooding and building conditions as well as any changes to FEMA’s repetitive loss list, to determine whether the number of buildings on the list or other circumstances have changed, and revise the mapping and action items accordingly.
- The update can be a new report or an addendum to the existing report.
- An annual evaluation report that reviews and updates the 5-step process may qualify as the area analysis update.
- The update can qualify as the annual evaluation report for the year it was prepared.
- The update must be made available to the media and the public (including the property owners and residents of the repetitive loss areas).

If, during the area analysis or annual reviews, the community finds that the flood risk to one or more repetitive loss properties has been mitigated, FEMA must be notified by submitting an AW-501, as described in Section 501.

- If the repetitive flooding problem has been mitigated, the appropriate documentation must be submitted in order to remove the properties from FEMA’s repetitive loss list (see Section 501).
- Any changes to an adopted area analysis must be approved following the same process as approval of the original analysis.

Credit Points for RLAA

$$RLAA = 140$$

The maximum credit for this element is 140 points. A community can obtain the maximum only if it prepares and adopts repetitive loss area analyses for all its repetitive loss areas. This is factored in through the impact adjustment.

Impact Adjustment for RLAA

rRLAA is the ratio of the number of buildings covered by credited area analyses to the total number of buildings in the community’s repetitive loss areas. See Sections 301–303 on calculating an impact adjustment.

$$rRLAA = \frac{bAA}{bRLA}, \text{ where}$$

bAA = the number of buildings addressed in credited area analyses, and

bRLA = the number of buildings in the community’s repetitive loss areas

Documentation for RLAA Provided by the Community

(1) At each verification visit,

- (a) A copy of each repetitive loss area analysis report or update of an earlier report that the community wants credited (see Step 5).
- (b) Documentation showing how the owners or residents of the areas were notified (see Step 1).
- (c) Documentation showing how the analysis was made available to the media and the public.
- (d) A copy of the resolution or other formal action by the governing body that adopts the area analysis or accepts changes in subsequent updates.

(2) With the annual recertification,

- (a) A copy of the annual evaluation report (Section 512.b, credit criterion (4)). If not in the evaluation report, the recertification submittal must also document how the evaluation report and update were made available to the media and the public.

NOTE: Failure to submit the area analysis' evaluation report with the annual recertification or the update at the next cycle verification visit will result in loss of the credit (i.e., RLAA = 0). Loss of credit for this activity may cause a repetitive loss Category C community to revert to a Class 10.

512.c. Natural floodplain functions plan (NFP)

The maximum credit for this element is 100 points.

NFP credit is provided for adopting plans that protect one or more natural functions within the community's floodplain. Examples include

- A habitat conservation plan that explains and recommends actions to protect rare, threatened, or endangered aquatic or riparian species.
- A habitat protection or restoration plan that identifies critical habitat within the floodplain, actions to protect remaining habitat, and/or actions to restore fully functioning habitat. Frequently this will result in the preservation and/or restoration of riparian habitat that is necessary for water-dependent species.
- A "green infrastructure plan" that identifies open space corridors or connected networks of wetlands, woodlands, wildlife habitats, wilderness, and other areas that support native species, maintain natural ecological processes, and/or sustain air and water resources (for credit, the corridors or networks must include some floodplains).
- A plan or section of a comprehensive or other community plan that includes an inventory of the ecological attributes of the watershed and/or the floodplain and recommends appropriate actions for protecting them, provided that the recommendations are implemented through a mechanism such as a development regulation, development order, grant program, or capital improvement plan.

NOTE: Element NFOS2, (section 2 of the natural floodplain functions open space credit under Activity 420 (Open Space Preservation)), provides bonus credit for open space parcels that are designated in a plan to protect natural functions. A plan that receives NFP credit qualifies parcels for this extra open space credit.

Credit Criteria for NFP

(1) For all plans:

- (a) The plan may cover more than one community, but it must have an impact on natural floodplain functions within the community seeking credit.
- (b) The plan must be adopted. If the plan is not a community plan adopted by the community's governing body, it must be adopted by the appropriate regional agency.
- (c) The plan must be updated at least once every 10 years. The update must include a review of any changes to conditions as well as progress made since the original plan

was prepared. Any changes to the adopted plan must be approved by the original adopting agency.

- (d) The plan must include action items for protecting one or more identified species of interest and natural floodplain functions. The action items must describe who is responsible for implementing the action, how it will be funded, and when it will be done. General policy statements with no means of implementation are not considered action items.
 - (e) There is no credit for a plan that addresses water quality issues prepared pursuant to a requirement for an NPDES (National Pollution Discharge Elimination System) permit. Plans to improve drainage, stormwater storage, or channel bank erosion may be credited under Activity 450 (Stormwater Management) or Activity 540 (Drainage System Maintenance).
- (2) For NFP1: A plan for NFP1 credit must include a comprehensive inventory of the natural floodplain habitat within the community. It must identify areas that warrant protection or preservation in order to maintain fully functioning habitat for the species of interest. Where threatened or endangered species are present, each species must be addressed and a restoration plan must be included.
- (3) For NFP2: This sub-element credits other plans that meet the credit criteria listed in (1). These could be single-issue or single-species plans or plans that cover only one area of the community's floodplain.

Credit Points for NFP

NFP = the total of the following

NFP1 = 80 points, for a plan, or combination of plans, that meets credit criteria (1) and (2) and covers the entire SFHA within a community

NFP2 = 15 points, for each plan that meets credit criterion (1)

Impact Adjustment for NFP

There is no impact adjustment for this element. The NFP1 plan must cover the entire community or all of the community's floodplains. Each NFP2 plan receives the appropriate credit regardless of the extent of the area covered.

Documentation for NFP Provided by the Community

- (1) At each verification visit,
 - (a) A copy of each natural floodplain functions plan or update to a plan that the community wants credited.
 - (b) A copy of the resolution or other formal adoption action.

513 Credit Calculation

$c510 = (FMP \times rFMP) + (RLAA \times rRLAA) + NFP$, where

FMP = the total of the credit points for the 10 steps in Section 512.a

514 For More Information

- a. Additional information, reference materials, and examples can be found at www.CRSresources.org/500.
- b. See Appendix C to order a free copy of *CRS Credit for Floodplain Management Planning*. It is also on the CRS website, at www.CRSresources.org/500.
- c. Hazus-MH is a risk assessment software program that is described in Figure 510-2. Copies are available free from FEMA. Users need to be familiar with operating GIS software. Training is also available. More information is available at www.fema.gov/hazus/.
- d. Contact state or regional planning, water resources, natural resources, environmental protection, state hazard mitigation, or NFIP coordinating agencies for information on state and federal agencies that can help prepare a floodplain management plan.
- e. The following publications discuss the floodplain management planning process and the variety of measures that should be examined. They can be found on the websites noted.

FEMA has a series of “how-to guides” on planning, to help communities meet the multi-hazard mitigation planning criteria. They can be found at www.fema.gov/hazard-mitigation-planning-resources#1.

Getting Started: Building Support for Mitigation Planning (FEMA-386-1) covers planning Phase I and CRS planning Steps 1–3.

Understanding Your Risks: Identifying Hazards and Estimating Losses (FEMA-386-2) covers planning Phase II and CRS planning Steps 4–5.

Developing the Mitigation Plan: Identifying Mitigation Actions and Implementation Strategies (FEMA-386-3) covers planning Phase III and CRS planning Steps 6–8.

Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA-386-4) covers planning Phase IV and CRS planning Steps 9–10.

Integrating Manmade Hazards into Mitigation Planning, FEMA-386-7.

Reducing Damage from Localized Flooding: A Guide for Communities, FEMA-511 (2005). Also available at www.fema.gov/library/viewRecord.do?id=1448.

Planning for Post Disaster Recovery and Reconstruction, American Planning Association (APA) Planning Advisory Service, 346 pages, APA Report # 483/484, FEMA-421 (1998). www.fema.gov/library/viewRecord.do?id=1558.

Planning for a Sustainable Future: The Link Between Hazard Mitigation and Livability, 43 pages, FEMA-364, 2000. Also available for downloading at <http://www.fema.gov/media-library/assets/documents/2110?id=1541>.

Reducing Losses in High Risk Flood Hazard Areas—A Guidebook for Local Officials, FEMA-116, 1987. Also available for downloading at www.fema.gov/library/viewRecord.do?id=1508.

“Mitigation Benefit Cost (BCA) Toolkit Compact Disc.” This CD includes all the FEMA BCA software, technical manuals, BCA training course documentation, and other supporting material and BCA guidance. Copies can be obtained by calling FEMA’s toll-free BC Hotline at 1-866-222-3580.

- f. *Hazard Mitigation: Integrating Best Practices into Planning*, James C. Schwab (ed.) (2010) is published by the American Planning Association as Planning Advisory Service No. 560. Available for \$60 from www.planning.org/apastore/.
- g. The Corps of Engineers can also provide technical information and advice to communities interested in preparing a comprehensive floodplain management plan. Requests for assistance should be submitted to the Flood Plain Management Services Coordinator at the appropriate District Office of the Corps. Corps offices can be found at <http://www.usace.army.mil/Locations.aspx>.
- h. The following publications can help with a repetitive loss area analysis.

Selecting Appropriate Mitigation Measures for Floodprone Structures, FEMA-551.

Reducing Damage from Localized Flooding: A Guide for Communities, FEMA-511 (2005).

Flood Proofing: How to Evaluate Your Options, U.S. Army Corps of Engineers (1994). Download at <http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx>. Click on “NFPC Publications” and scroll down to find the title.

515 Related Activities under the Community Rating System

- A floodplain management plan should be a blueprint for ALL of a community’s public information and floodplain management activities. Planning Step 7 should review all ongoing and possible activities and Step 8 should identify which should continue, which should change, and what new ones should be initiated.
- The CRS Community Self Assessment in Section 240 can help with the hazard and problem analyses in FMP Steps 4 and 5.
- Activities 330 (Outreach Projects) and 370 (Flood Insurance Promotion) provide credit for having a committee that meets criteria very similar to those of the committee in FMP Step 2. The same committee can fulfill all activities’ credit criteria.

- The credit for natural floodplain functions open space (NFOS) under Activity 420 (Open Space Preservation) can be increased if the open space parcels are identified in a natural floodplain functions plan (NFP).
- A repetitive loss area analysis (RLAA) can identify projects and priorities for mitigation activities that can receive bonus credit under Activities 520 (Acquisition and Relocation) and 530 (Flood Protection).
- A multi-hazard mitigation plan that meets FEMA planning criteria is a prerequisite for FEMA funding for projects that can be credited under Activities 520 (Acquisition and Relocation) and 530 (Flood Protection).

Los Angeles County
Comprehensive Floodplain Management Plan

**APPENDIX C.
STEERING COMMITTEE GROUND RULES**

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STEERING COMMITTEE GROUND RULES

PURPOSE OF THE STEERING COMMITTEE

The role of the Steering Committee (SC) is to guide the planning process for the *Los Angeles County Comprehensive Floodplain Management Plan*. The SC will provide guidance and leadership, oversee the planning process, and act as the point of contact for local governments and the various interest groups interested in this planning effort. Members of the SC were selected to represent a cross-section of views and interests within the planning area. Through this inclusion of diverse interests, the SC hopes to enhance the robustness of the planning effort and to build support for floodplain management activities across stakeholder groups. A successful planning effort will result in the adoption and approval of a floodplain management plan that sets the stage for reducing the adverse impacts of floods within the County through activities and strategies embraced by both elected officials and their constituents.

CHAIRPERSON AND VICE CHAIRPERSON

Hu Yi has been selected as the chairperson and **Debbie Sharpton** has been selected as the vice chairperson of the SC. The role of the chairperson is to:

- lead meetings so that agendas are followed and meetings adjourn on-time;
- allow all members to be heard during discussions;
- moderate discussions between members with differing points of view; and
- be a sounding board for staff in the preparation of agendas and how to best involve the full Committee in work plan tasks.

The role of the vice chairperson is to assume the duties of the chair when the chair is not able to attend a meeting or forum.

QUORUM

A quorum for the SC will be 7 members. When less than 7 members are present at a meeting, items listed on the agenda may still be reviewed and discussed; however, any committee action as to those items will be postponed until a quorum is present.

ALTERNATES

Committee members were selected for the SC based on their specific backgrounds and perspectives on matters related to floodplain management. Regular attendance by members is needed to understand the issues presented, identify and reflect on various stakeholder perspectives, and reach agreements on plan recommendations. However, there may be circumstances when regular members cannot attend. To address these circumstances, alternates may be designated for each SC member. An alternate attending on behalf of a SC member shall have the same rights and responsibilities as the SC member during that meeting. Alternates will be included on all SC emails and should stay informed of the business of the SC.

DECISION-MAKING

The SC will strive for consensus in its decision-making process. If consensus cannot be reached as to a particular item or issue, the SC's decision will be determined by a majority vote of the Committee members in attendance at the meeting, and the meeting minutes will reflect the number of votes in favor, opposed and in abstention.

RECOMMENDATIONS

The Committee's recommendations will be recorded in the meeting summaries and reflected in the floodplain management plan as appropriate. The Committee may also be asked to assist in public presentations of the Plan and its recommendations.

STAFFING

The Planning Team for this project includes appropriate personnel from the Los Angeles County Department of Public Works, Watershed Management Division along with contract consultant assistance provided by Tetra Tech, Inc. The Planning Team will schedule meetings, distribute agendas, prepare information/presentations for Committee meetings, write meeting summaries, and generally seek to facilitate the Committee's activities.

A County-designated public information officer, **Kerjon Lee** (626) 458-4348, will be the designated spokesperson for this planning effort.

MEETING DATES

Meetings generally will be conducted on the 4th Tuesday of each month from 10:30 AM to 12:30 PM at Los Angeles County Department of Public Works Headquarters in Alhambra. Meetings will be open to the public and advertised as such.

ATTENDANCE

Participation of all Committee members in meetings is important and members should make every effort to attend each meeting. If Committee members will not be able to attend a meeting, they should provide as much advance notice as reasonably possible to the Planning Team before the meeting is conducted. If neither a SC member nor his or her alternate attends three consecutive meetings, the SC chairperson will reach out to the member to determine if participation will still be possible. The Steering Committee will strive to maintain the SC membership at 13 members with a representative makeup similar to the initial committee makeup.

PUBLIC INVOLVEMENT

All Steering Committee meetings will be open to the public.

Members of the public wishing to address the SC at a meeting may do so based on the following protocol:

- Requests to be heard must be made to the Chairperson of the Steering Committee by submitting a completed speaker request form to the Chairperson before the meeting is called to order . Speaker request forms shall ask for the following information :
 - Agenda item number to be discussed or Public Comment
 - If the person is in favor/opposed to the agenda item (if applicable)
 - Person's name
 - Person's telephone number (optional)
 - Person's address (optional)
 - Name of organization (if applicable)
 - A brief summary of the person's position on the matter (optional).

- Each member of the public will be granted a total of 3 minutes to address their topics of concern. This allotted time cannot be aggregated or passed on to another individual.
- All comments must have relevance to the floodplain management plan and the planning area. Relevance will be determined by the Chairperson.

A member of the public may request clarification from the SC by raising his or her hand during the normal course of the meeting; however, permission to speak will be granted at the discretion of the chairperson.

The meeting agendas for all SC meetings will be posted on the Floodplain Management website and at Los Angeles County DPW Headquarters a minimum of 72 hours prior to all scheduled meetings.

COURTESY

Committee members should treat each other with respect, listen to each other, work cooperatively, and allow all members to voice their opinions.

STEERING COMMITTEE MEMBERSHIP

Agency	Steering Committee Member	Alternate
LACDPW - Watershed Management Division	George De La O	Eduardo Escobar
LACDPW - Disaster Services Group	Loni Eazell	Belinda Popoff
LACDPW - Water Resources Division	Martin Araiza	
LACDPW - Flood Maintenance Division	Hu Yi (Chairperson)	Araik Zargaryan
LACDPW - Building and Safety Division	Lisa Naslund	Jessica Bunker
Los Angeles County Fire Dept.	Scott Gardner	David Godoy
Los Angeles County Regional Planning	Mark Child	Connie Chung and Gina Natoli
Mountains Restoration Trust	Debbie Sharpton (Vice Chairperson)	Wyatt Rovera and Don Lenz
Malibou Lake Mountain Club	Michael Hart	
American Red Cross Los Angeles Region	Kendra Pospychalla	Tomoyo Kuriyama
Los Angeles Chamber of Commerce	Frank Lopez	John Larson
Local Business Owner, Crystallaire Country Club	John Blalock	
Altadena Town Council	Okorie Ezieme	

Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX D.
PUBLIC OUTREACH MATERIALS

APPENDIX D. PUBLIC OUTREACH MATERIALS

SUMMARY OF SURVEY RESULTS

About the Survey

The Los Angeles County Department of Public Works developed and disseminated a 33-question online survey to assist with the incorporation of public outreach in its 2015 Comprehensive Floodplain Management Plan. The survey was available through a link on the County website. In addition to multiple choice questions, Los Angeles County residents were offered the opportunity to provide additional information and detail through several open response sections, the majority of which were associated with a closed response question to ensure as much detail as possible. The survey, completed by 136 County residents, sought to determine public awareness and perception on several flood-related issues, including:

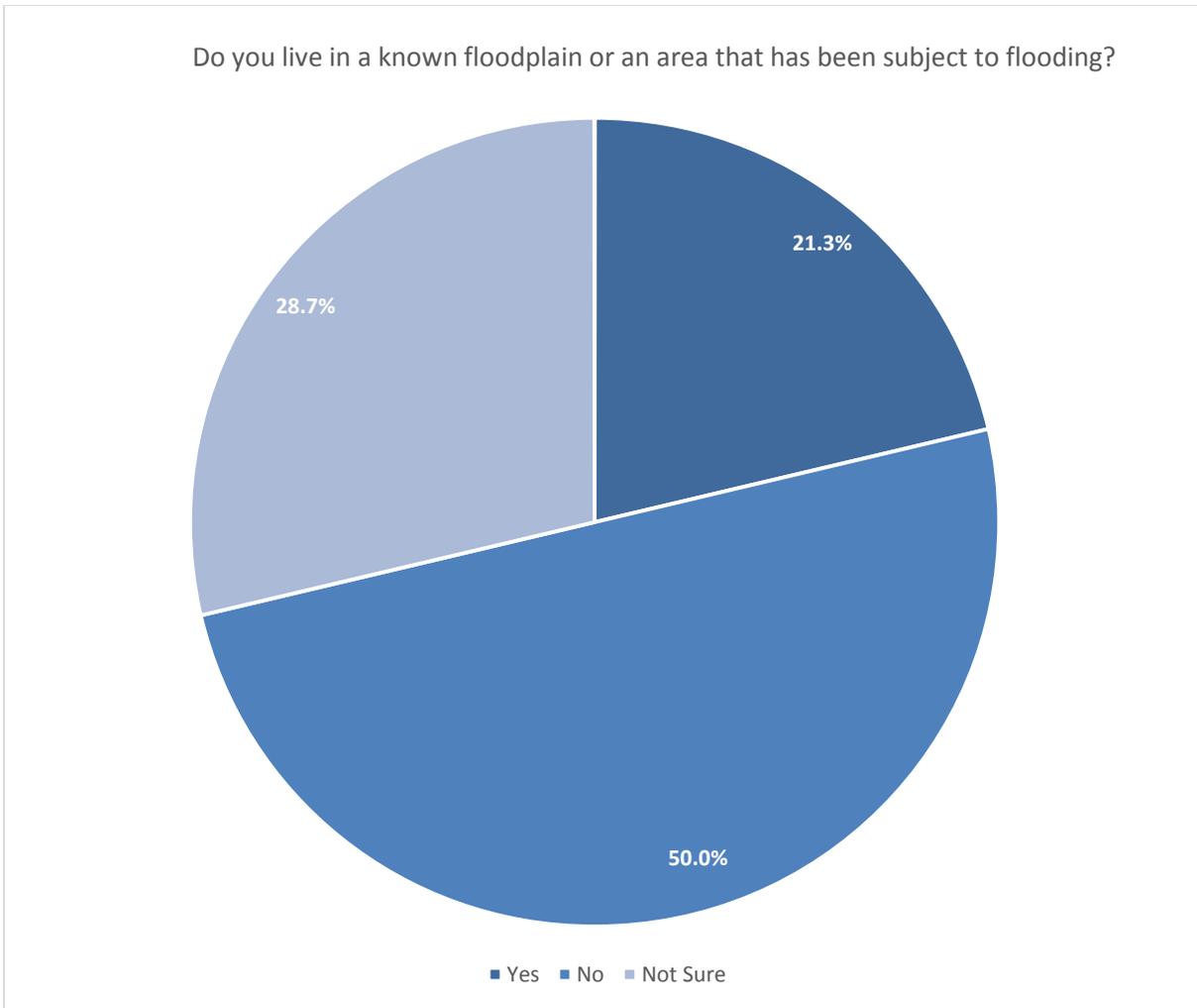
- Flood Hazards
- Flood Preparedness and Education
- Flood Control and Risk Reduction Measures

About the Survey Respondents

As noted above, 136 residents provided information via the survey to enhance the 2015 Comprehensive Floodplain Management Plan. All respondents were over the age of 18, and the number of responses per age group divided into a fairly even distribution (Question 27). While the majority of respondents were male (64.1 percent), women still provided a sizeable contribution of responses (Question 28). The majority of respondents had at least some college experience, if not a degree or graduate degree (combined total of 97.2 percent) (Question 29). Nine of the respondents also identified themselves as having a special access or functional need, alerting the County to their need for early warning or specialized response during a disaster event (Question 26).

The survey respondents were from a wide geographical range, representing 64 different ZIP codes (Question 2). Additionally, the majority of respondents were homeowners (80.9 percent) and not renters (Question 4). In Question 30, residents noted how long they had lived at their current property, with the largest response at 1 to 5 years (36.2 percent), followed by more than 20 years (21.9 percent), and then 11 to 20 years (18.1 percent). Of the respondents who definitely live in the floodplain, 25 percent indicated that the presence of a flood hazard was not disclosed to them prior to the purchase of their home (Question 18). Over 20 percent of respondents believe they live in a known floodplain or area subject to flooding, per Question 3. Of all respondents whose addresses could be geo-located for confirmation, 10.8 percent live in a known floodplain. Therefore, 65.5 percent of respondents who responded “yes” were unable to be confirmed as mapped floodplain residents.

The high percentage of residents who stated that they live in flood prone areas suggests several possibilities – (1) residents may be vulnerable to stormwater-flooding or flood-related hazards which can occur outside the floodplain, (2) current mapped floodplain boundaries may not accurately reflect changes in development or land use, or (3) residents would benefit from a public education and outreach program on flood zones and floodplains.



In the same question, respondents also provided feedback on areas that have experienced flooding, as well as different flood problems. While most flood instances were relatively minor (dirt and mud on roads after hard rains, minimal roadway easement runoff) or due to older infrastructure, including storm drains with insufficient capacity, some residents listed more severe problems. One person was not able to get home from their job in Burbank for over a week when Avenues J to T flooded from El Nino rains. Another shared that there is no flood control structure for a mile above their home in Altadena, resulting in their home routinely flooding.

Several residents also used the open response areas in the survey to request an evaluation of whether their home is located in the floodplain. Comments have indicated that, either due to a higher elevation or lack of flooding during their time of residency, their homes may not have the appropriate flood risk applied.

Perception of Flood Hazards

Question 12 asked respondents to rank how concerned they are about flood-related hazards in Los Angeles County, including hazards such as climate change impacts, tsunami, groundwater flooding, coastal flooding, river/channel migration, stream bank erosion, coastal erosion, urban flooding/drainage issues, land subsidence, and mudflow hazards.

Residents identified urban flooding/drainage issues as the hazard that they were most concerned, very concerned, or extremely concerned about (with 40.4 percent of residents indicating one of those levels). Climate change impacts were the second highest concern (with 35.6 percent concerned or higher), and mudflow hazards were the third highest concern (with 33.9 percent concerned or higher). Climate change and mudflow hazards were also selected as the two hazards where the most respondents indicated extremely concerned (5.8 percent and 4.1 percent, respectively, compared to other concern levels). Some respondents also identified other flood-related hazards, including heavy rains, earthquakes, the California aqueduct failure, and burn areas flooding after severe storms. California aqueduct failure was listed by two respondents, while the other hazards were only listed once.

Flood Preparedness and Education

Survey respondents were also asked a series of questions to gauge their level of preparedness and how they would like to receive preparedness/outreach information. When asked how prepared their household was in Question 9, 40.6 percent indicated feeling somewhat prepared. Only 10.4 percent felt either well prepared or very well prepared. In Question 24, where residents were asked to indicate how they felt about the statement, “Information about the risks associated with flood hazards is readily available and easy to locate,” 41.4 percent disagreed or strongly disagreed. These responses suggest that a potential area for the County to strengthen their flood management program to be helping residents understand where they can go to learn more about flood hazards and risk. Since 48.6 percent of respondents strongly agree (along with 30.5 percent of respondents somewhat agreeing) that it is one’s personal responsibility to educate themselves about flood risks, such a program should be well-received by residents (Question 23).

In Question 10, respondents checked all the sources that they believe to have provided them with useful information to prepare for a flood event. Federal, state, or local emergency management (45.6 percent) was the most frequent source. The other main sources of information included locally-provided news or media (29.8 percent) and personal experience (20.2 percent). Several respondents indicated work as an “other” source, and 25.4 percent did not use any information source.

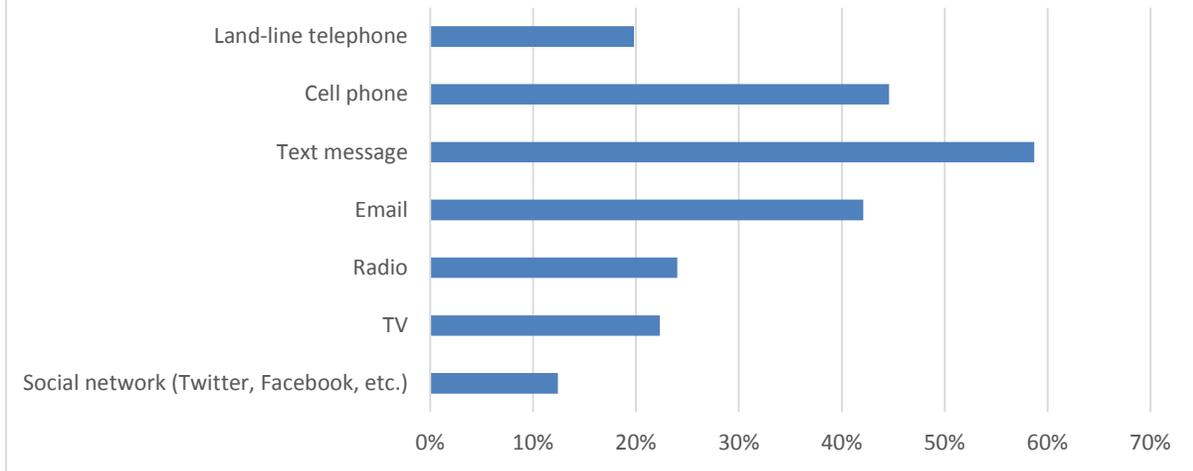
Respondents additionally identified the top five methods they thought to be most effective in providing flood hazard information (Question 13), along with their preferred contact means for an emergency alert (Question 14). The top five flood information methods were:

- Internet (52.1 percent)
- TV News (47.9 percent)
- Radio News (43.8 percent)
- Public Awareness Campaign, e.g., Flood Awareness Week, Winter Storm Preparedness Month (32.2. percent)
- Social Media, e.g., Twitter, Facebook, etc. (32.2 percent)

Public Meetings, Local Government Newsletters, and the Newspaper also ranked at over 20 percent. The Chamber of Commerce and the Telephone Book were the lowest ranked, at 0.0 percent and 0.8 percent, respectively.

In regards to emergency alerts, respondents most preferred text messages (58.7 percent), cell phones (44.6 percent), and email (42.1 percent). Respondents also suggested amateur radio, US mail, and Community Emergency Response Team (CERT) networks as alternate contact methods beyond those listed by the County.

What method is best for you and your family to get time sensitive warning information or instructions for action?

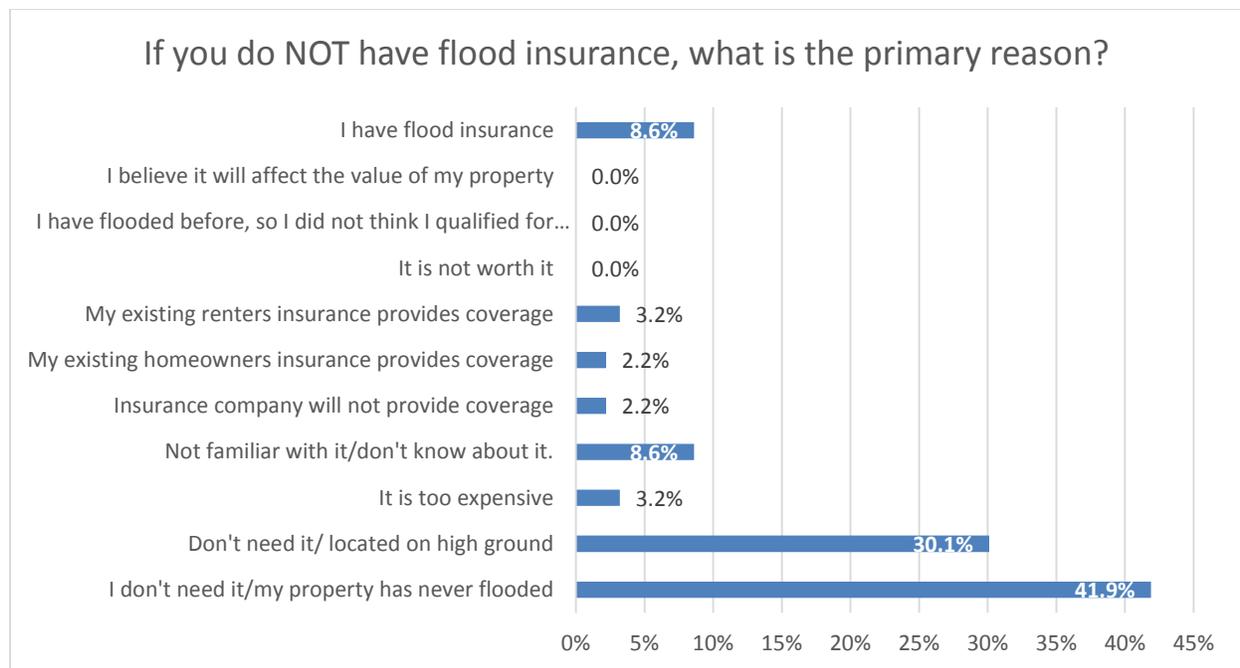


Flood Control and Risk Reduction Measures

Respondents had the opportunity to comment on different flood control and management measures, including both personal/residential activities and County-managed activities.

Flood Insurance

The National Flood Insurance Program (NFIP) is one of the more well-known flood risk management programs in place. Question 15 evaluated how many respondents have flood insurance, with 14.9 percent of respondents answering yes, 69.4 with no, and 15.7 percent as not sure. Most respondents that do not have flood insurance said that this is due to not needing it (property never having flooded) (41.9 percent) or not needing it (property located at high ground) (30.1 percent) (Question 16). Other reasons listed included an inability to afford more insurance, living on the 2nd floor, and not being sure how to tell whether homeowners insurance includes flood insurance. Some residents used the open response portion of this question to request clarification on their flood zone risk and whether they were required to have it, similar to in Question 3.



Government-Sponsored Programs

In Question 22, respondents indicated whether they believed that the government (local, state, and federal) has the responsibility to provide education and programs promoting citizen action to reduce exposure to risks associated with flood hazard. The response was positive, with 33.3 percent strongly agreeing and 37.1 percent somewhat agreeing. In Question 21, respondents ranked the types of government-sponsored projects they support in the following order:

- Retrofitting infrastructure (improving culverts, bridges, and local drainage)
- Capital projects (dams, levees, flood walls, and drainage improvements)
- Providing better flood risk information to the public
- Strengthening codes and regulations to higher regulatory standards
- Acquiring vulnerable properties and maintaining them as open space
- Assisting vulnerable property owners with securing mitigation funding
- Other measures (including raising flood insurance rates for repetitive loss properties and updated flood maps)

At a personal level, most respondents were not sure (39.2 percent) how much they would be willing to spend to retrofit their homes against flood disasters (Question 6). Of those willing to invest in retrofitting their homes, 7.8 percent would spend \$10,000 or more, 4.9 percent would spend \$5,000 to \$9,999, 12.7 percent would spend \$1,000 to \$4,999, and 7.8 percent would spend less than \$1,000. The most popular incentive to retrofit, as identified in Question 7, was grant funding (62.4 percent), with low-interest rate home improvement loans (27.7 percent) and none (24.8 percent) scoring close together. Other suggested incentives included tax deductions, removal of flood insurance requirements, and budgeting for the CSD, which maintains a local flood channel.

SURVEY RESPONSES AND CHARTS

Question 1

What is your home address?		
Answer Options	Response Percent	Response Count
Street Address	99.0%	102
City	100.0%	103
	<i>answered question</i>	103
	<i>skipped question</i>	33

Question 2

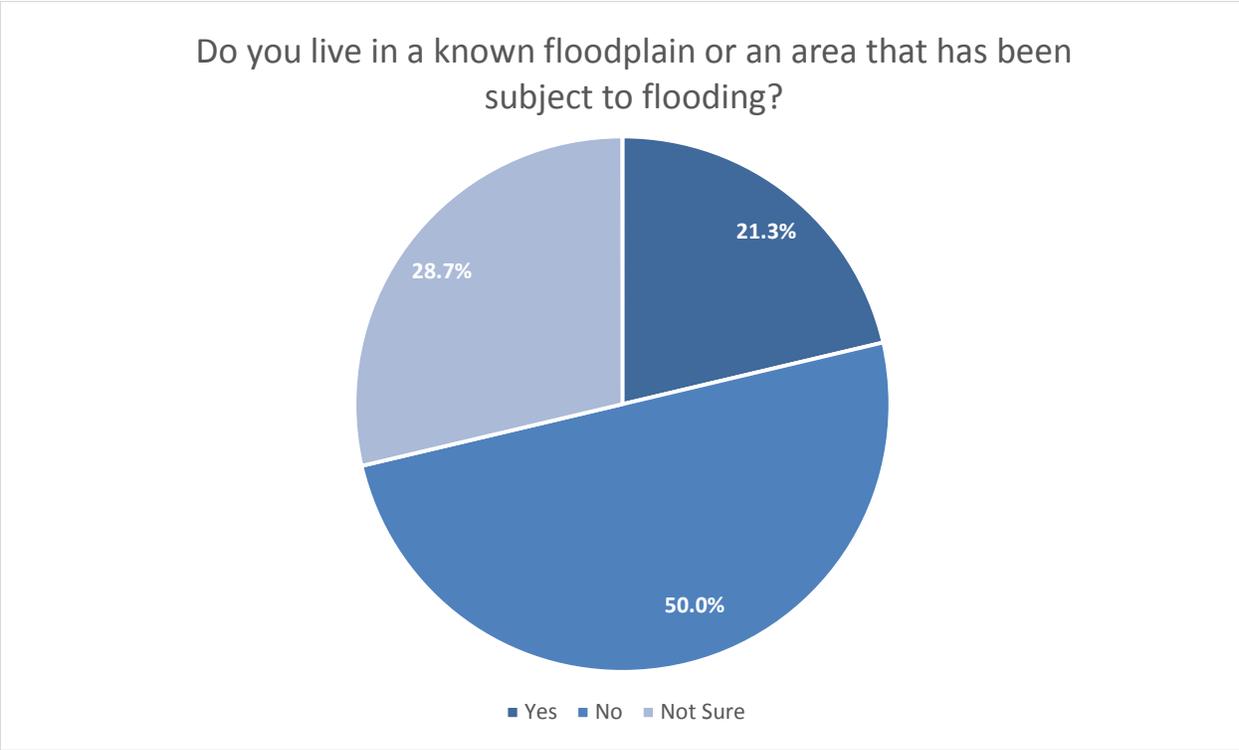
What is your zip code?			
Answer Options	Response Average	Response Total	Response Count
Zip Code	N/A	N/A	128
<i>answered question</i>			128
<i>skipped question</i>			8

ZIP Code	Number of Respondents	Percent of Total	ZIP Code	Number of Respondents	Percent of Total
90005	1	1.56%	91301	7	10.94%
90022	1	1.56%	91302	2	3.13%
90027	1	1.56%	91304	1	1.56%
90034	1	1.56%	91324	3	4.69%
90046	1	1.56%	91364	1	1.56%
90069	1	1.56%	91387	2	3.13%
90230	1	1.56%	91390	4	6.25%
90245	1	1.56%	91501	1	1.56%
90265	1	1.56%	91702	1	1.56%
90270	1	1.56%	91724	1	1.56%
90272	1	1.56%	91745	1	1.56%
90275	1	1.56%	91754	2	3.13%
90501	1	1.56%	91765	2	3.13%
90504	1	1.56%	91780	1	1.56%
90604	1	1.56%	91784	1	1.56%
90606	2	3.13%	91789	2	3.13%
90650	1	1.56%	91791	2	3.13%
90731	1	1.56%	91801	1	1.56%
90815	2	3.13%	91803	1	1.56%
90909	1	1.56%	92503	1	1.56%
91001	9	14.06%	92647	1	1.56%
91006	2	3.13%	93455	1	1.56%
91016	1	1.56%	93510	4	6.25%
91020	1	1.56%	93535	3	4.69%
91030	2	3.13%	93536	3	4.69%
91040	1	1.56%	93544	20	31.25%
91101	1	1.56%	93551	1	1.56%
91103	1	1.56%	93552	1	1.56%
91104	4	6.25%	93553	1	1.56%
91107	2	3.13%	93560	1	1.56%
91206	1	1.56%	93591	6	9.38%
91208	1	1.56%	93644	1	1.56%

Question 3

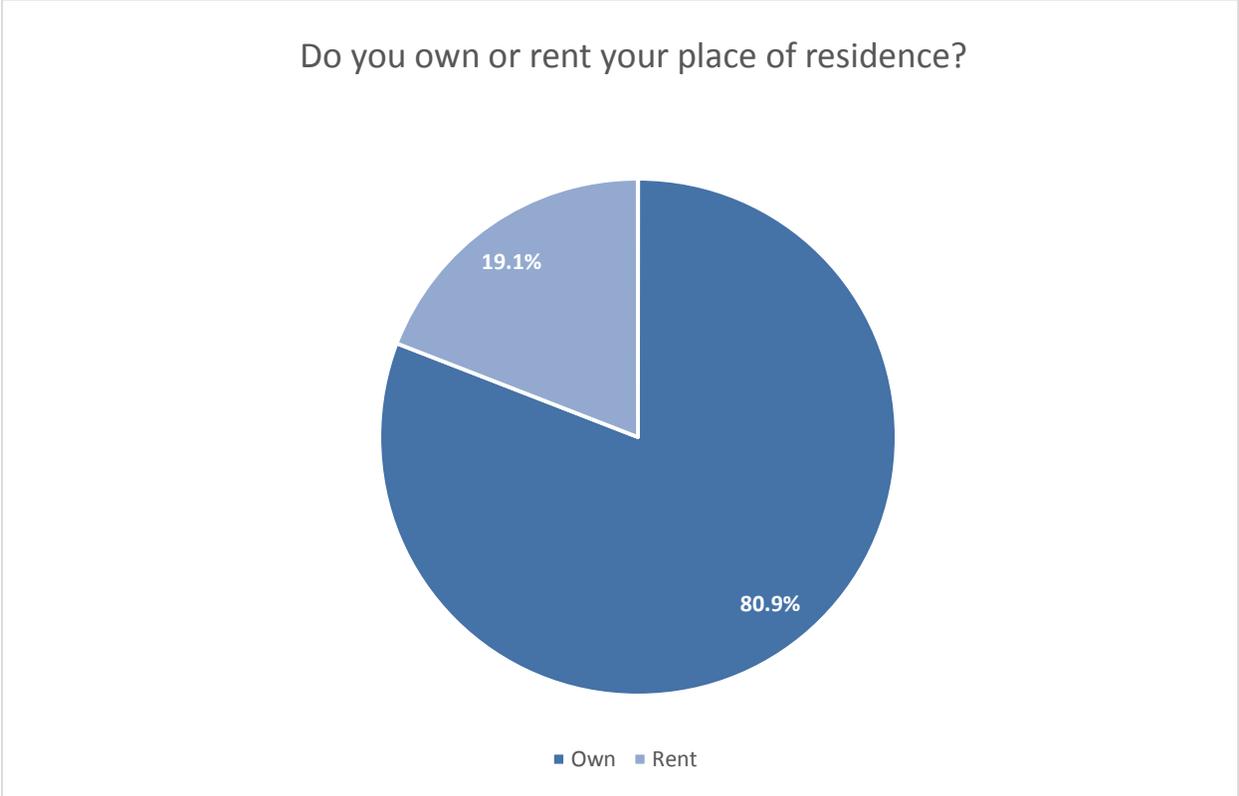
Do you live in a known floodplain or an area that has been subject to flooding?		
Answer Options	Response Percent	Response Count
Yes	21.3%	29
No	50.0%	68
Not Sure	28.7%	39
Please describe any experiences you have had with flooding at your current residence:		63
answered question		136
skipped question		0

Note: Responses above are based on respondents’ personal knowledge and perception. In contrast, based on geo-located addresses, 10.8 percent of respondents live in a known floodplain. 34.5 percent of respondents who indicated “yes” correctly identified themselves as living in the floodplain. The other 65.5 percent were either incorrect, did not provide their addresses, live in addresses that could not be geo-located or live in areas that are not mapped floodplains. Only 1.5 percent of respondents who indicated “no” incorrectly identified themselves as not living in the floodplain. All respondents who selected “not sure” either do not live in the floodplain or had addresses that could not be geo-located for confirmation. 72 percent of respondents provided addresses that could be geo-located to confirm location in relation to the mapped floodplain.



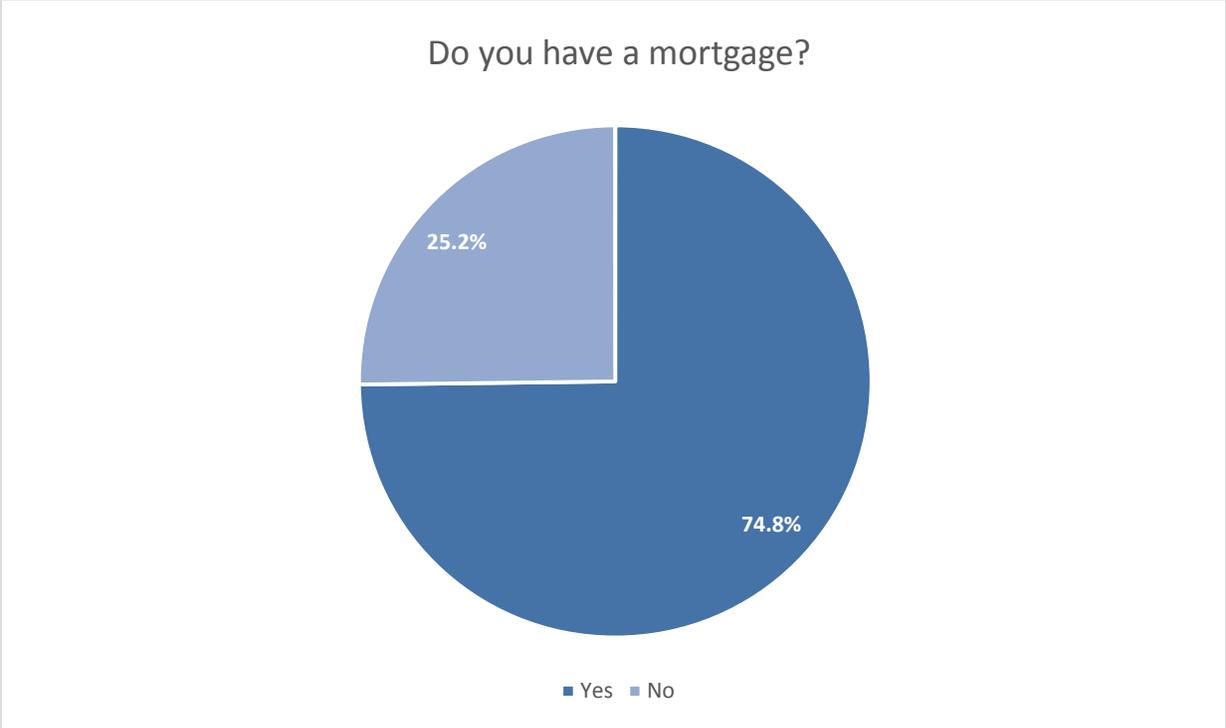
Question 4

Do you own or rent your place of residence?		
Answer Options	Response Percent	Response Count
Own	80.9%	110
Rent	19.1%	26
answered question		136
skipped question		0



Question 5

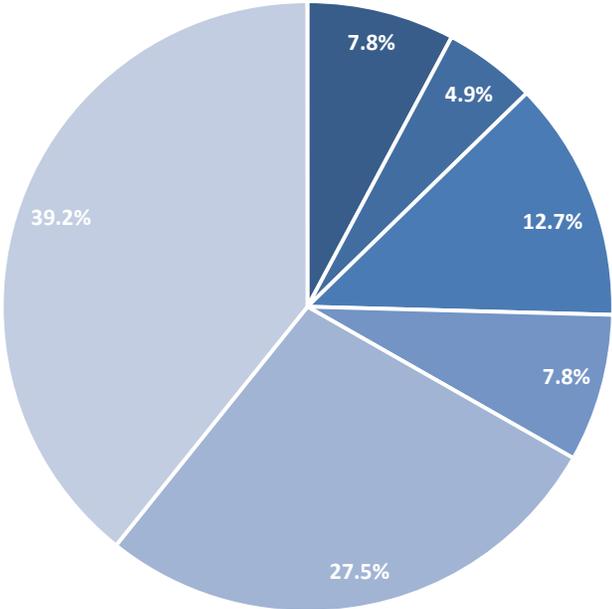
Do you have a mortgage?		
Answer Options	Response Percent	Response Count
Yes	74.8%	80
No	25.2%	27
answered question		107
skipped question		29



Question 6

How much money would you be willing to spend to retrofit your home to reduce risks associated with flood disasters? (e.g., elevating a home above flood level, flood-proofing, building berms or floodwalls)		
Answer Options	Response Percent	Response Count
\$10,000 or above	7.8%	8
\$5,000 to \$9,999	4.9%	5
\$1,000 to \$4,999	12.7%	13
Less than \$1,000	7.8%	8
Nothing	27.5%	28
Not Sure	39.2%	40
answered question		102
skipped question		34

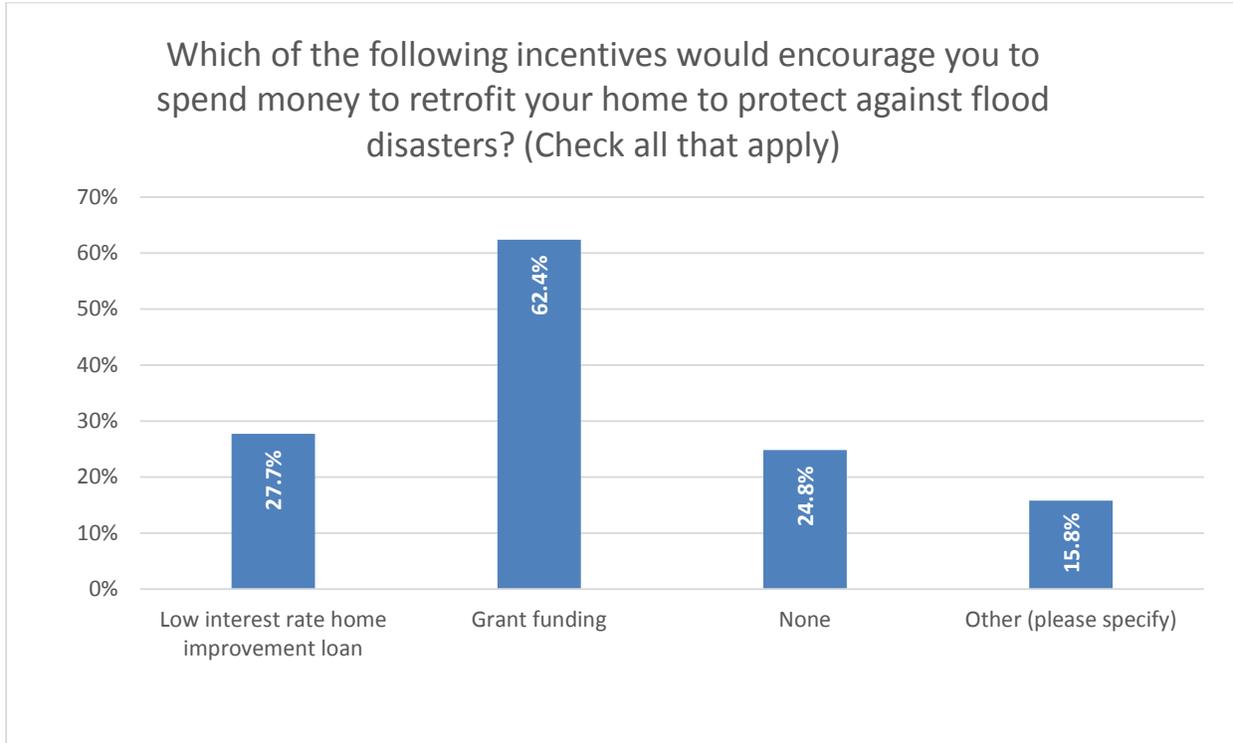
How much money would you be willing to spend to retrofit your home to reduce risks associated with flood disasters? (e.g., elevating a home above flood level, flood-proofing, building berms or floodwalls)



■ \$10,000 or above ■ \$5,000 to \$9,999 ■ \$1,000 to \$4,999 ■ Less than \$1,000 ■ Nothing ■ Not Sure

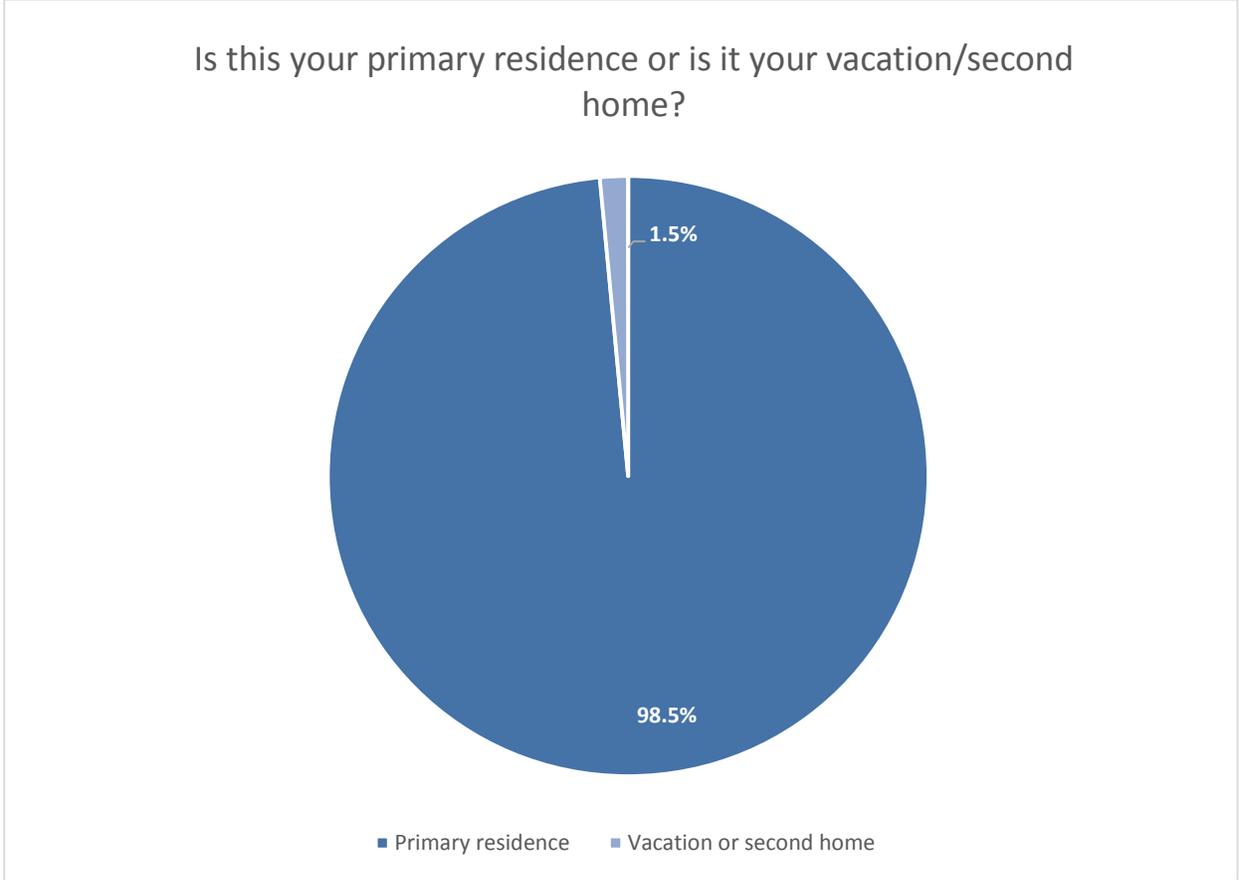
Question 7

Which of the following incentives would encourage you to spend money to retrofit your home to protect against flood disasters? (Check all that apply)		
Answer Options	Response Percent	Response Count
Low interest rate home improvement loan	27.7%	28
Grant funding	62.4%	63
None	24.8%	25
Other (please specify)	15.8%	16
answered question		101
skipped question		35



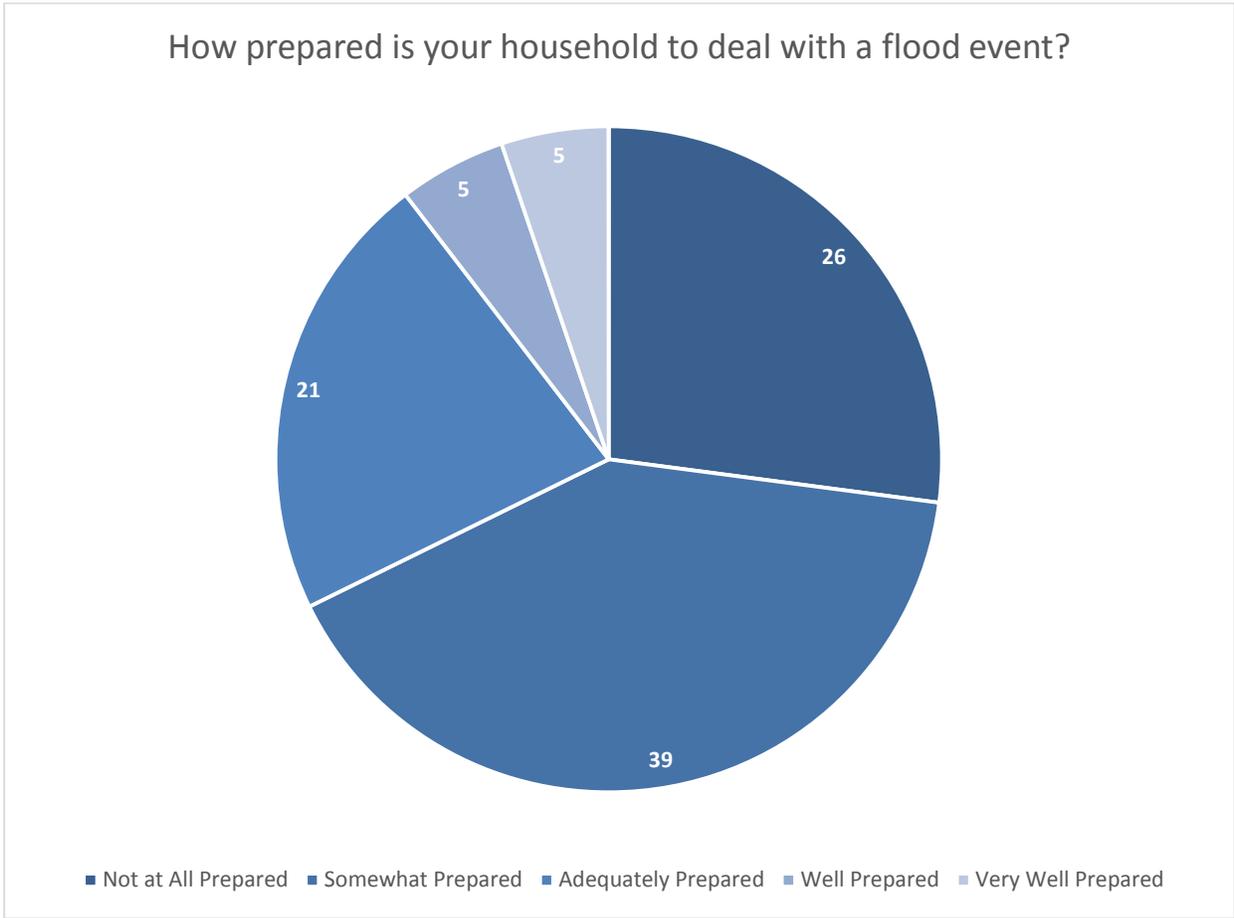
Question 8

Is this your primary residence or is it your vacation/second home?		
Answer Options	Response Percent	Response Count
Primary residence	98.5%	131
Vacation or second home	1.5%	2
answered question		133
skipped question		3



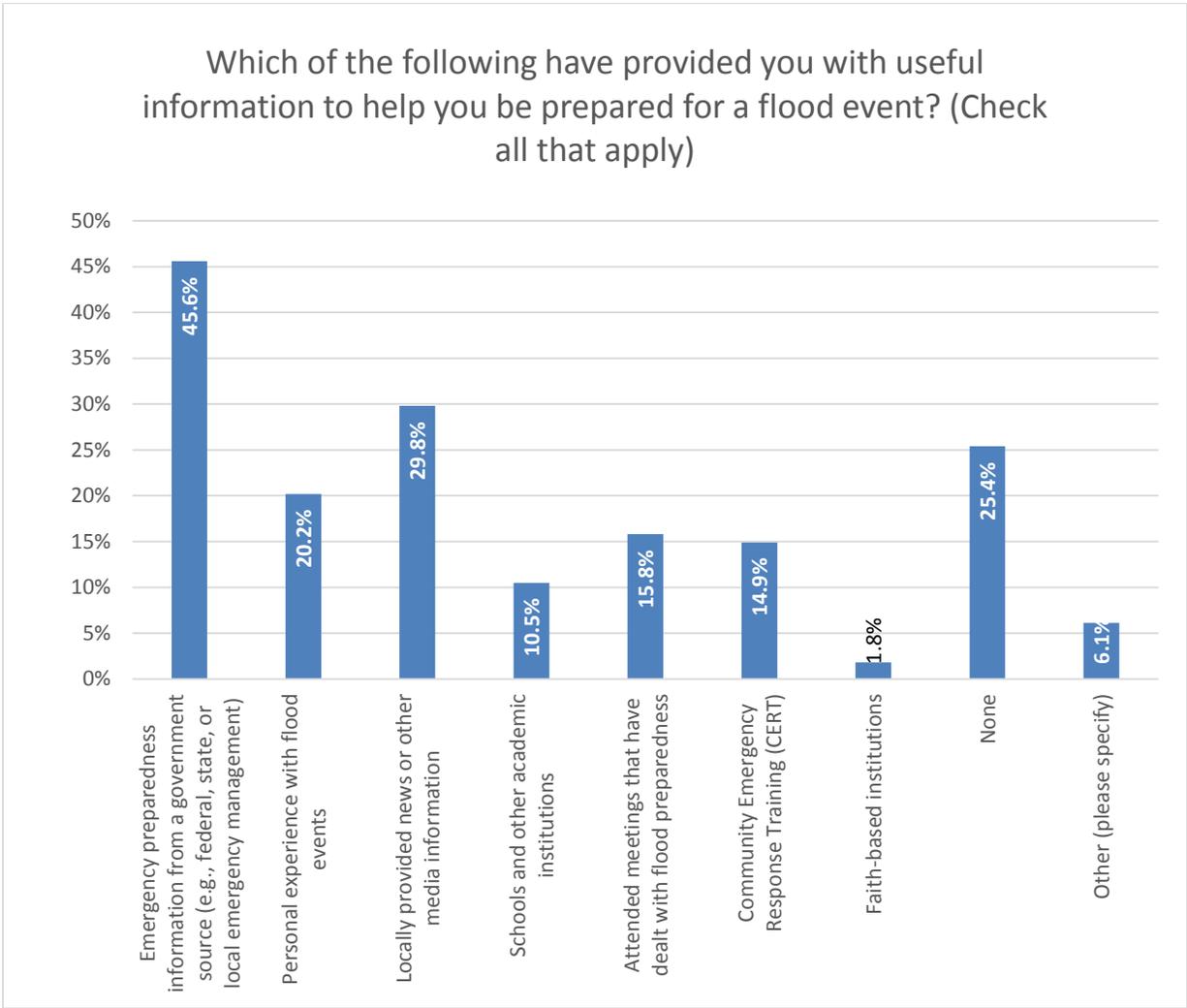
Question 9

How prepared is your household to deal with a flood event?							
Answer Options	Not at All Prepared	Somewhat Prepared	Adequately Prepared	Well Prepared	Very Well Prepared	Rating Average	Response Count
Check one (Count):	26	39	21	5	5	2.21	96
Percent:	27%	41%	22%	5%	5%		
answered question							96
skipped question							40



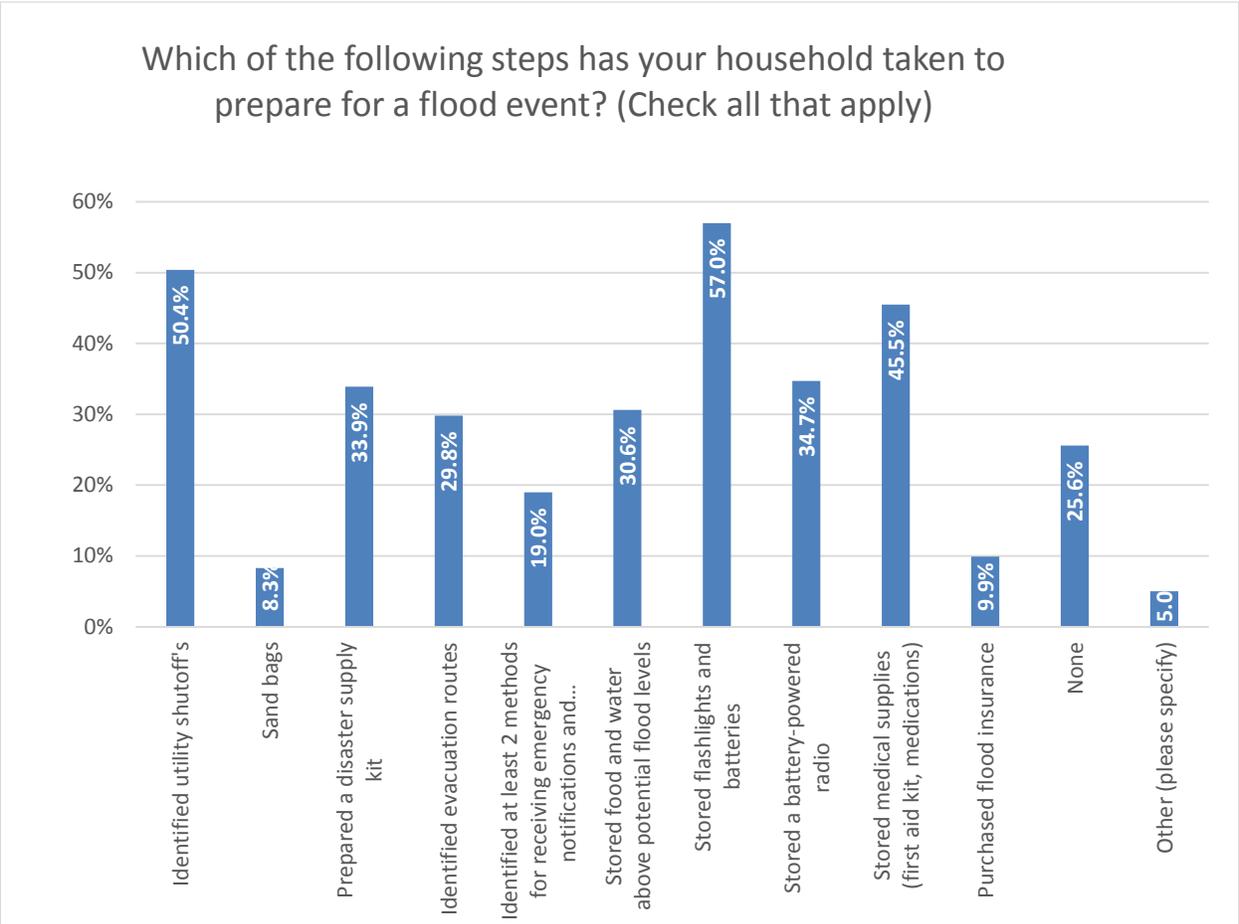
Question 10

Which of the following have provided you with useful information to help you be prepared for a flood event? (Check all that apply)		
Answer Options	Response Percent	Response Count
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	45.6%	52
Personal experience with flood events	20.2%	23
Locally provided news or other media information	29.8%	34
Schools and other academic institutions	10.5%	12
Attended meetings that have dealt with flood preparedness	15.8%	18
Community Emergency Response Training (CERT)	14.9%	17
Faith-based institutions	1.8%	2
None	25.4%	29
Other (please specify)	6.1%	7
answered question		114
skipped question		22



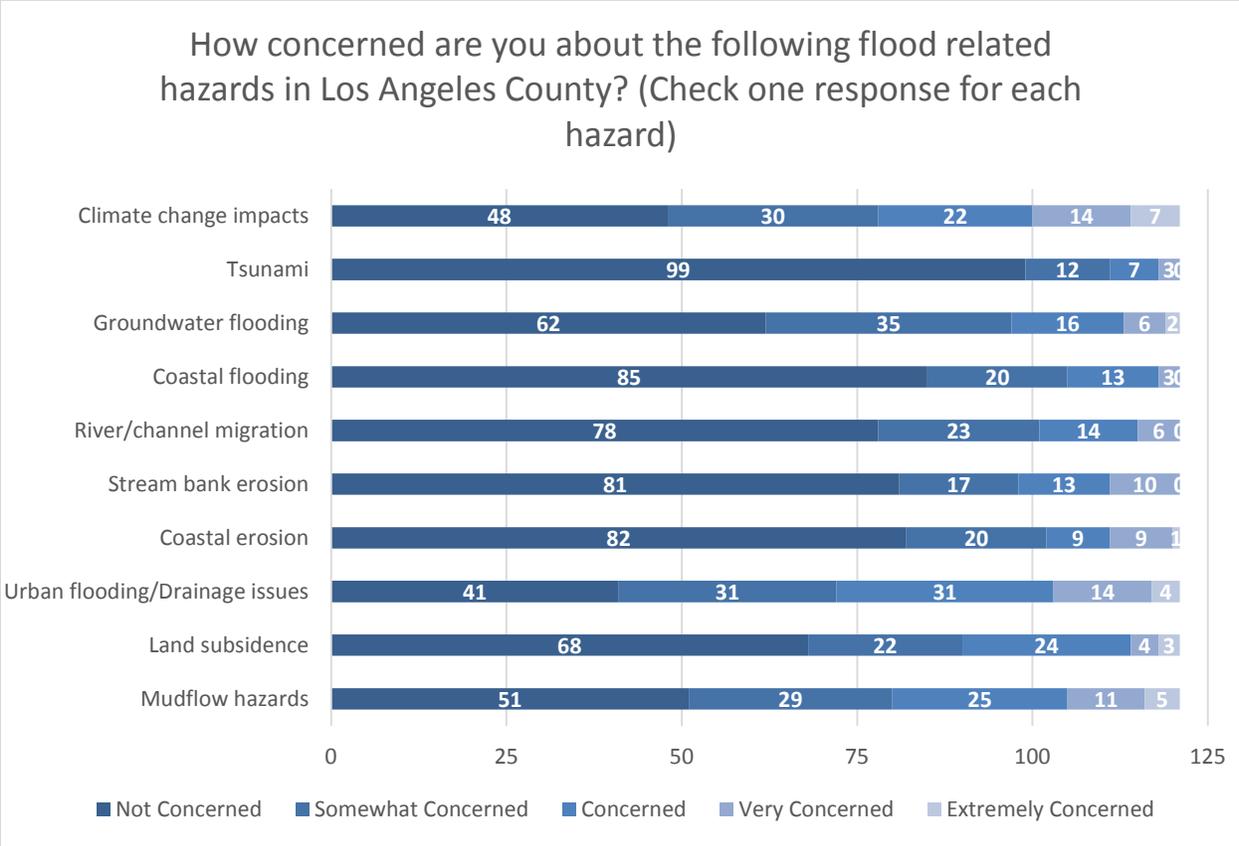
Question 11

Which of the following steps has your household taken to prepare for a flood event? (Check all that apply)		
Answer Options	Response Percent	Response Count
Identified utility shutoff's	50.4%	61
Sand bags	8.3%	10
Prepared a disaster supply kit	33.9%	41
Identified evacuation routes	29.8%	36
Identified at least 2 methods for receiving emergency notifications and information during emergencies	19.0%	23
Stored food and water above potential flood levels	30.6%	37
Stored flashlights and batteries	57.0%	69
Stored a battery-powered radio	34.7%	42
Stored medical supplies (first aid kit, medications)	45.5%	55
Purchased flood insurance	9.9%	12
None	25.6%	31
Other (please specify)	5.0%	6
answered question		121
skipped question		15



Question 12

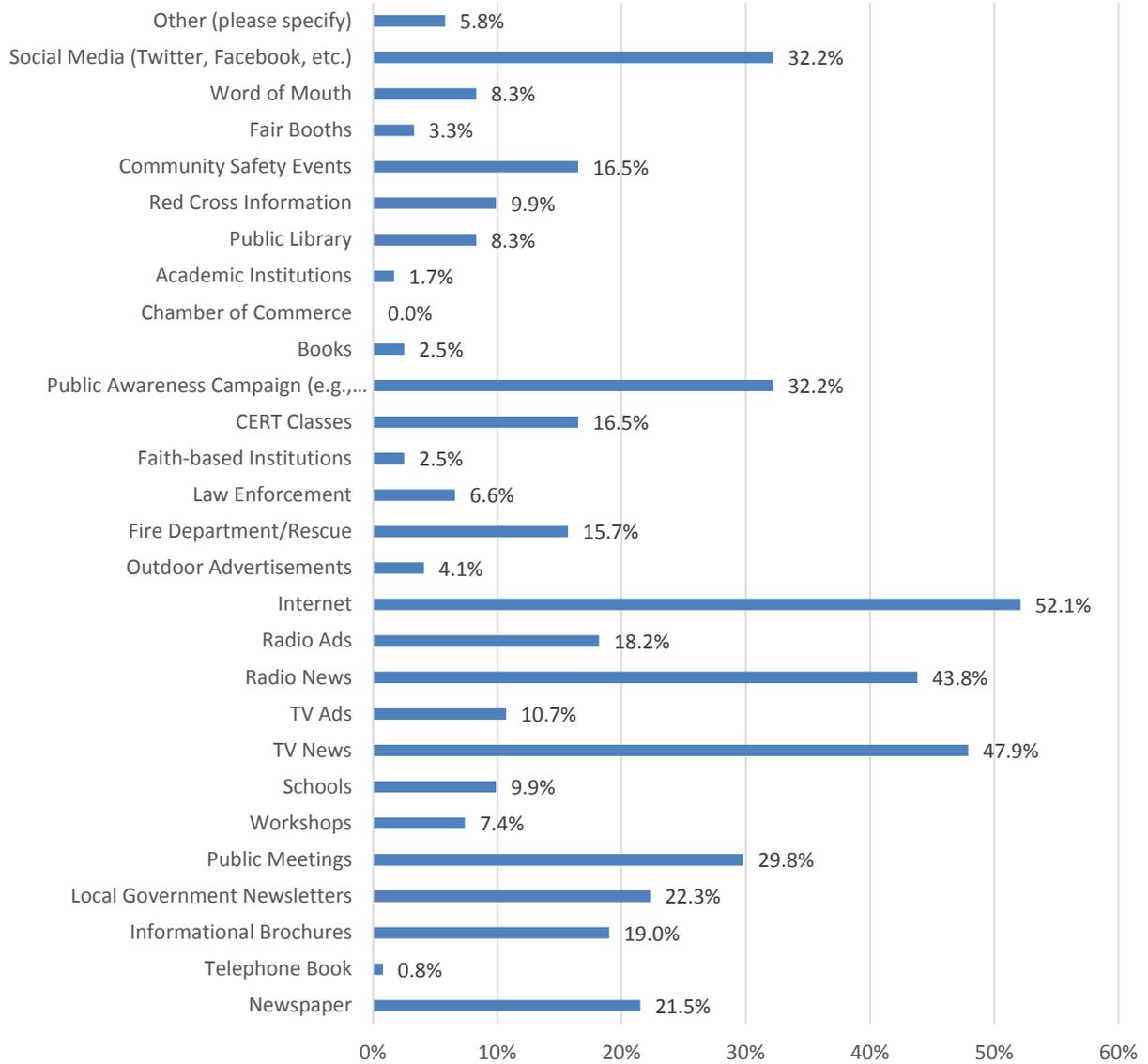
How concerned are you about the following flood related hazards in Los Angeles County? (Check one response for each hazard)							
Answer Options	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	Rating Average	Response Count
Climate change impacts	48	30	22	14	7	2.19	121
Tsunami	99	12	7	3	0	1.29	121
Groundwater flooding	62	35	16	6	2	1.77	121
Coastal flooding	85	20	13	3	0	1.45	121
River/channel migration	78	23	14	6	0	1.57	121
Stream bank erosion	81	17	13	10	0	1.60	121
Coastal erosion	82	20	9	9	1	1.57	121
Urban flooding/Drainage issues	41	31	31	14	4	2.25	121
Land subsidence	68	22	24	4	3	1.78	121
Mudflow hazards	51	29	25	11	5	2.09	121
Other (Please specify other flood-related hazard and level of concern)							6
answered question							121
skipped question							15



Question 13

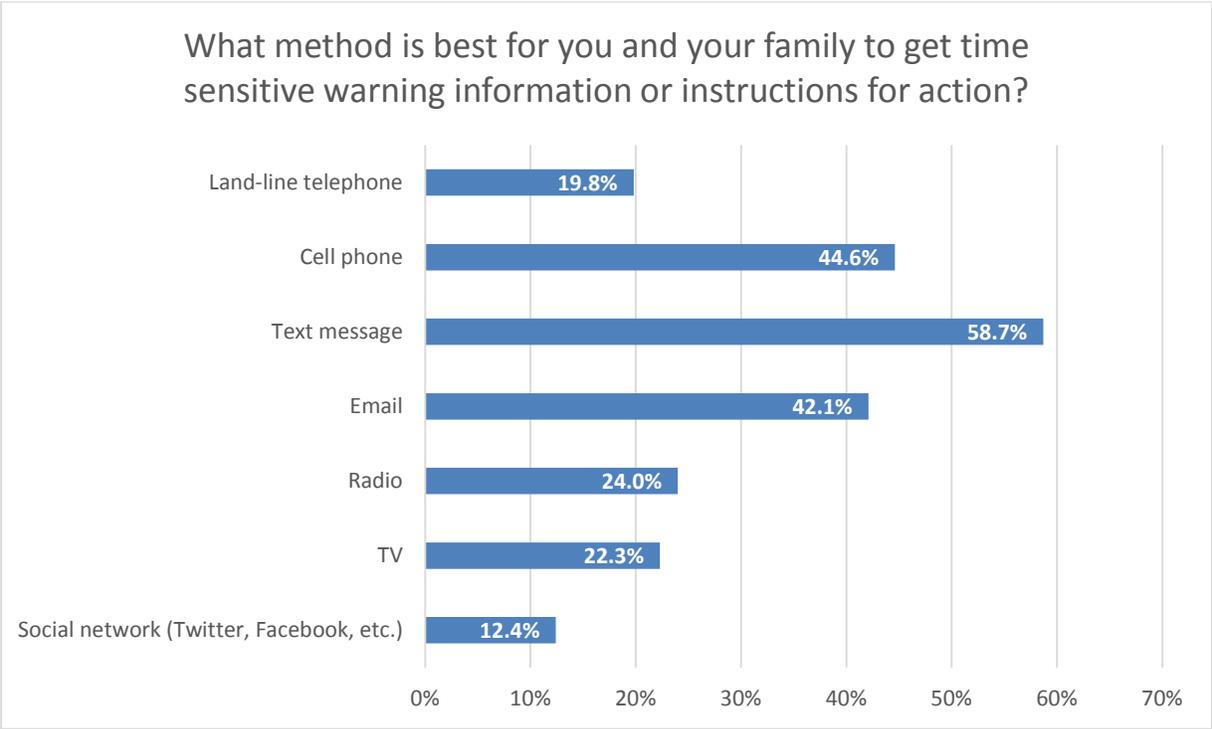
Choose five of the following methods you think are most effective for providing flood hazard and disaster information? (Choose up to 5 answers)		
Answer Options	Response Percent	Response Count
Newspaper	21.5%	26
Telephone Book	0.8%	1
Informational Brochures	19.0%	23
Local Government Newsletters	22.3%	27
Public Meetings	29.8%	36
Workshops	7.4%	9
Schools	9.9%	12
TV News	47.9%	58
TV Ads	10.7%	13
Radio News	43.8%	53
Radio Ads	18.2%	22
Internet	52.1%	63
Outdoor Advertisements	4.1%	5
Fire Department/Rescue	15.7%	19
Law Enforcement	6.6%	8
Faith-based Institutions	2.5%	3
CERT Classes	16.5%	20
Public Awareness Campaign (e.g., Flood Awareness Week, Winter Storm Preparedness Month)	32.2%	39
Books	2.5%	3
Chamber of Commerce	0.0%	0
Academic Institutions	1.7%	2
Public Library	8.3%	10
Red Cross Information	9.9%	12
Community Safety Events	16.5%	20
Fair Booths	3.3%	4
Word of Mouth	8.3%	10
Social Media (Twitter, Facebook, etc.)	32.2%	39
Other (please specify)	5.8%	7
	answered question	121
	skipped question	15

Choose five of the following methods you think are most effective for providing flood hazard and disaster information? (Choose up to 5 answers)



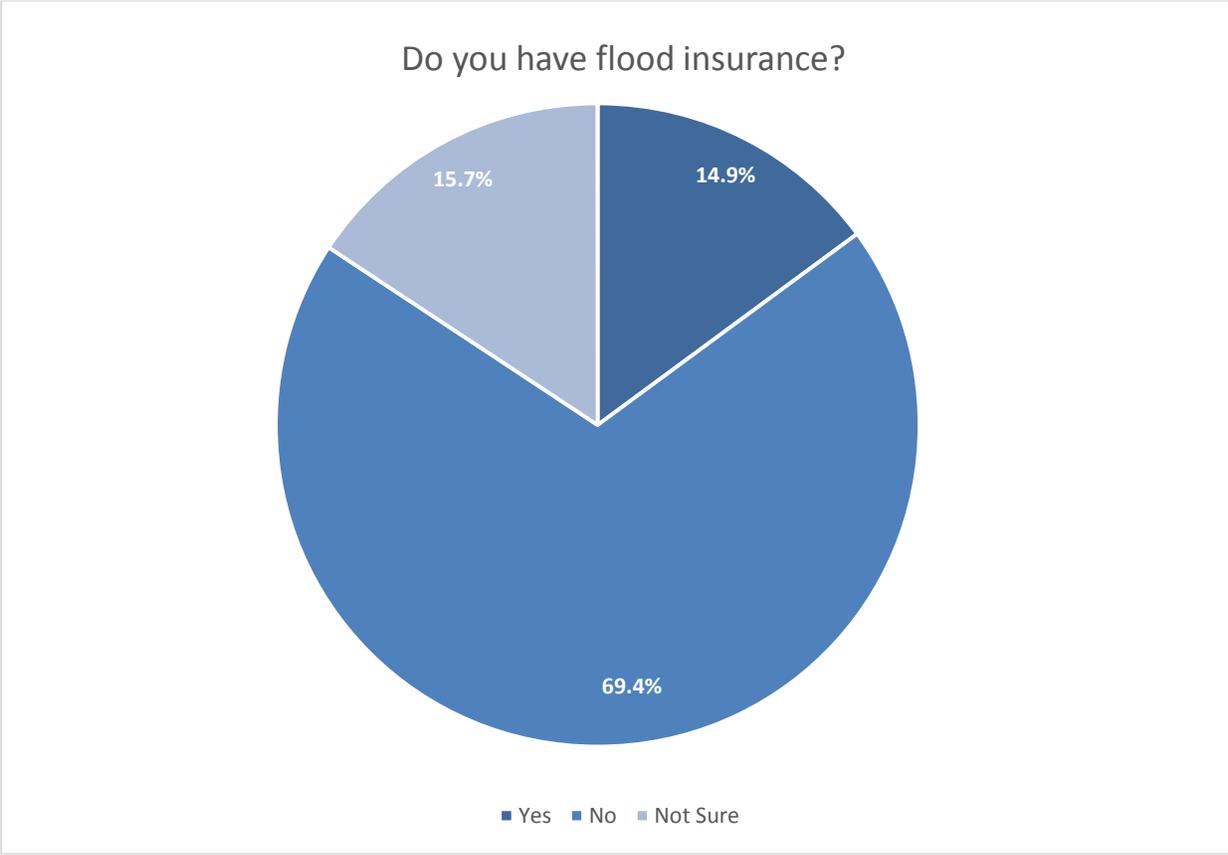
Question 14

What method is best for you and your family to get time sensitive warning information or instructions for action?		
Answer Options	Response Percent	Response Count
Land-line telephone	19.8%	24
Cell phone	44.6%	54
Text message	58.7%	71
Email	42.1%	51
Radio	24.0%	29
TV	22.3%	27
Social network (Twitter, Facebook, etc.)	12.4%	15
Other (please specify)		4
answered question		121
skipped question		15



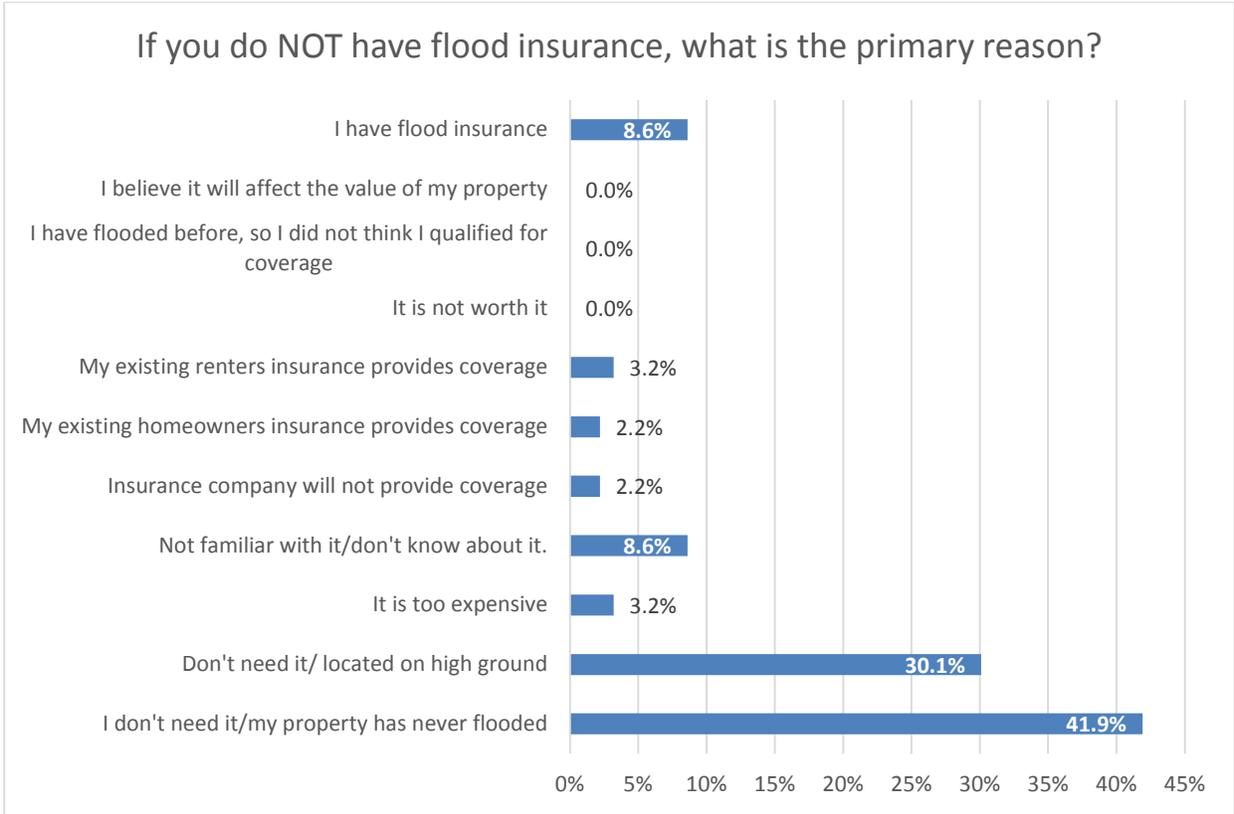
Question 15

Do you have flood insurance?		
Answer Options	Response Percent	Response Count
Yes	14.9%	18
No	69.4%	84
Not Sure	15.7%	19
answered question		121
skipped question		15



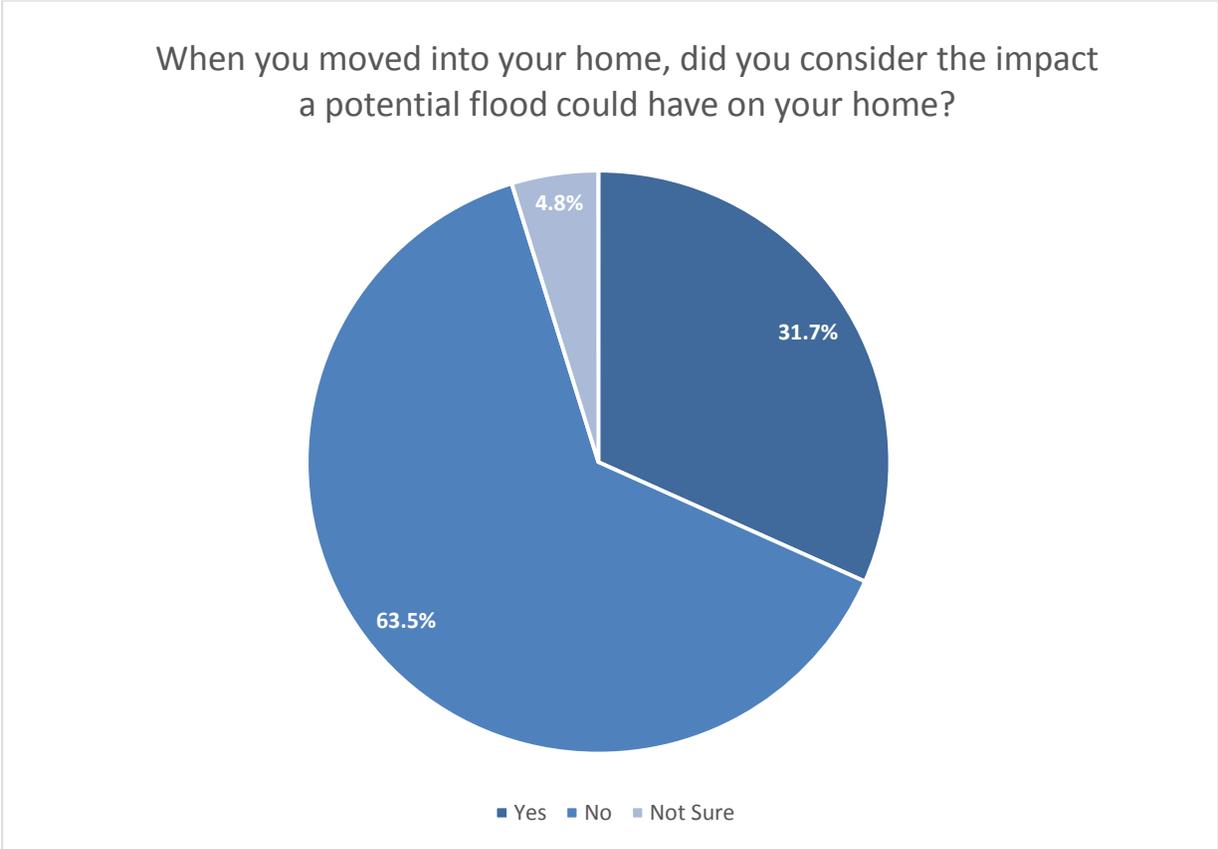
Question 16

If you do NOT have flood insurance, what is the primary reason?		
Answer Options	Response Percent	Response Count
I don't need it/my property has never flooded	41.9%	39
Don't need it/ located on high ground	30.1%	28
It is too expensive	3.2%	3
Not familiar with it/don't know about it.	8.6%	8
Insurance company will not provide coverage	2.2%	2
My existing homeowners insurance provides coverage	2.2%	2
My existing renters insurance provides coverage	3.2%	3
It is not worth it	0.0%	0
I have flooded before, so I did not think I qualified for coverage	0.0%	0
I believe it will affect the value of my property	0.0%	0
I have flood insurance	8.6%	8
Other (please specify)		7
answered question		93
skipped question		43



Question 17

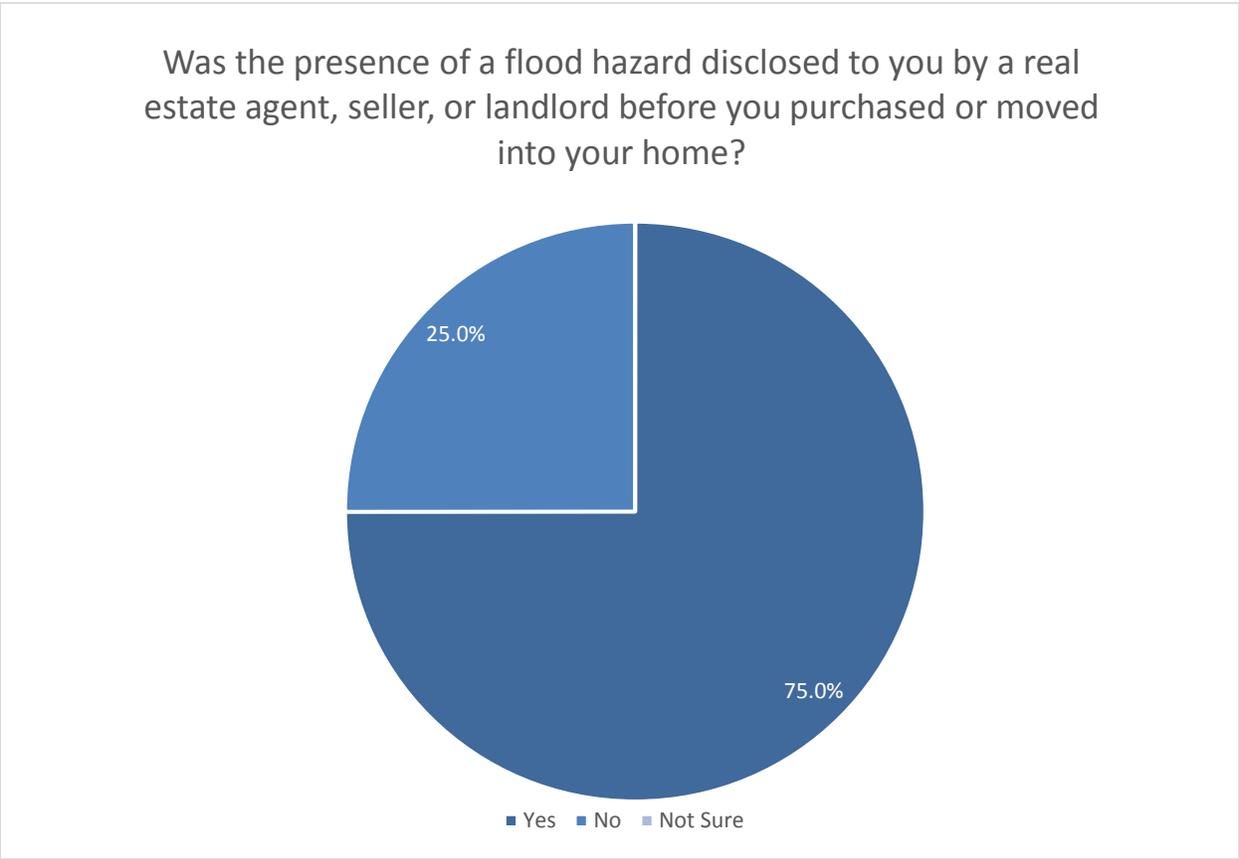
When you moved into your home, did you consider the impact a potential flood could have on your home?		
Answer Options	Response Percent	Response Count
Yes	31.7%	33
No	63.5%	66
Not Sure	4.8%	5
answered question		104
skipped question		32



Question 18

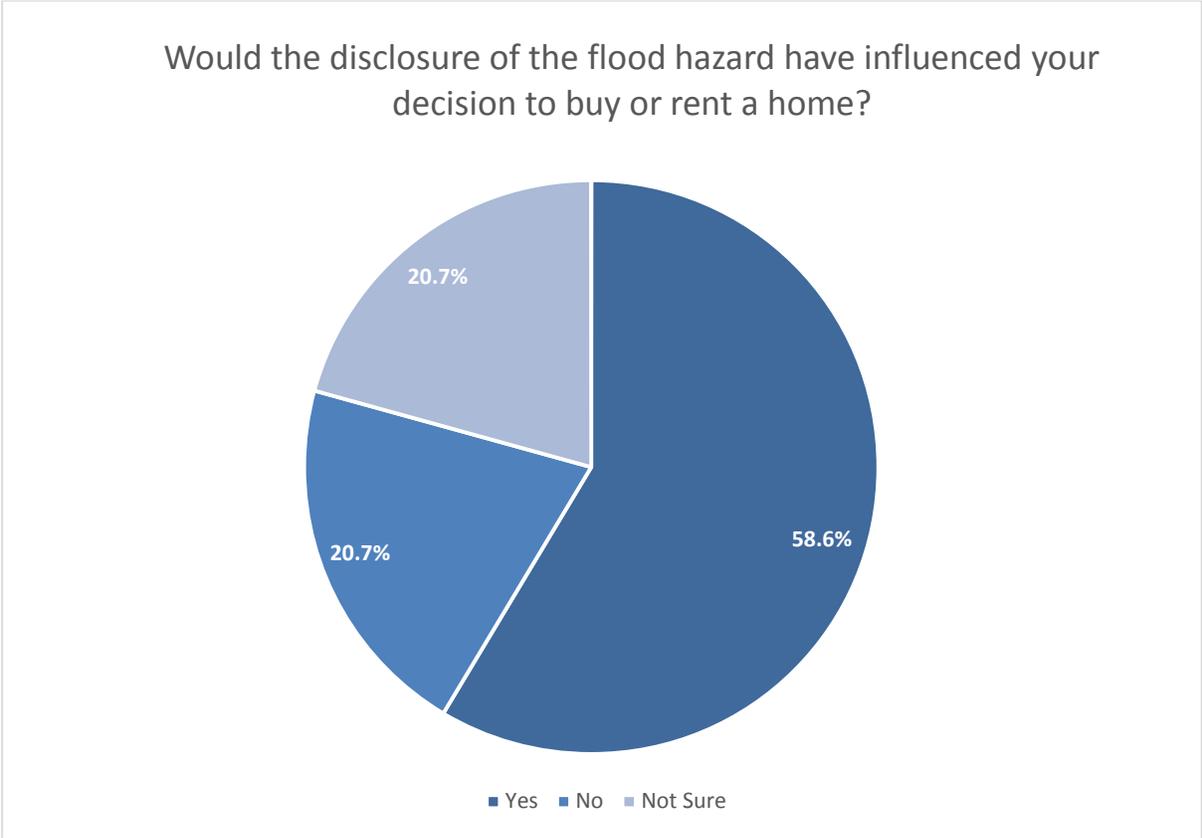
Was the presence of a flood hazard disclosed to you by a real estate agent, seller, or landlord before you purchased or moved into your home?		
Answer Options	Response Percent	Response Count
Yes	75.0%	6
No	25.0%	2
Not Sure	0.0%	0
answered question		8
skipped question		3

Note: Only responses from residents located in the floodplain are indicated here.



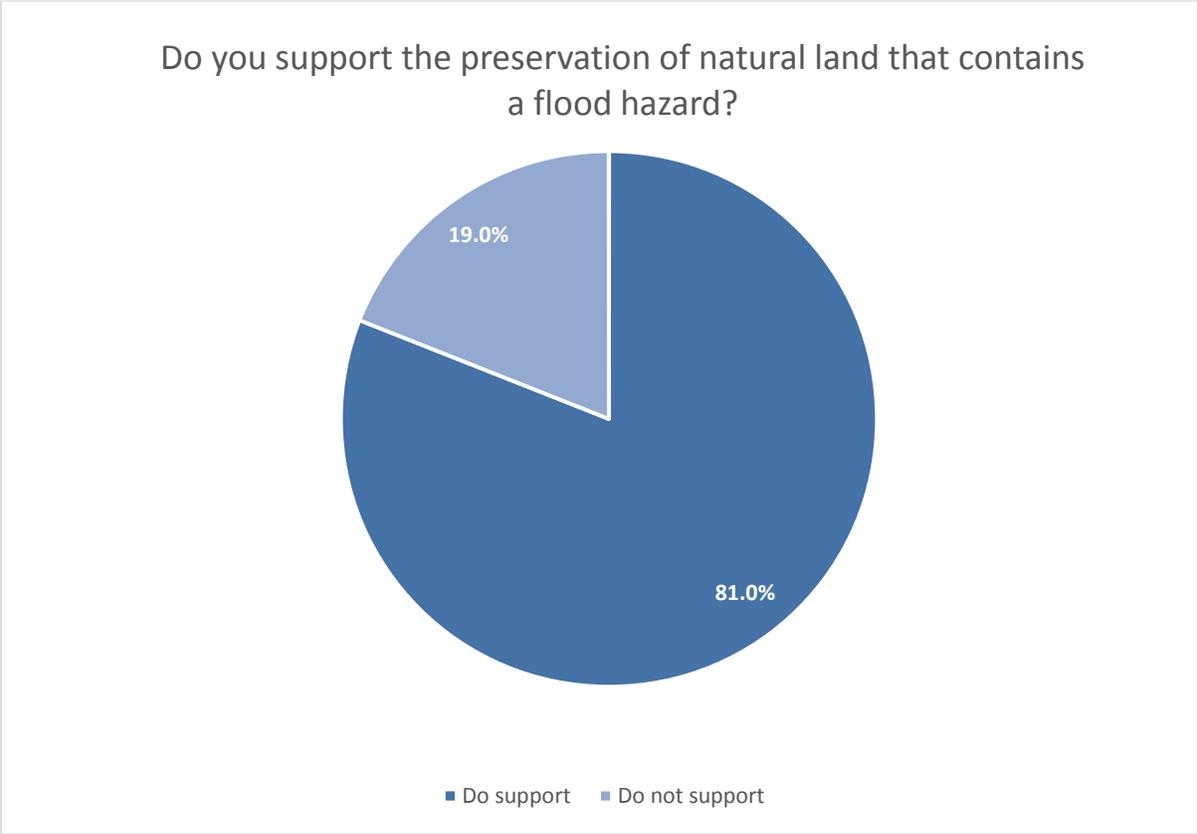
Question 19

Would the disclosure of the flood hazard have influenced your decision to buy or rent a home?		
Answer Options	Response Percent	Response Count
Yes	58.6%	65
No	20.7%	23
Not Sure	20.7%	23
answered question		111
skipped question		25



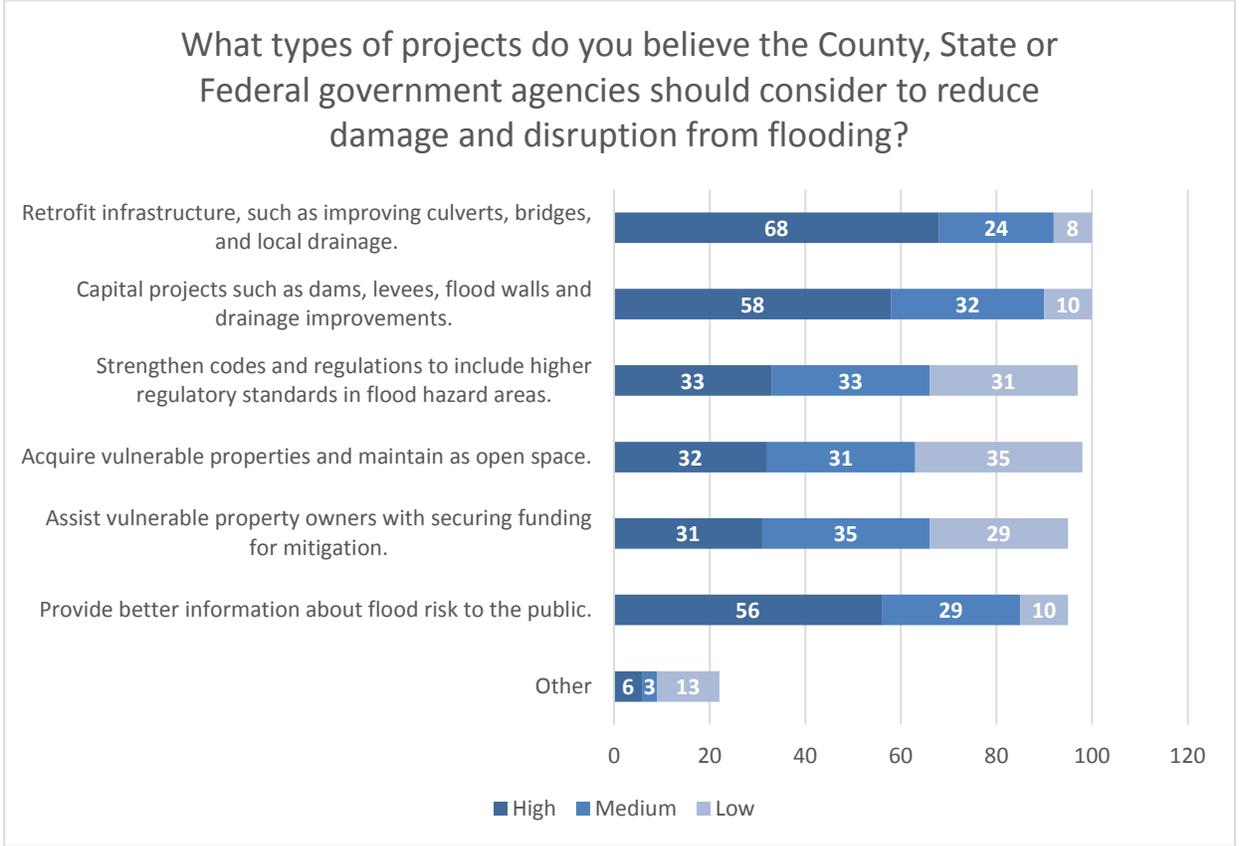
Question 20

Do you support the preservation of natural land that contains a flood hazard?		
Answer Options	Response Percent	Response Count
Do support	81.0%	81
Do not support	19.0%	19
answered question		100
skipped question		36



Question 21

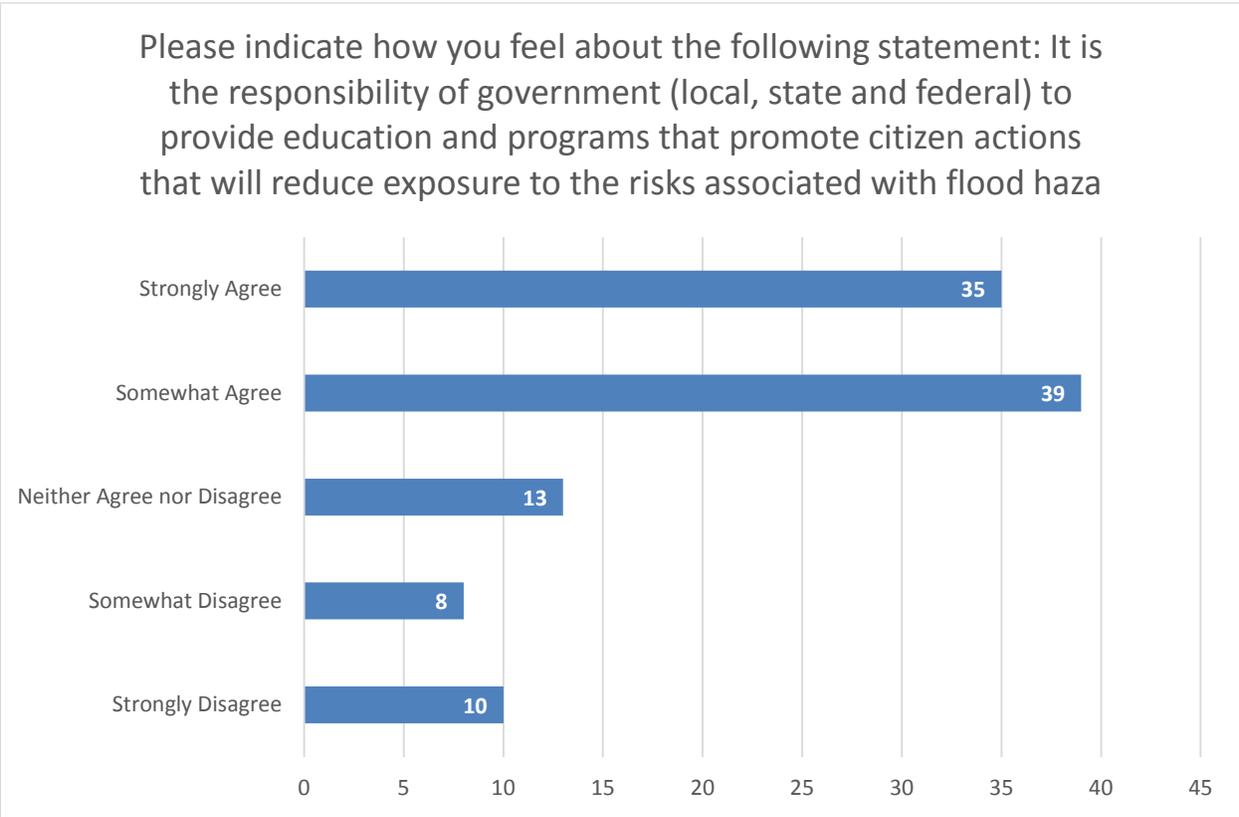
What types of projects do you believe the County, State or Federal government agencies should consider to reduce damage and disruption from flooding?					
Answer Options	High	Medium	Low	Rating Average	Response Count
Retrofit infrastructure, such as improving culverts, bridges, and local drainage.	68	24	8	1.40	100
Capital projects such as dams, levees, flood walls and drainage improvements.	58	32	10	1.52	100
Strengthen codes and regulations to include higher regulatory standards in flood hazard areas.	33	33	31	1.98	97
Acquire vulnerable properties and maintain as open space.	32	31	35	2.03	98
Assist vulnerable property owners with securing funding for mitigation.	31	35	29	1.98	95
Provide better information about flood risk to the public.	56	29	10	1.52	95
Other (please specify)	6	3	13	2.32	22
					4
answered question					103
skipped question					33



Question 22

Please indicate how you feel about the following statement: It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks associated with flood hazards.

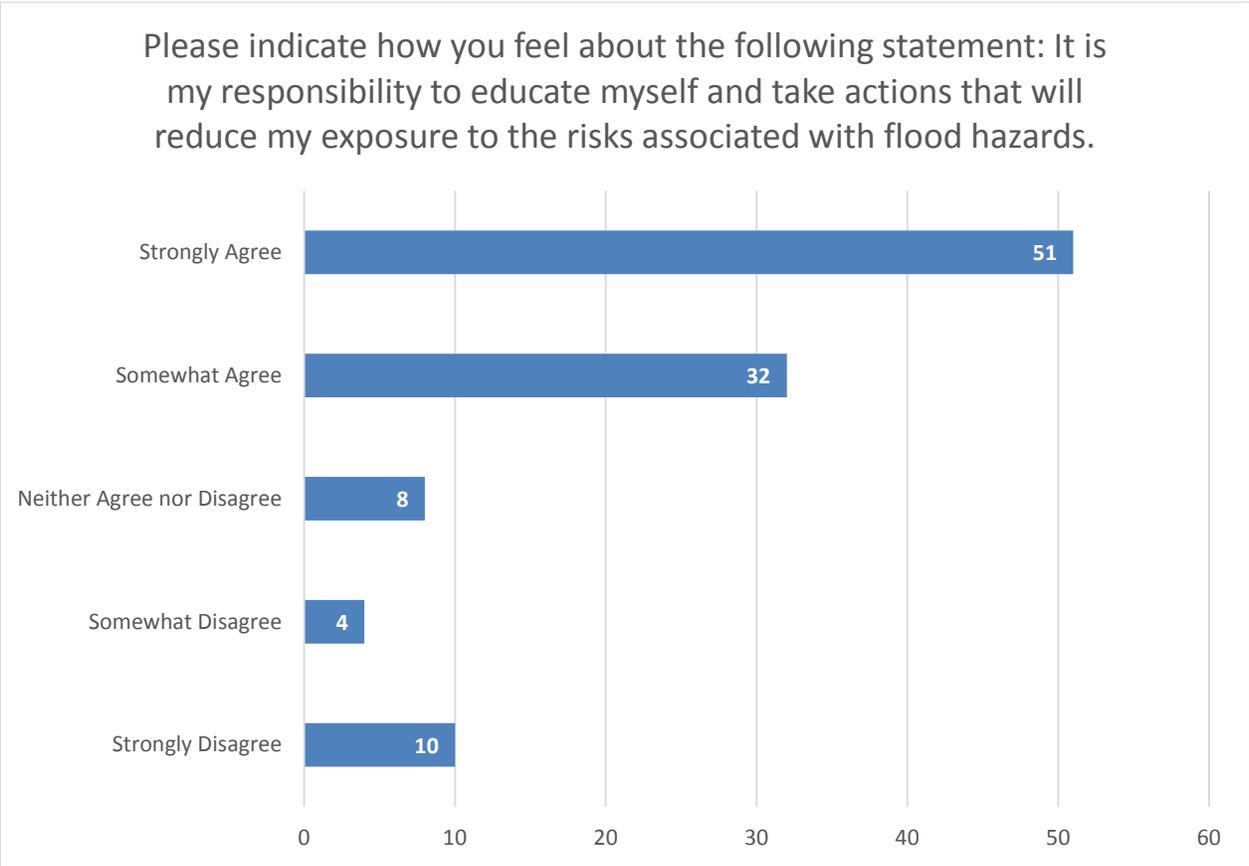
Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	10	8	13	39	35	3.77	105
	<i>answered question</i>						105
	<i>skipped question</i>						31



Question 23

Please indicate how you feel about the following statement: It is my responsibility to educate myself and take actions that will reduce my exposure to the risks associated with flood hazards.

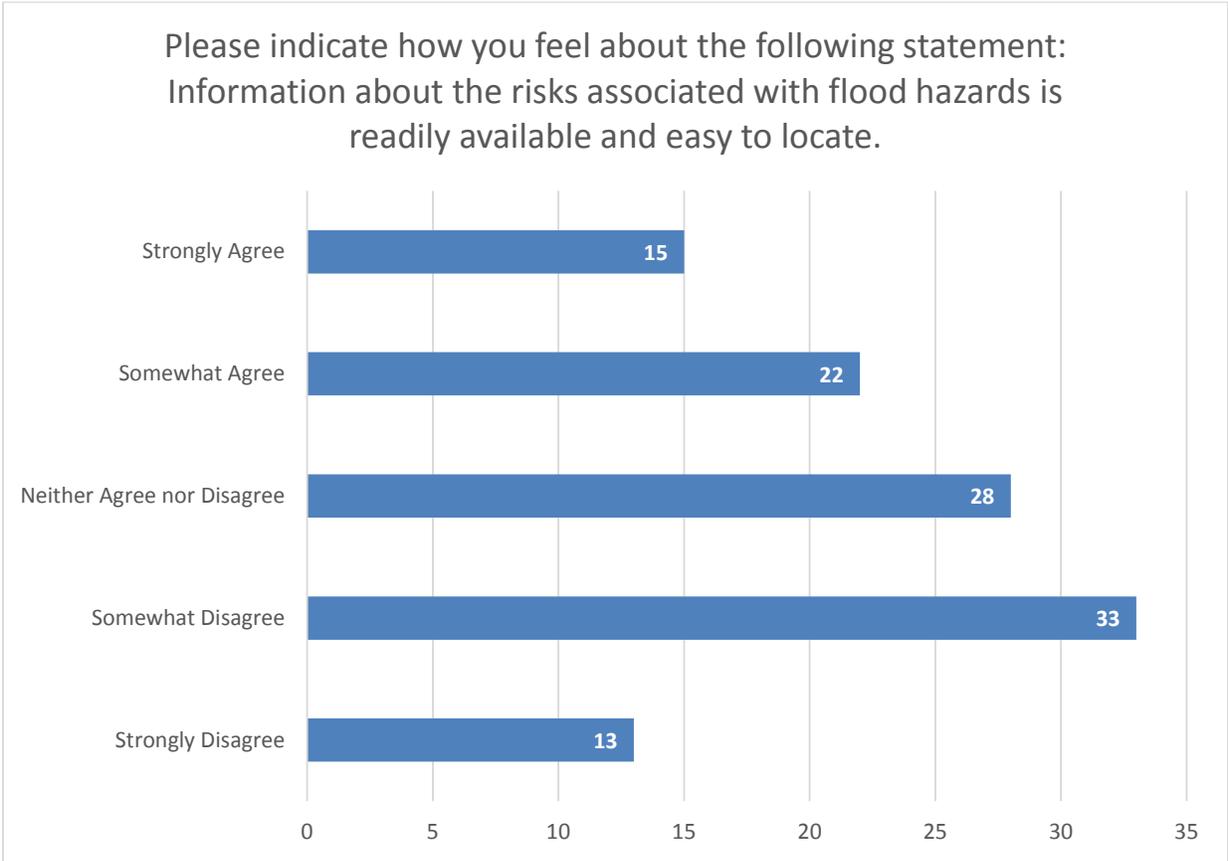
Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	10	4	8	32	51	4.05	105
	<i>answered question</i>						105
	<i>skipped question</i>						31



Question 24

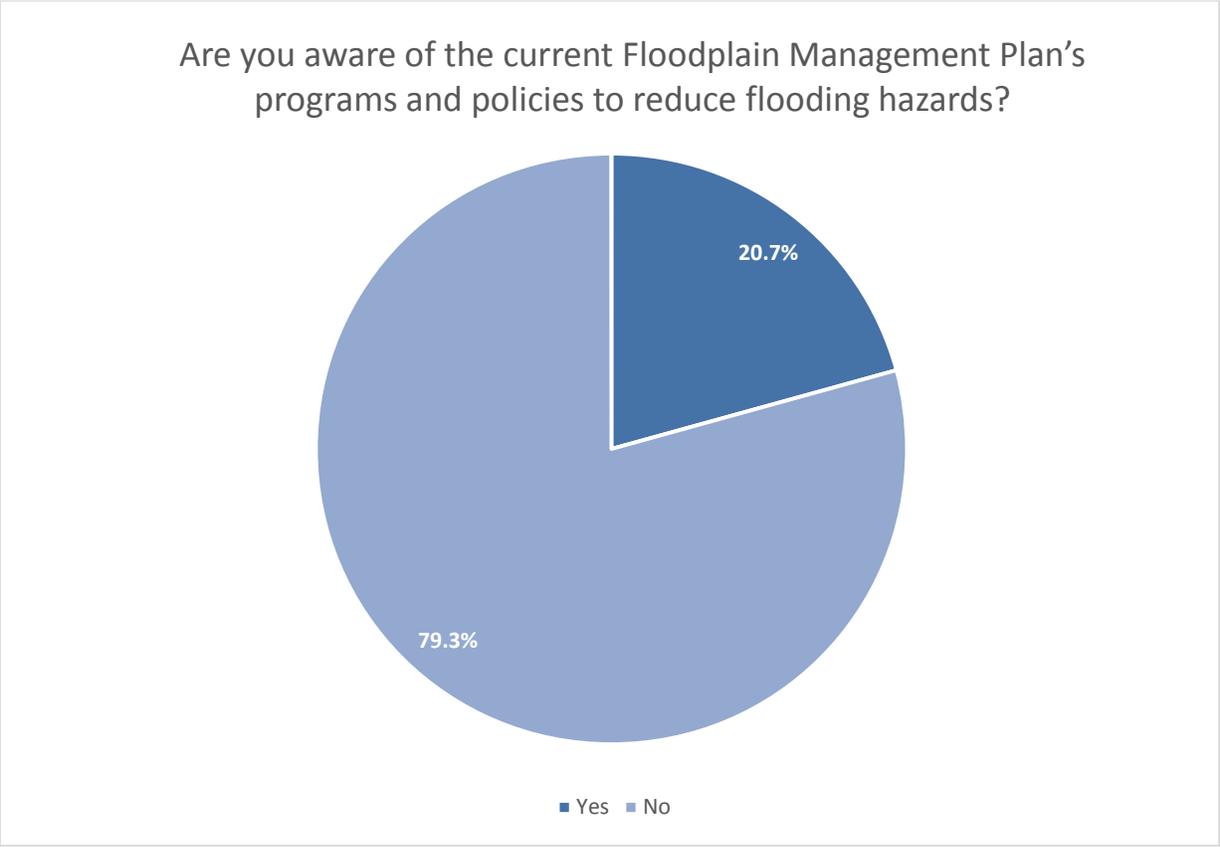
Please indicate how you feel about the following statement: Information about the risks associated with flood hazards is readily available and easy to locate.

Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	13	33	28	22	15	2.94	111
						<i>answered question</i>	111
						<i>skipped question</i>	25



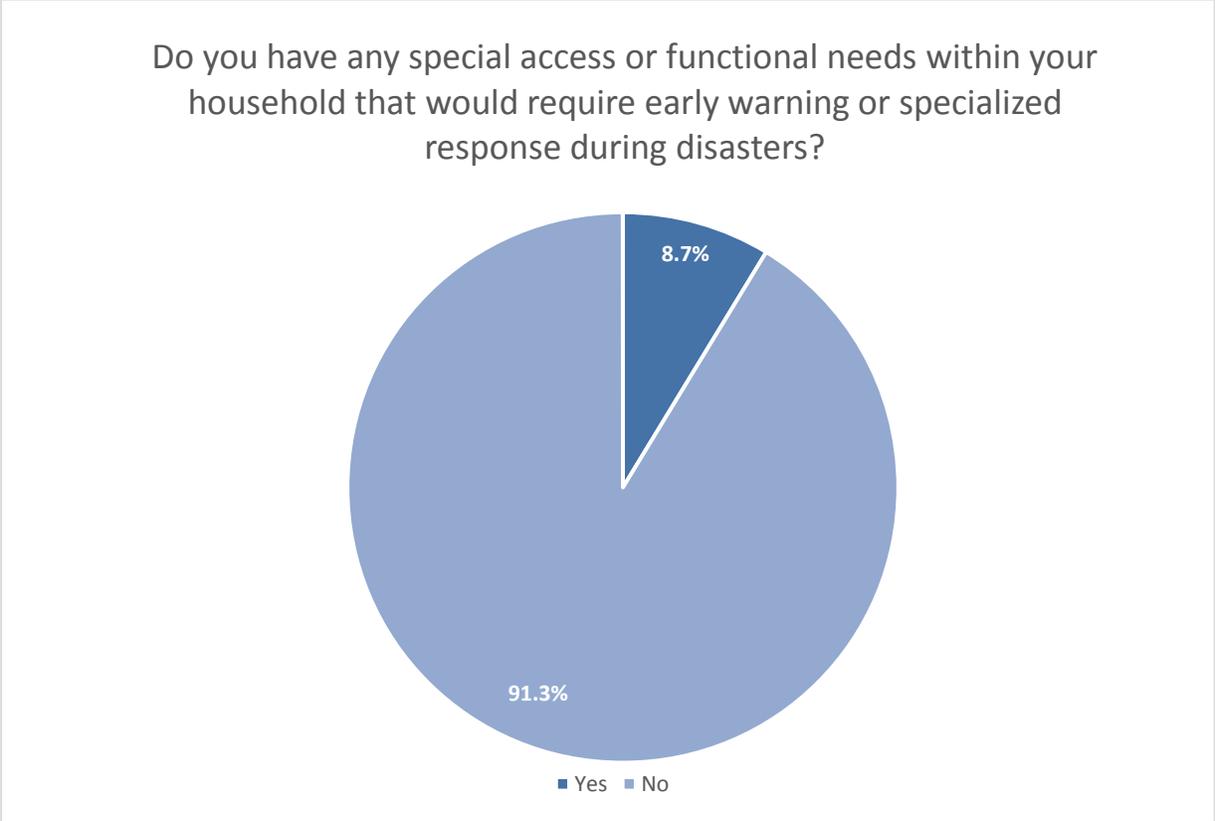
Question 25

Are you aware of the current floodplain management plan's programs and policies to reduce flooding hazards?		
Answer Options	Response Percent	Response Count
Yes	20.7%	23
No	79.3%	88
Please describe programs and policies of which you are aware		8
answered question		111
skipped question		25



Question 26

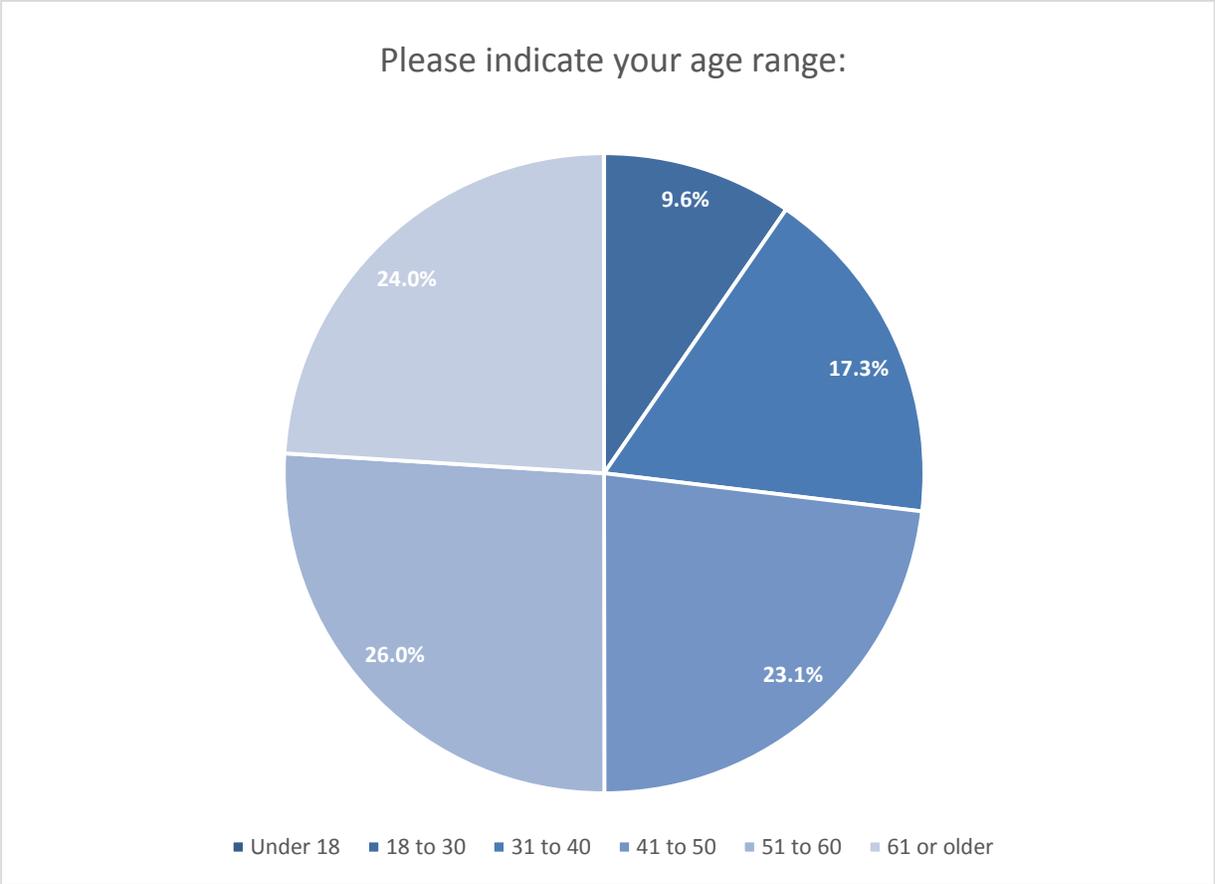
Do you have any special access or functional needs within your household that would require early warning or specialized response during disasters?		
Answer Options	Response Percent	Response Count
Yes	8.7%	9
No	91.3%	95
answered question		104
skipped question		32



Question 27

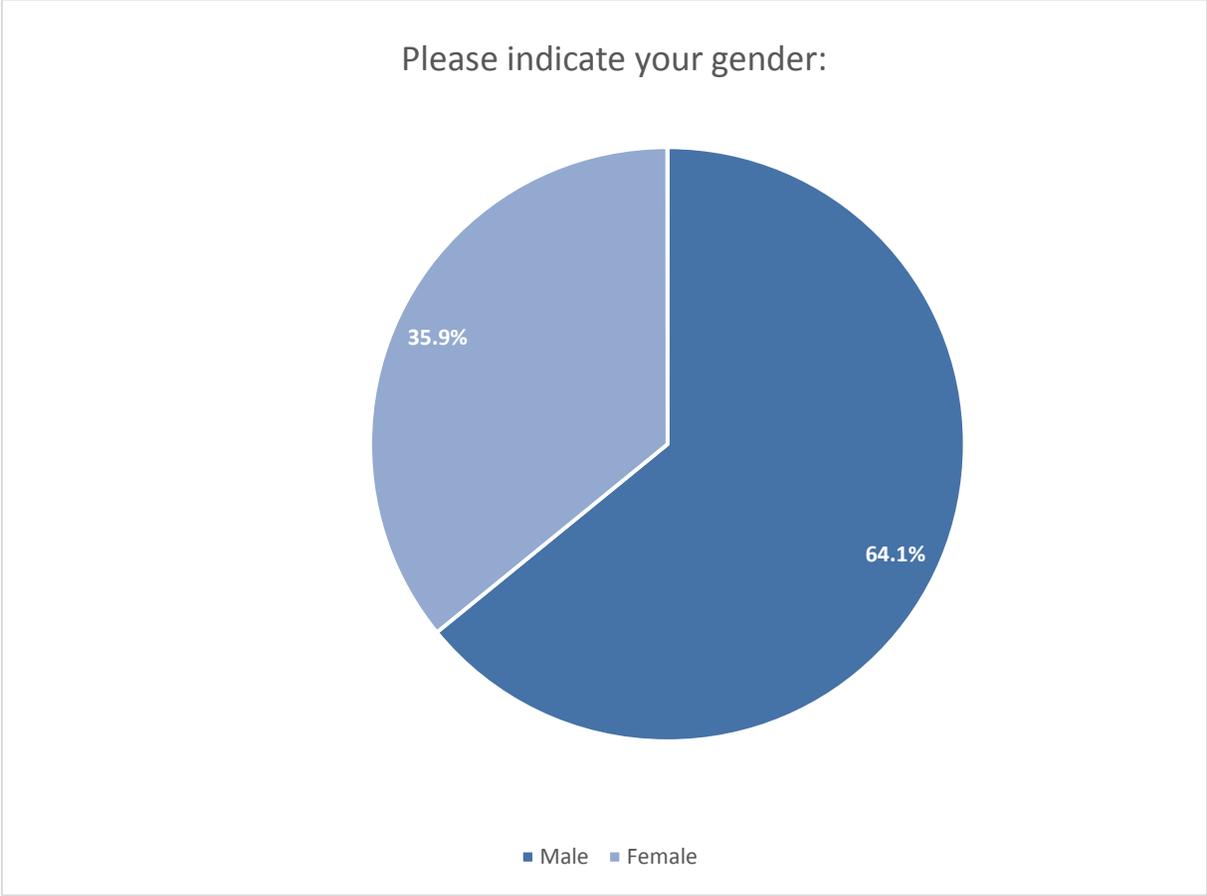
Please indicate your age range:

Answer Options	Response Percent	Response Count
Under 18	0.0%	0
18 to 30	9.6%	10
31 to 40	17.3%	18
41 to 50	23.1%	24
51 to 60	26.0%	27
61 or older	24.0%	25
answered question		104
skipped question		32



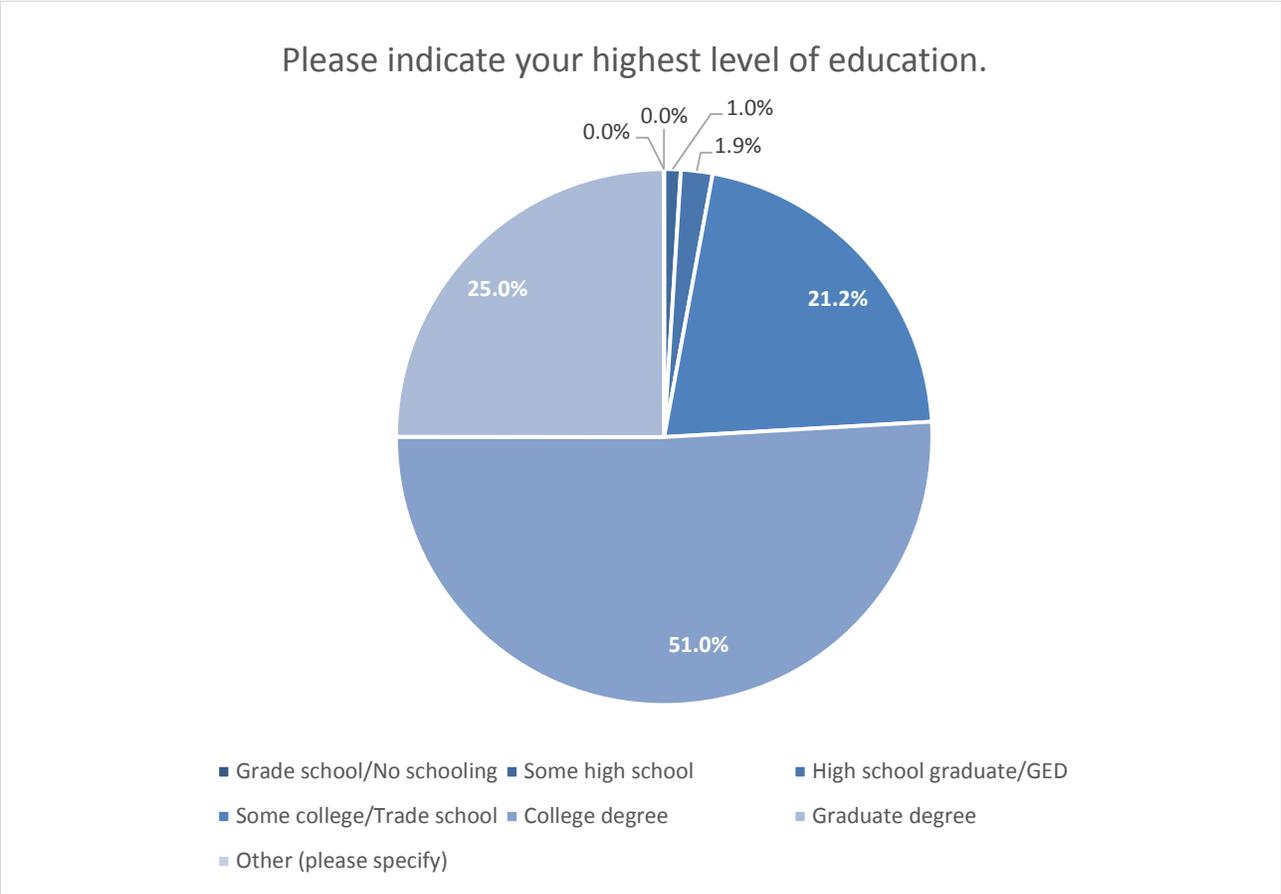
Question 28

Please indicate your gender:		
Answer Options	Response Percent	Response Count
Male	64.1%	66
Female	35.9%	37
answered question		103
skipped question		33



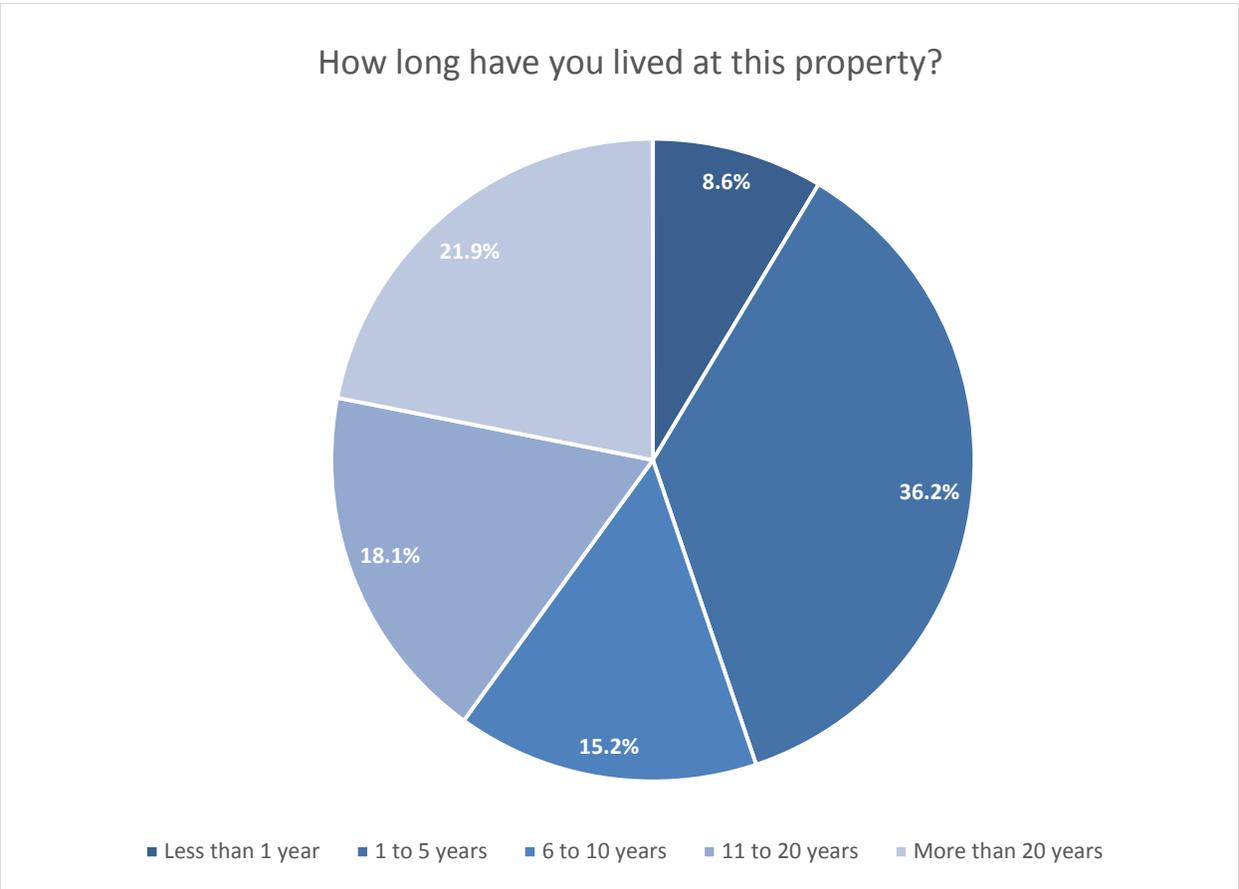
Question 29

Please indicate your highest level of education.		
Answer Options	Response Percent	Response Count
Grade school/No schooling	0.0%	0
Some high school	1.0%	1
High school graduate/GED	1.9%	2
Some college/Trade school	21.2%	22
College degree	51.0%	53
Graduate degree	25.0%	26
Other (please specify)	0.0%	0
answered question		104
skipped question		32



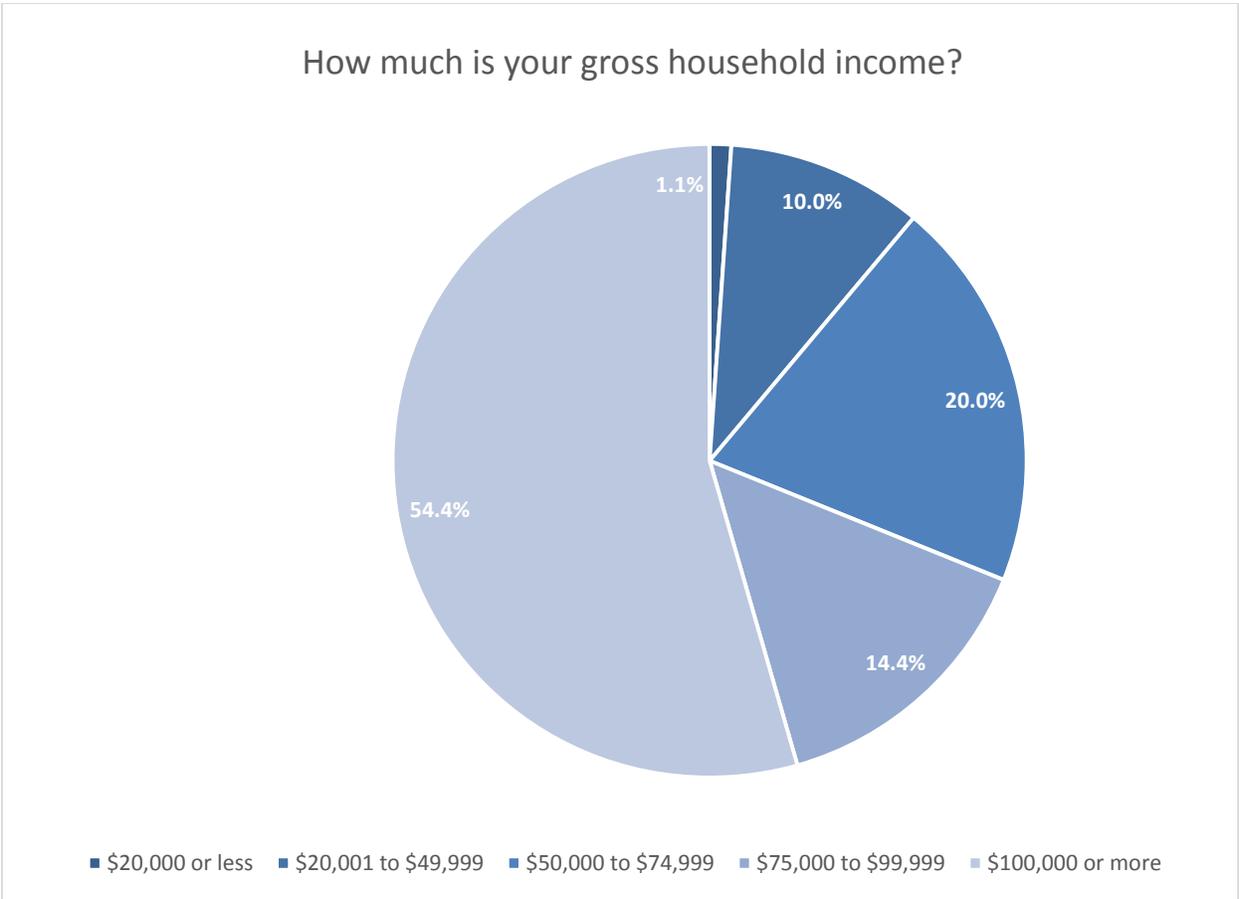
Question 30

How long have you lived at this property?		
Answer Options	Response Percent	Response Count
Less than 1 year	8.6%	9
1 to 5 years	36.2%	38
6 to 10 years	15.2%	16
11 to 20 years	18.1%	19
More than 20 years	21.9%	23
answered question		105
skipped question		31



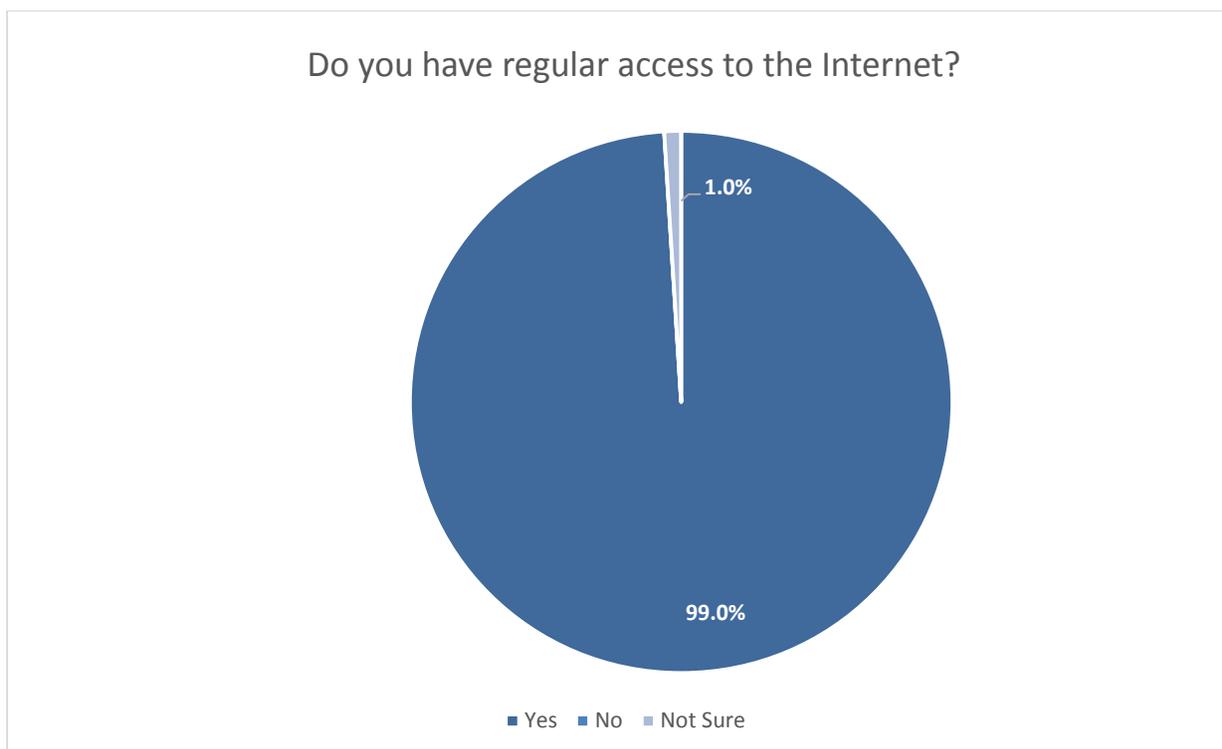
Question 31

How much is your gross household income?		
Answer Options	Response Percent	Response Count
\$20,000 or less	1.1%	1
\$20,001 to \$49,999	10.0%	9
\$50,000 to \$74,999	20.0%	18
\$75,000 to \$99,999	14.4%	13
\$100,000 or more	54.4%	49
answered question		90
skipped question		46



Question 32

Do you have regular access to the Internet?		
Answer Options	Response Percent	Response Count
Yes	99.0%	103
No	0.0%	0
Not Sure	1.0%	1
answered question		104
skipped question		32



Question 33

Comments	
Answer Options	Response Count
	17
answered question	17
skipped question	119

Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX E.
CRITICAL FACILITIES AND INFRASTRUCTURE MAPS

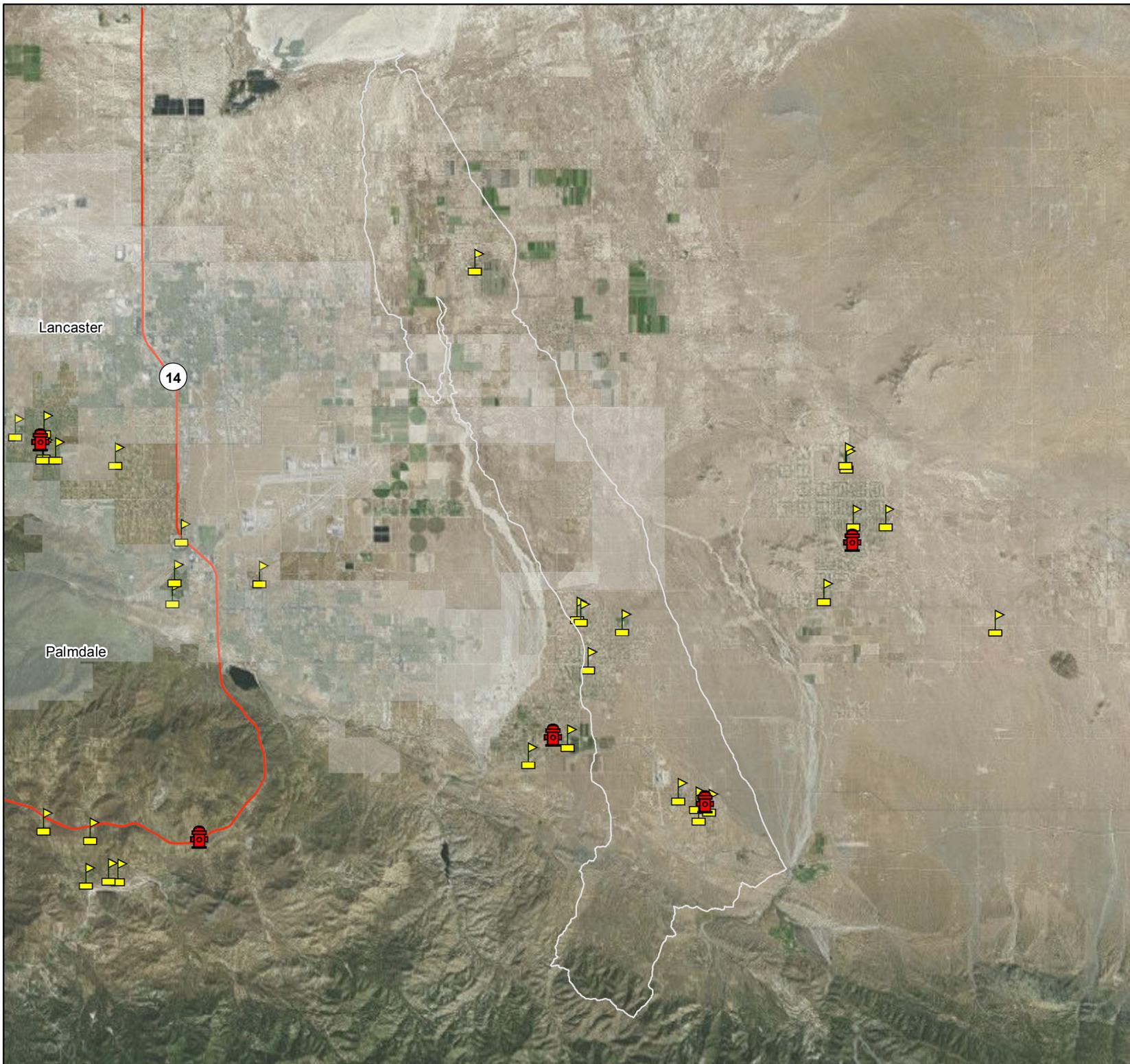
1809020616 Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



1809020616 Watershed

Critical Infrastructure

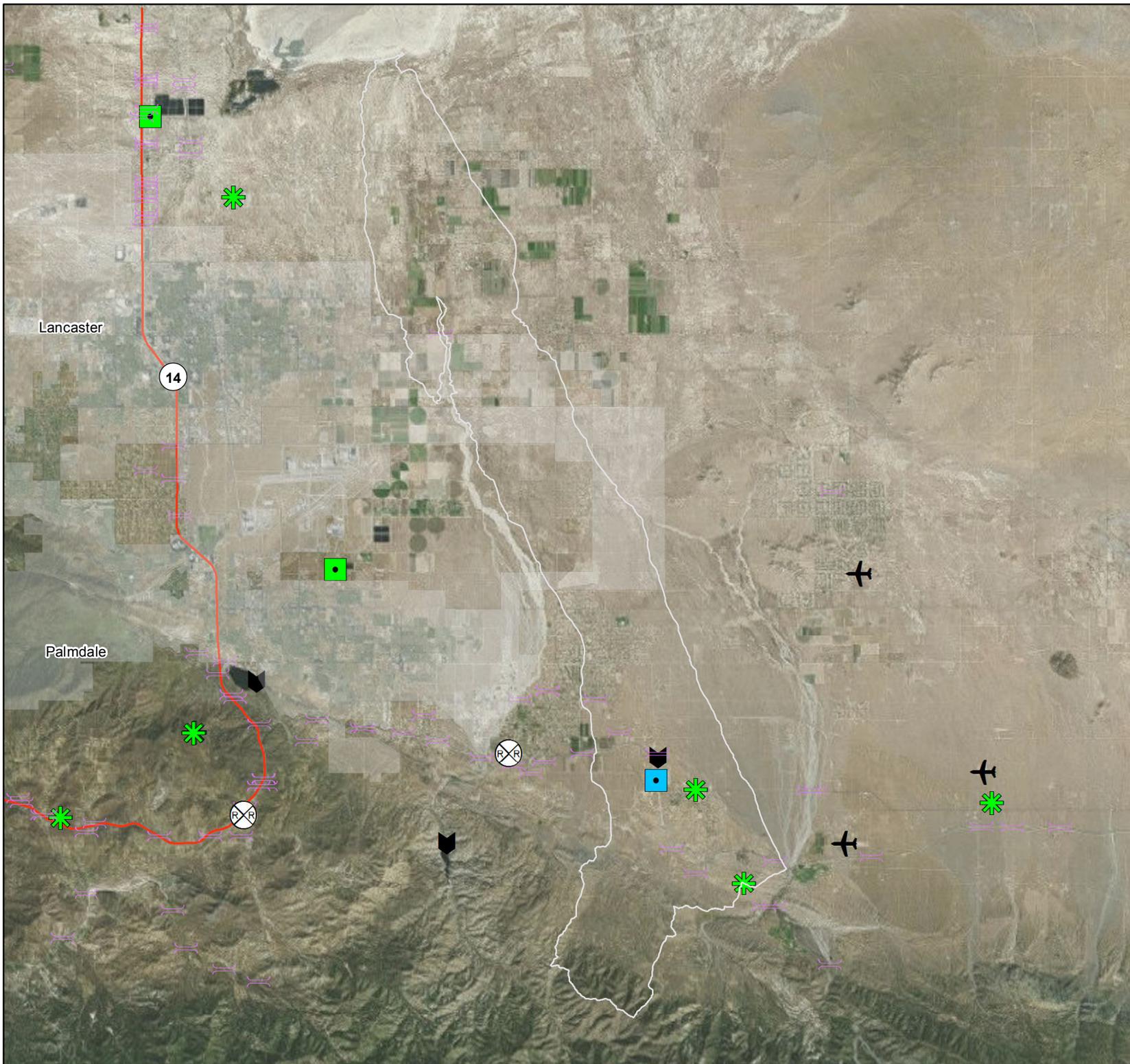
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



0 2 4
Miles



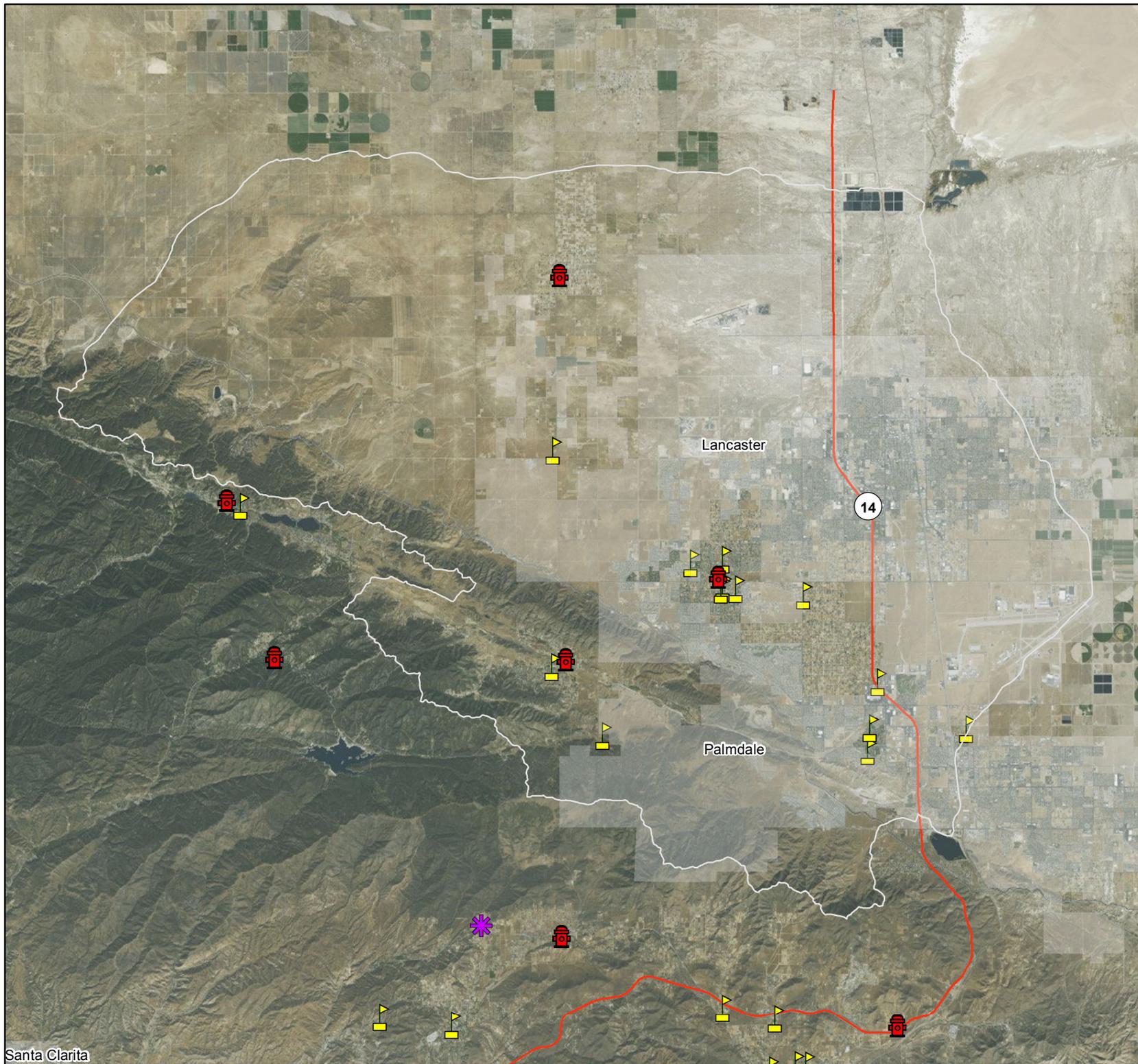
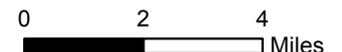
Amargosa Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



Santa Clarita

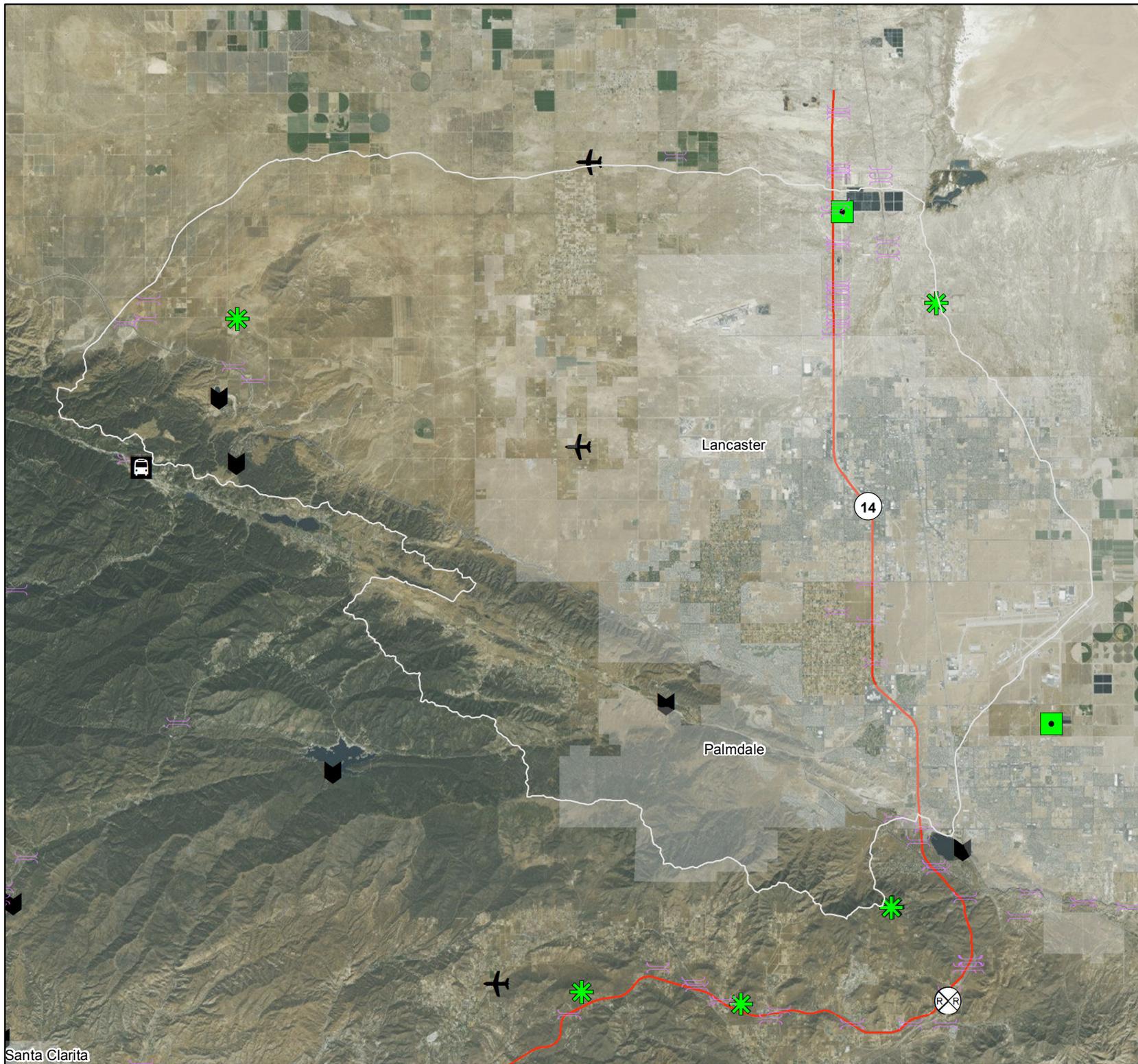
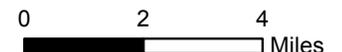
Amargosa Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



Santa Clarita

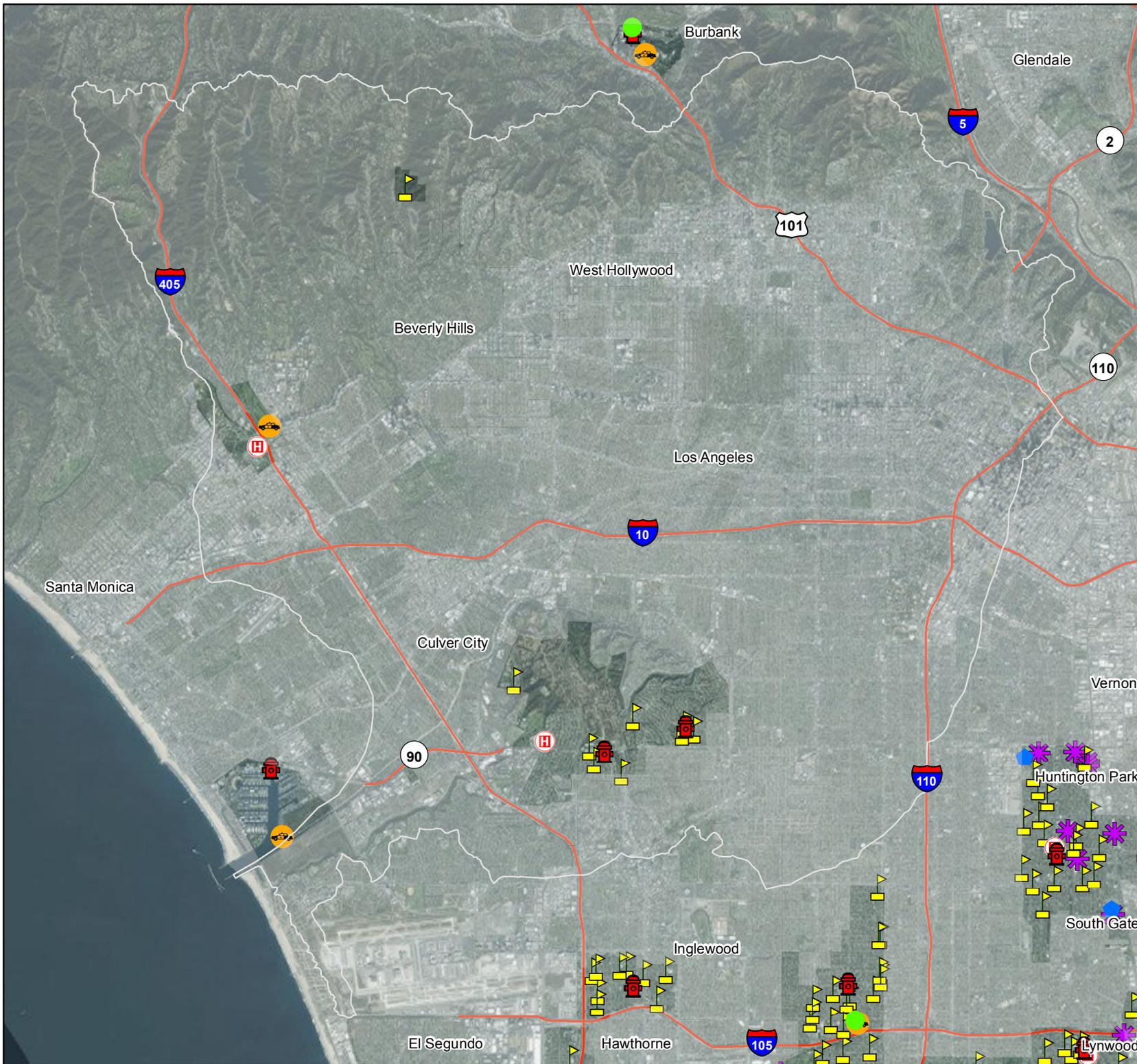
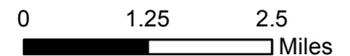
Ballona Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



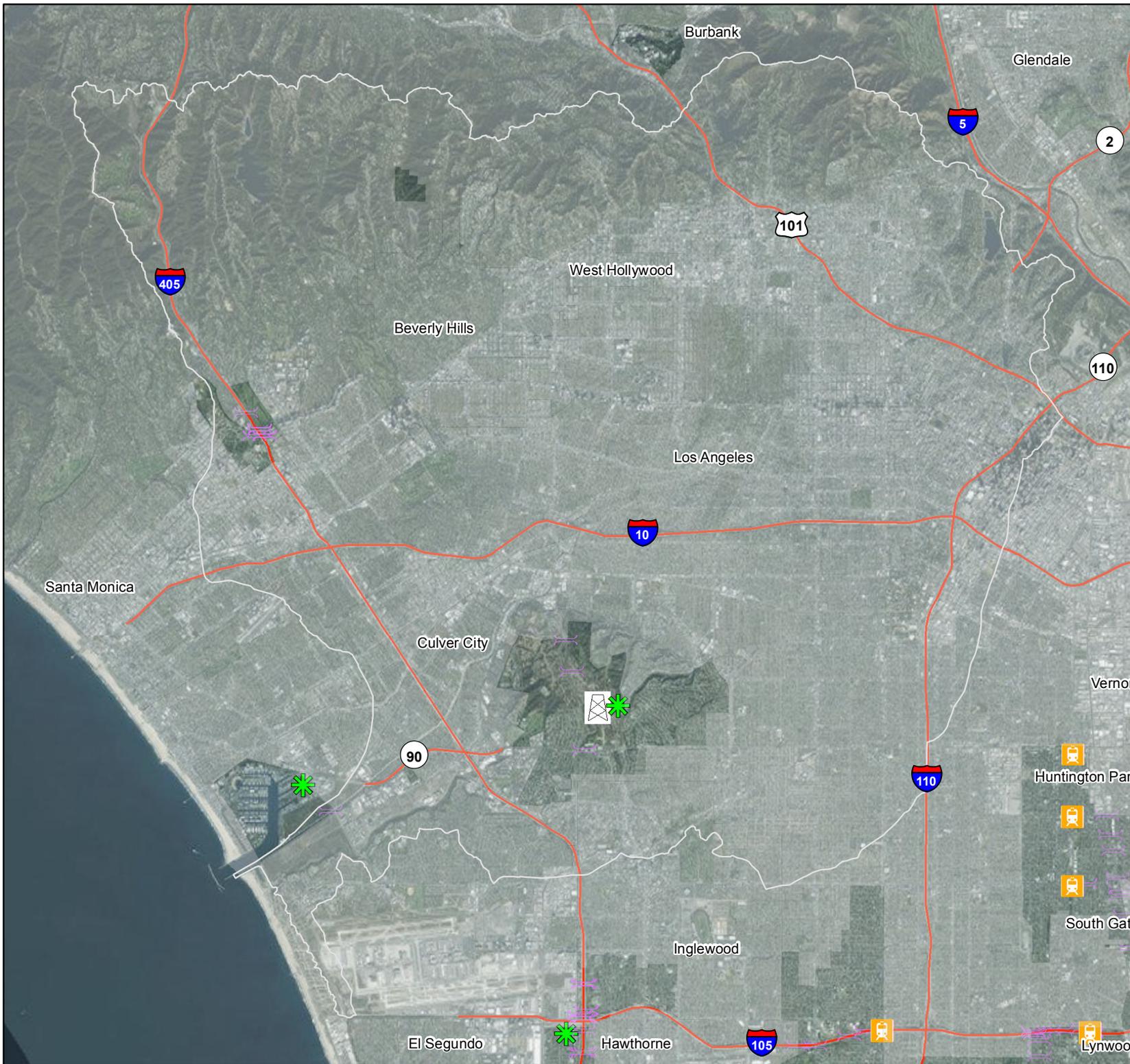
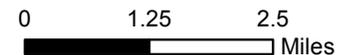
Ballona Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



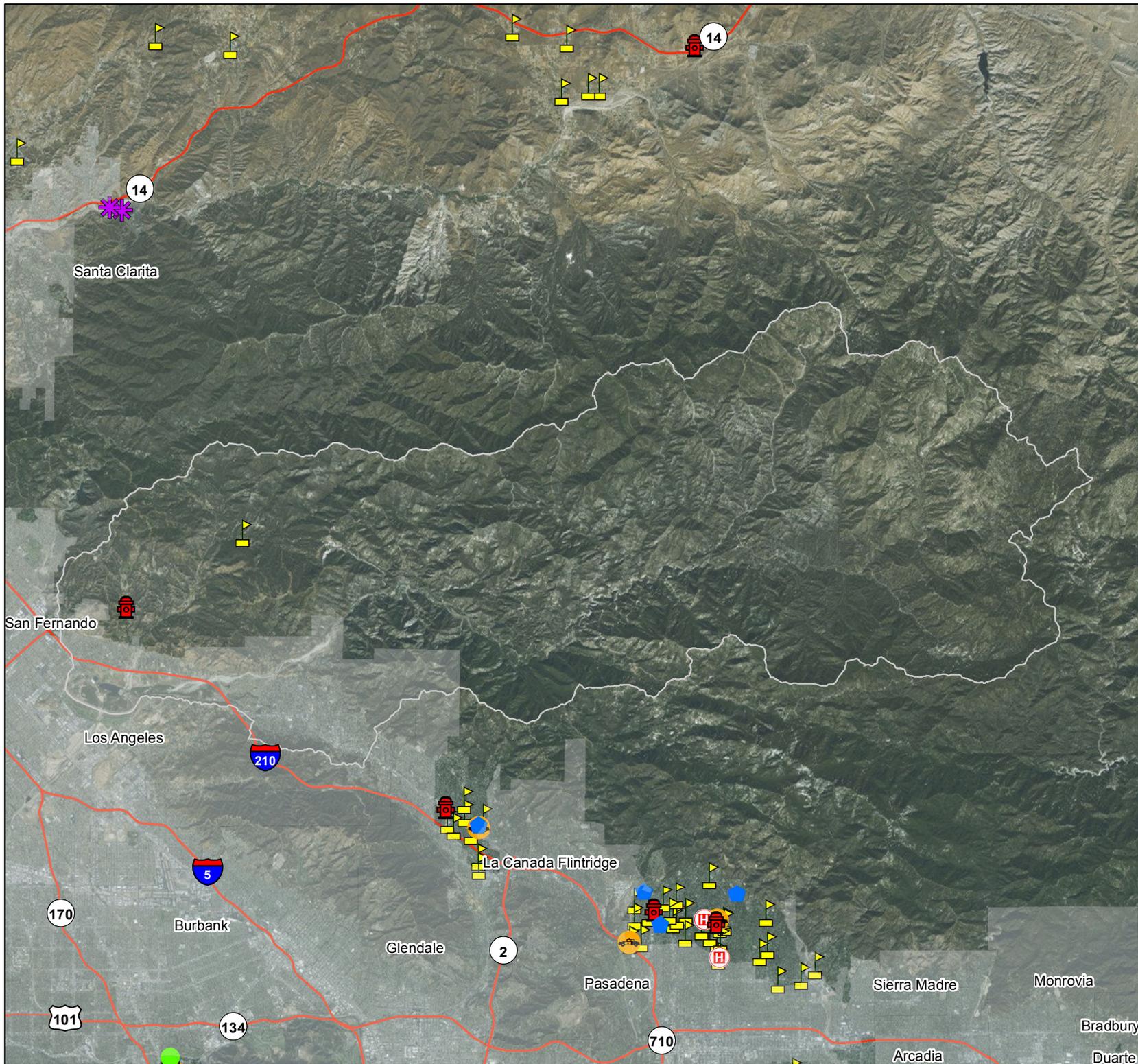
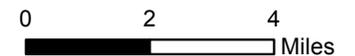
Big Tujunga Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



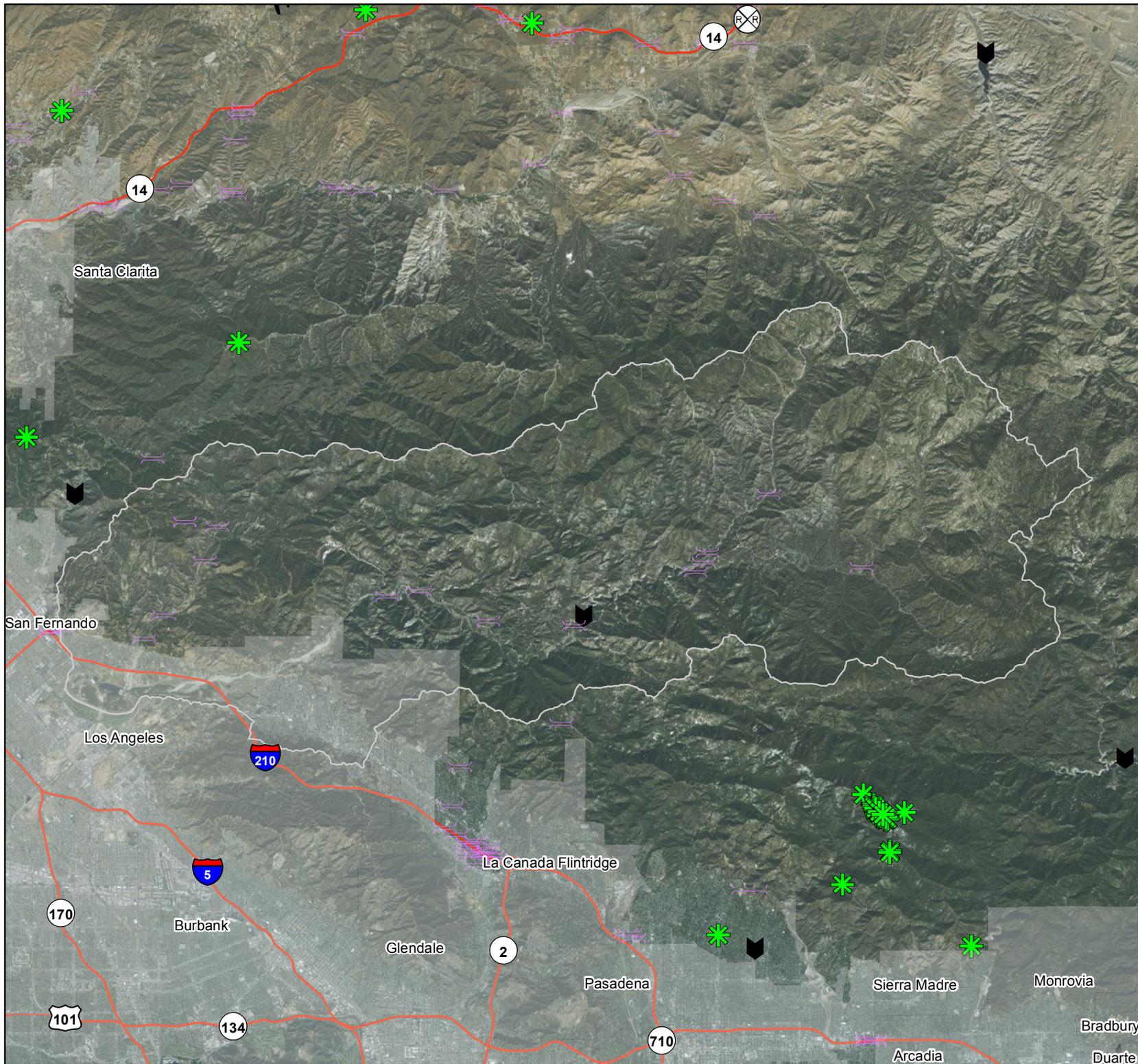
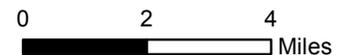
Big Tujunga Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



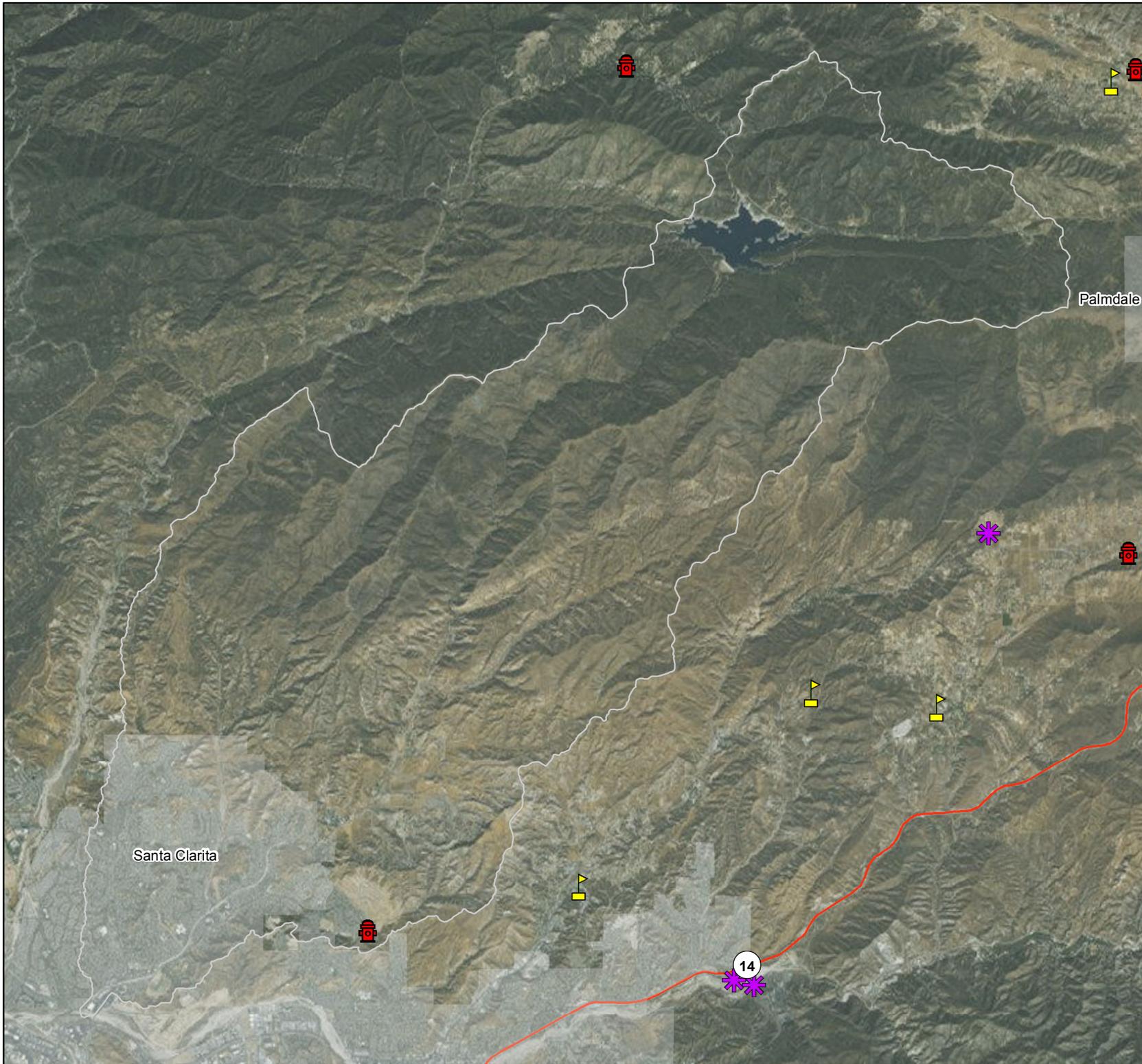
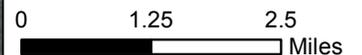
Bouquet Canyon Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Bouquet Canyon Watershed

Critical Infrastructure

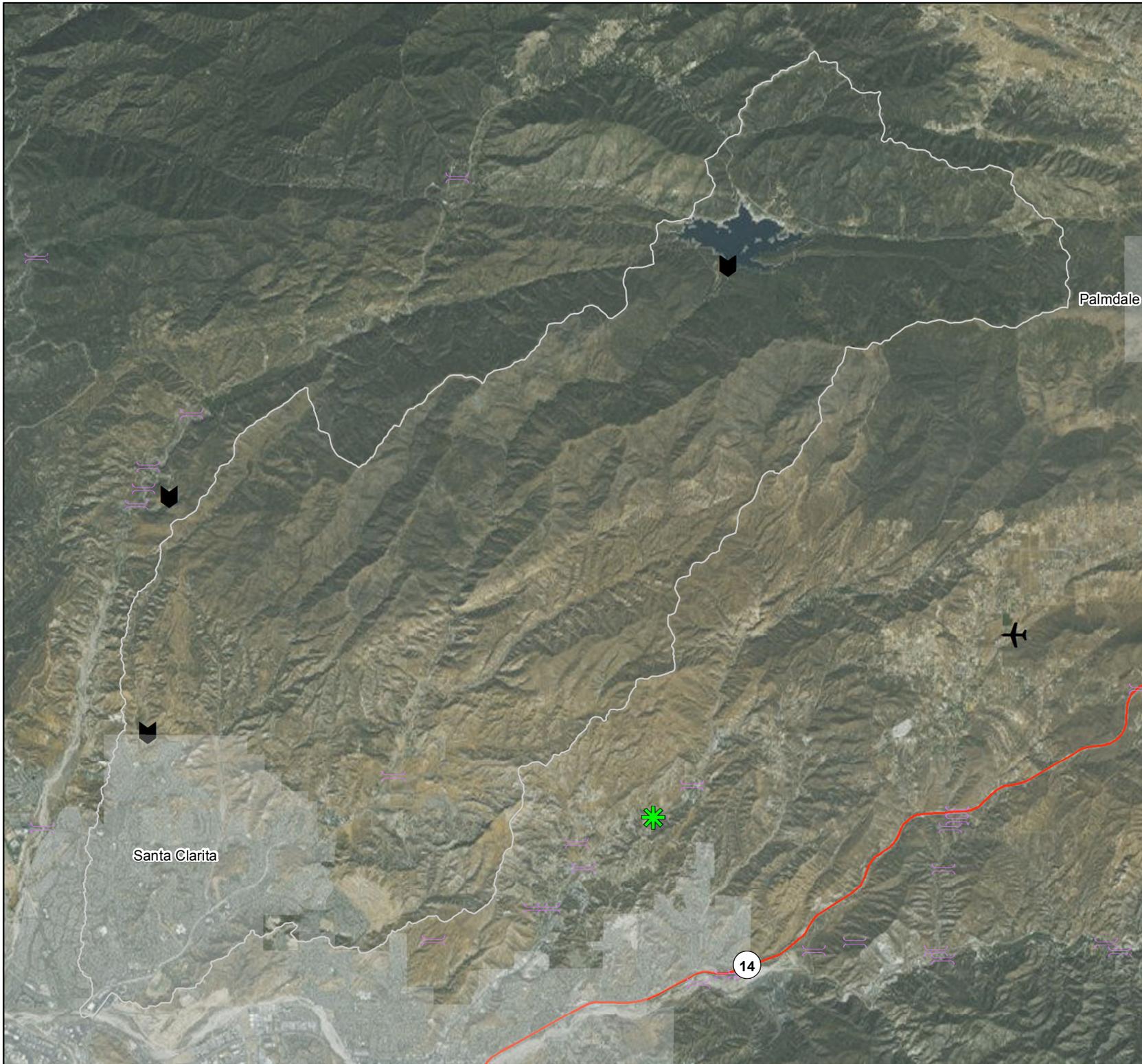
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

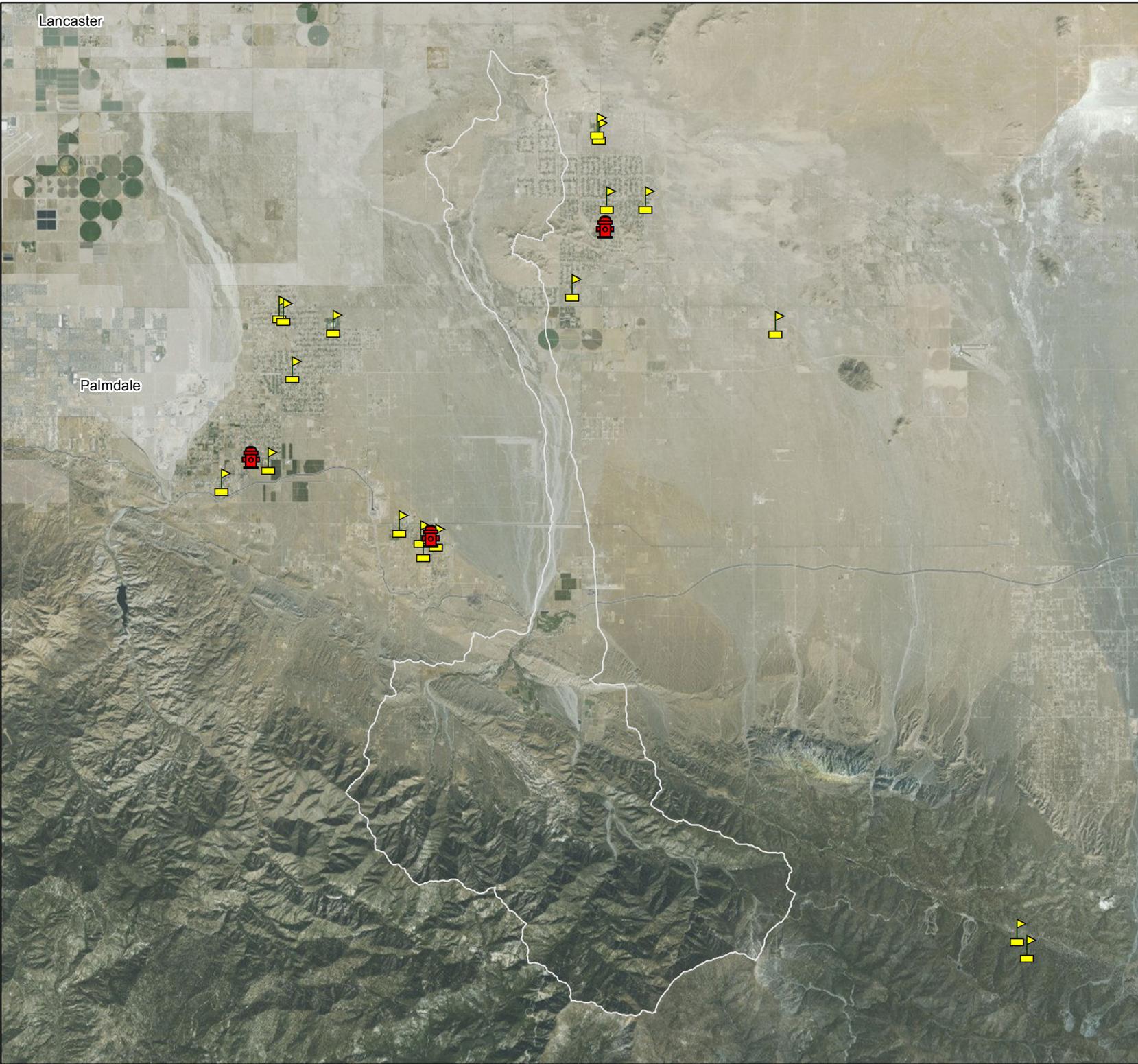
Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



0 1.25 2.5
Miles





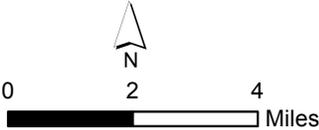
Big Rock Creek- Big Rock Wash Watershed

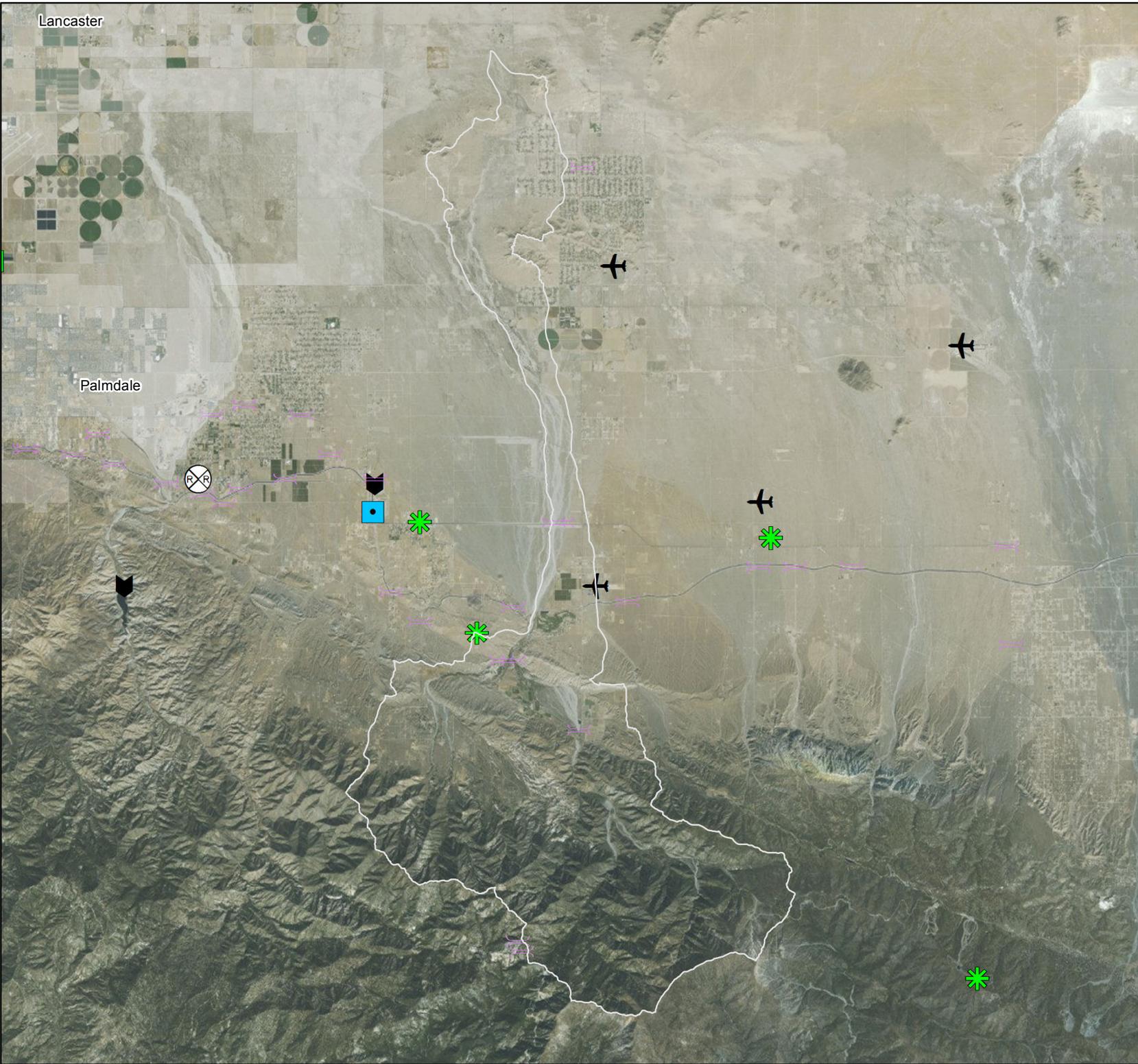
Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15





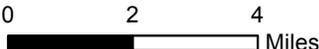
Big Rock Creek- Big Rock Wash Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



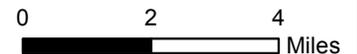
Big-Sycamore Canyon-Frontal Santa Monica Bay Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Big-Sycamore Canyon-Frontal Santa Monica Bay Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



0 2 4
Miles



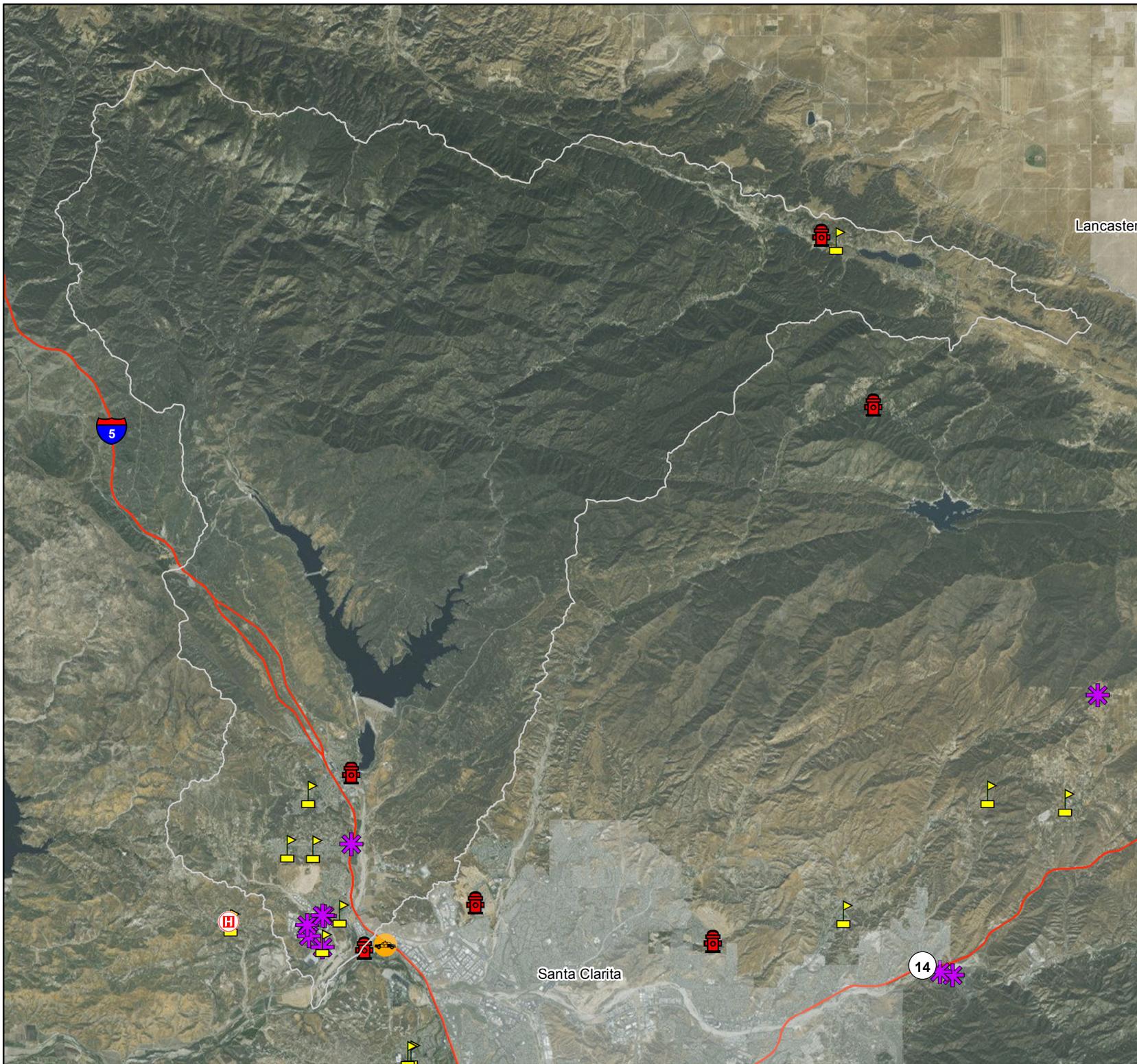
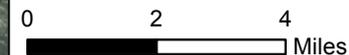
Castaic Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



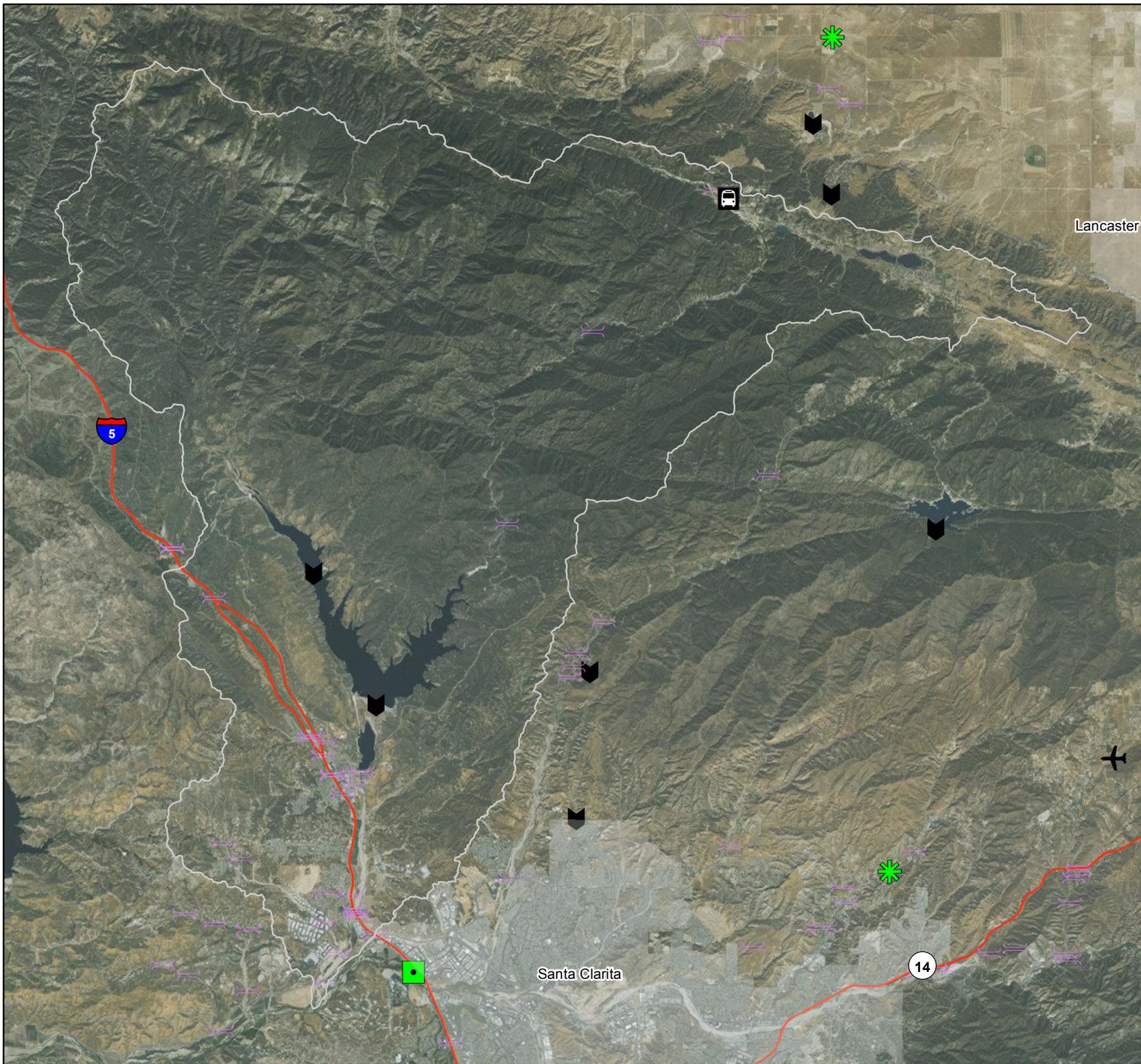
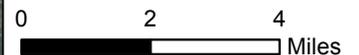
Castaic Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



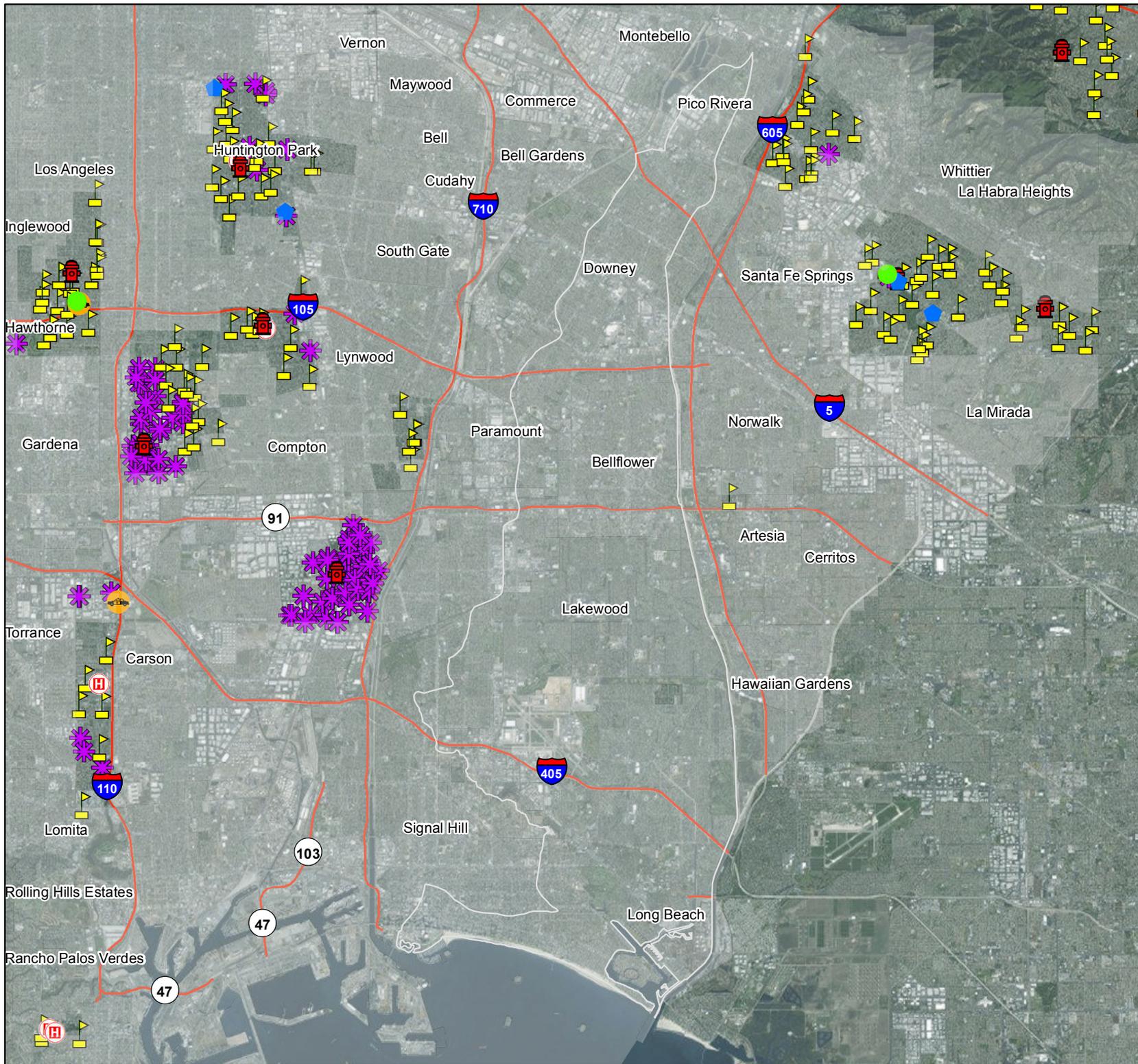
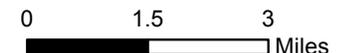
Colorado Lagoon-Frontal Alamitos Bay Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



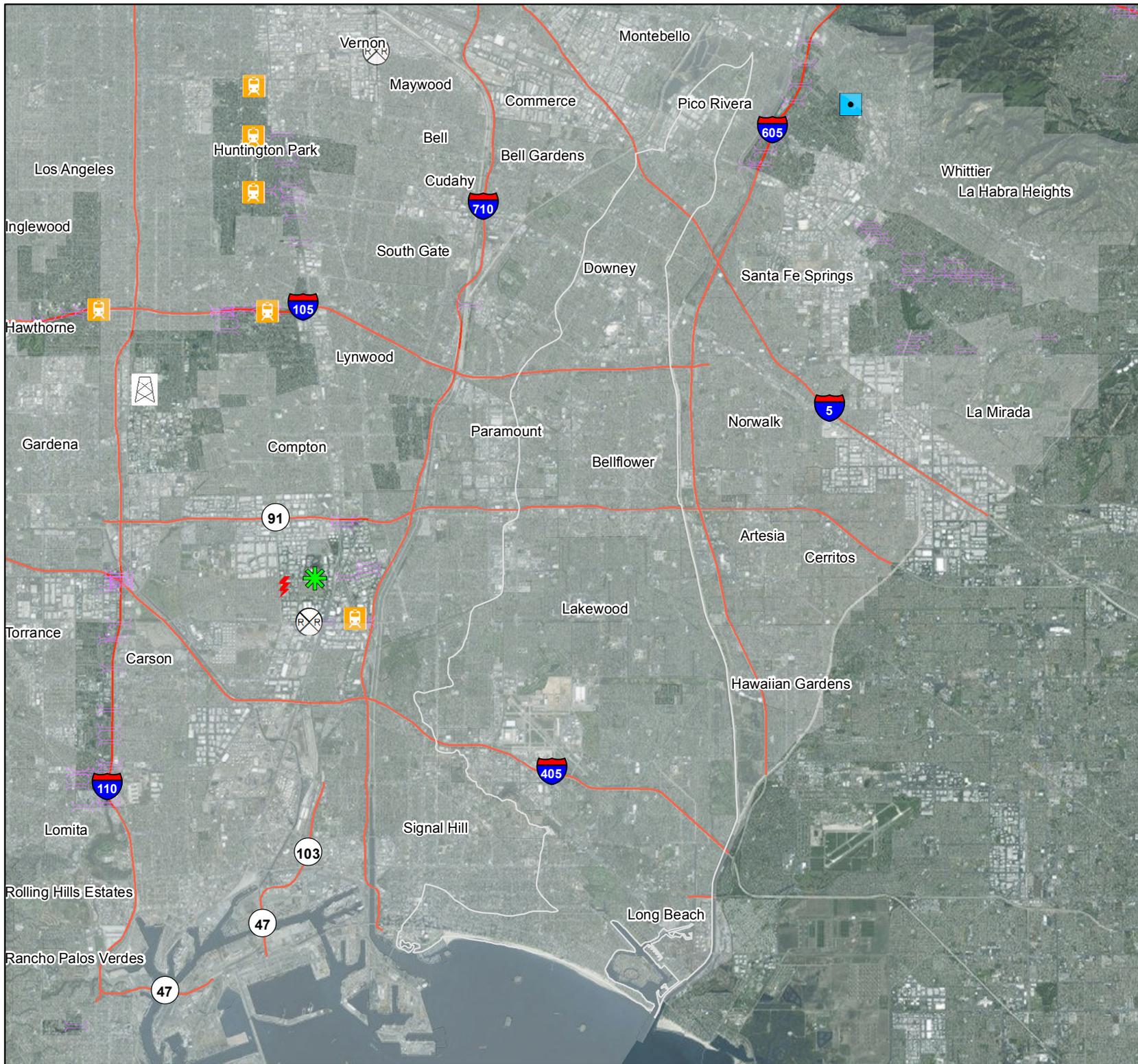
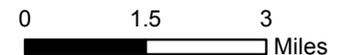
Colorado Lagoon-Frontal Alamitos Bay Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



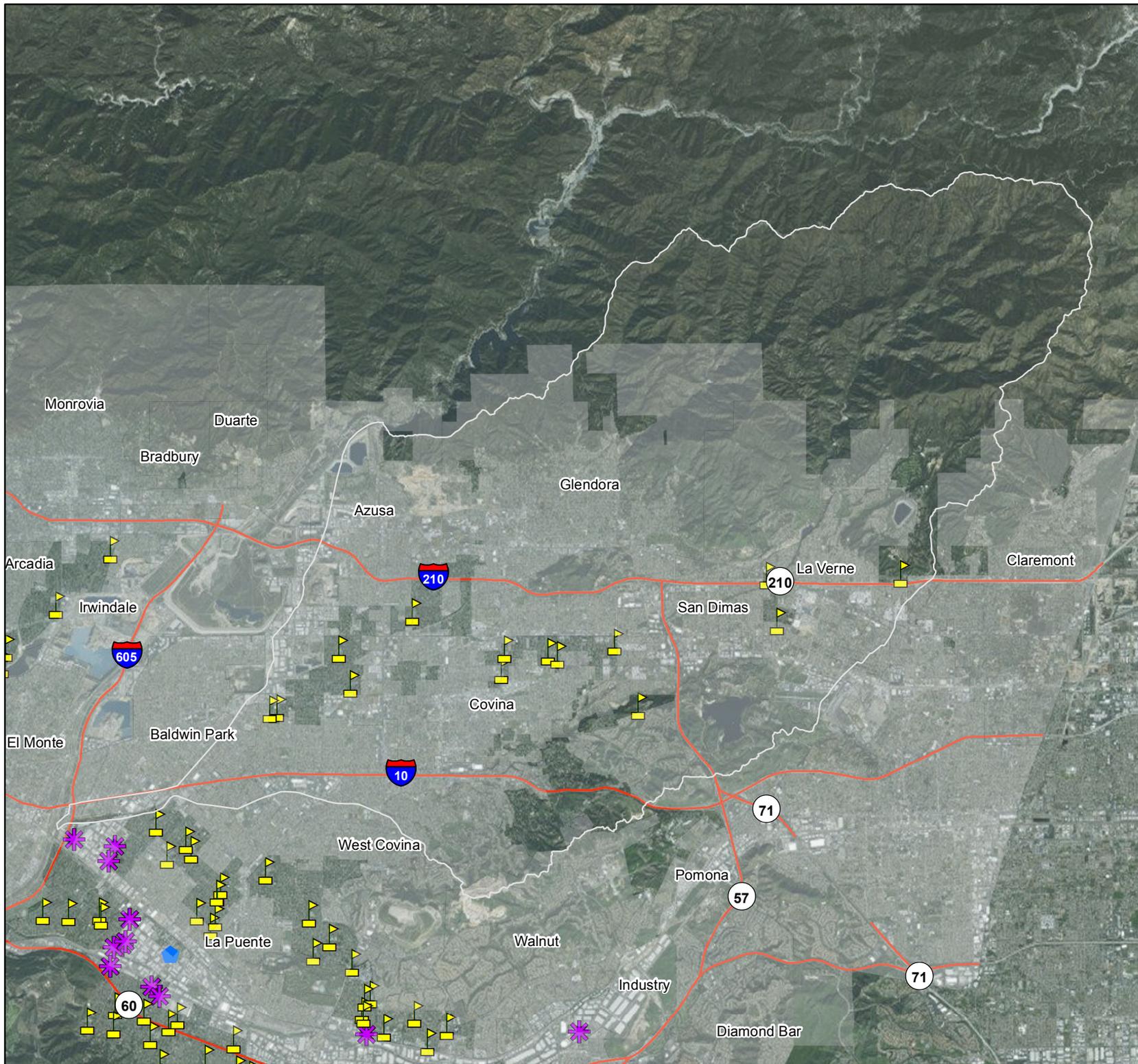
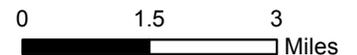
Dalton Wash Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



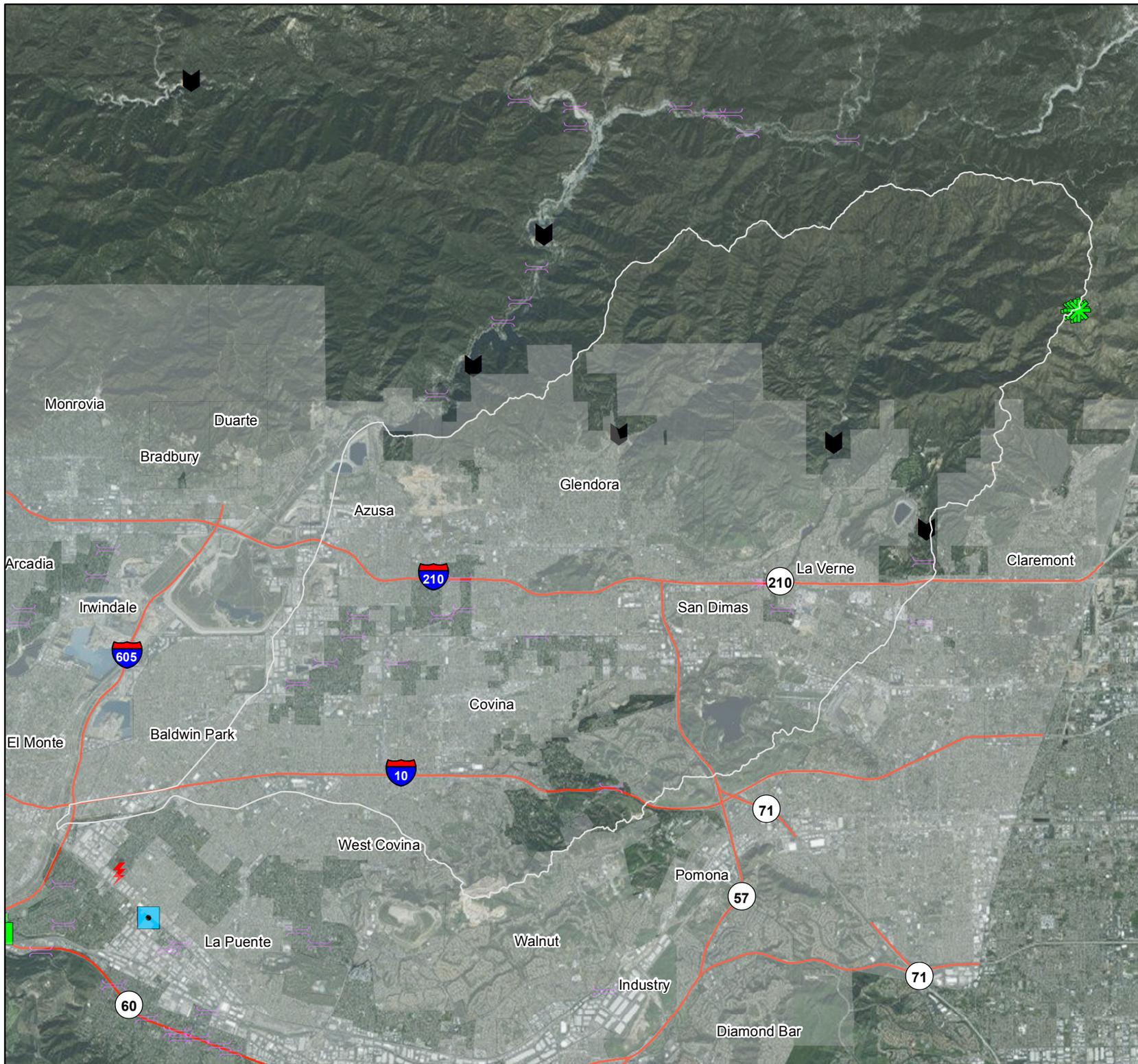
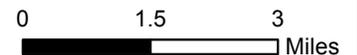
Dalton Wash Watershed

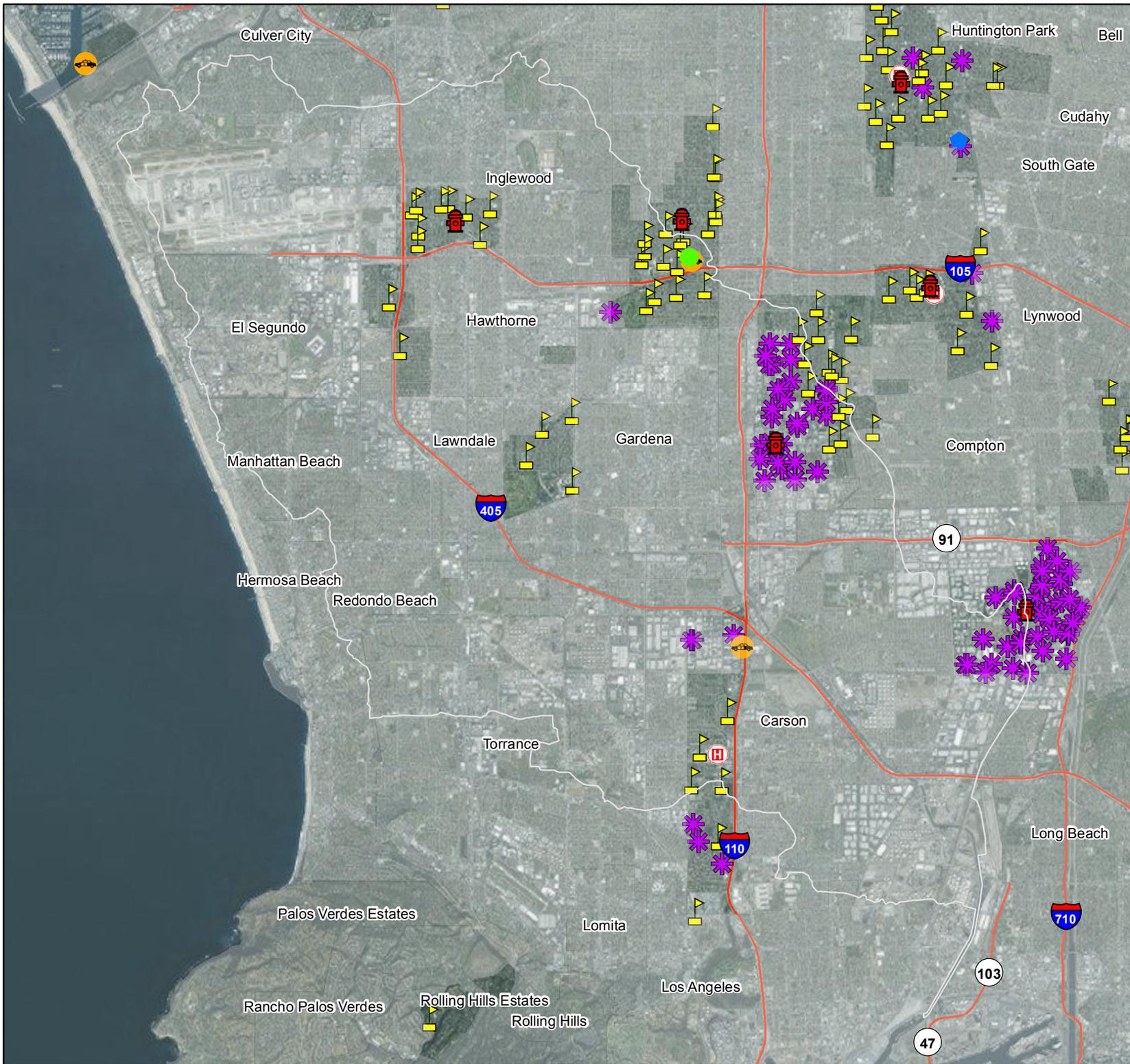
Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15





Dominguez Channel Watershed

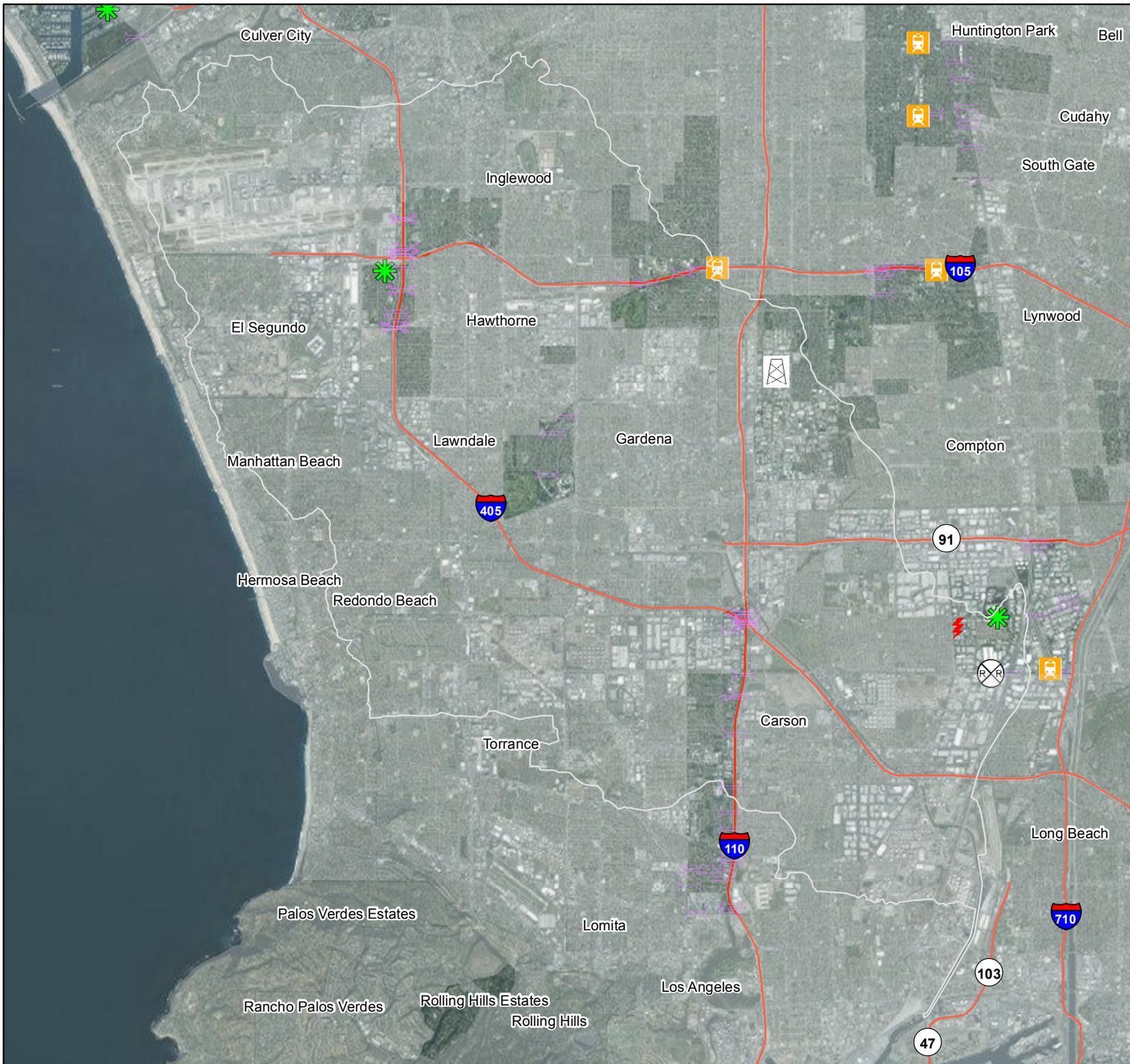
Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15





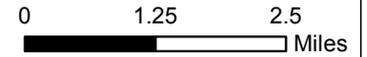
Dominguez Channel Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



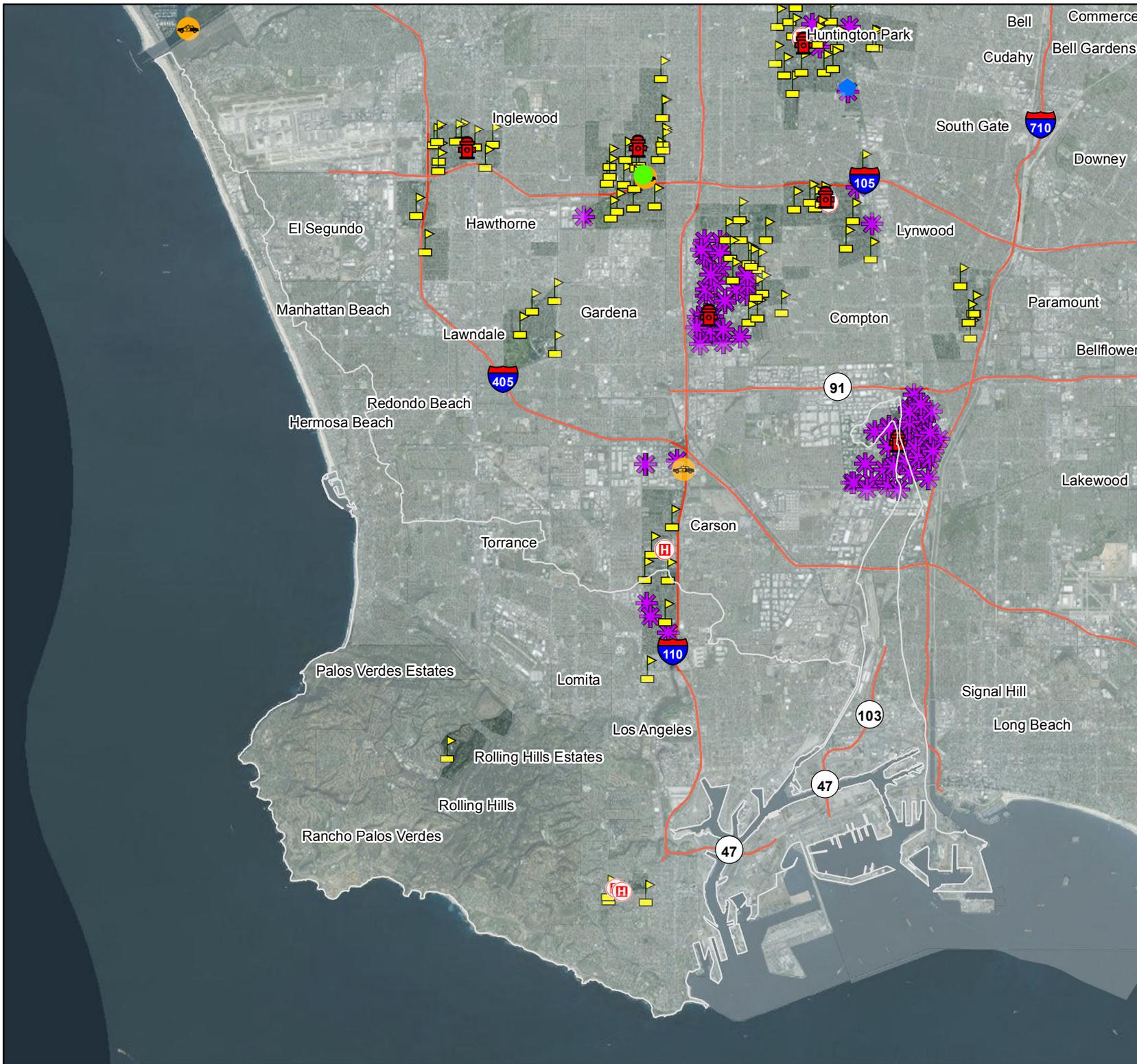
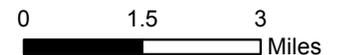
Frontal Santa Monica Bay-San Pedro Bay Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Frontal Santa Monica Bay-San Pedro Bay Watershed

Critical Infrastructure

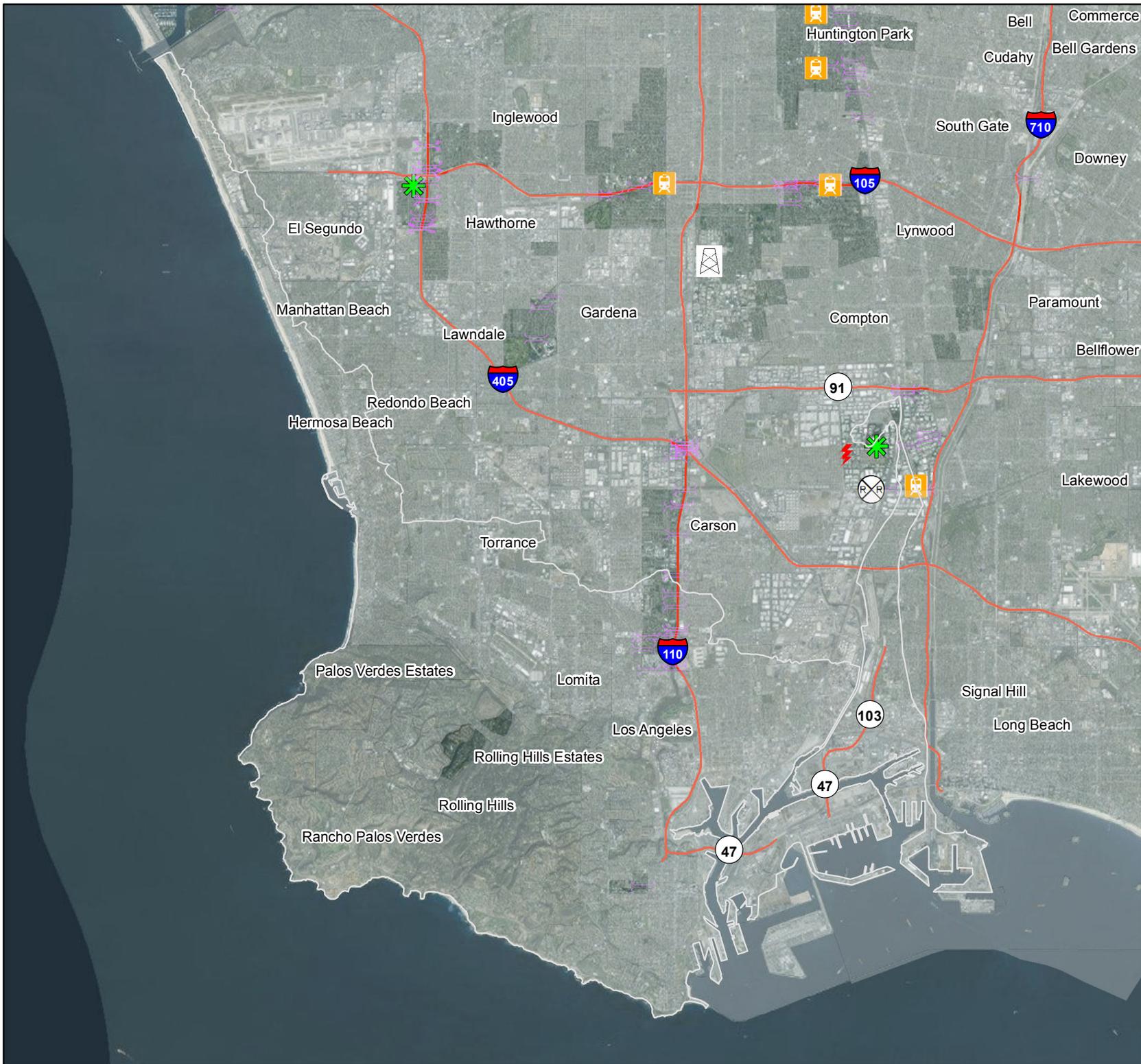
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

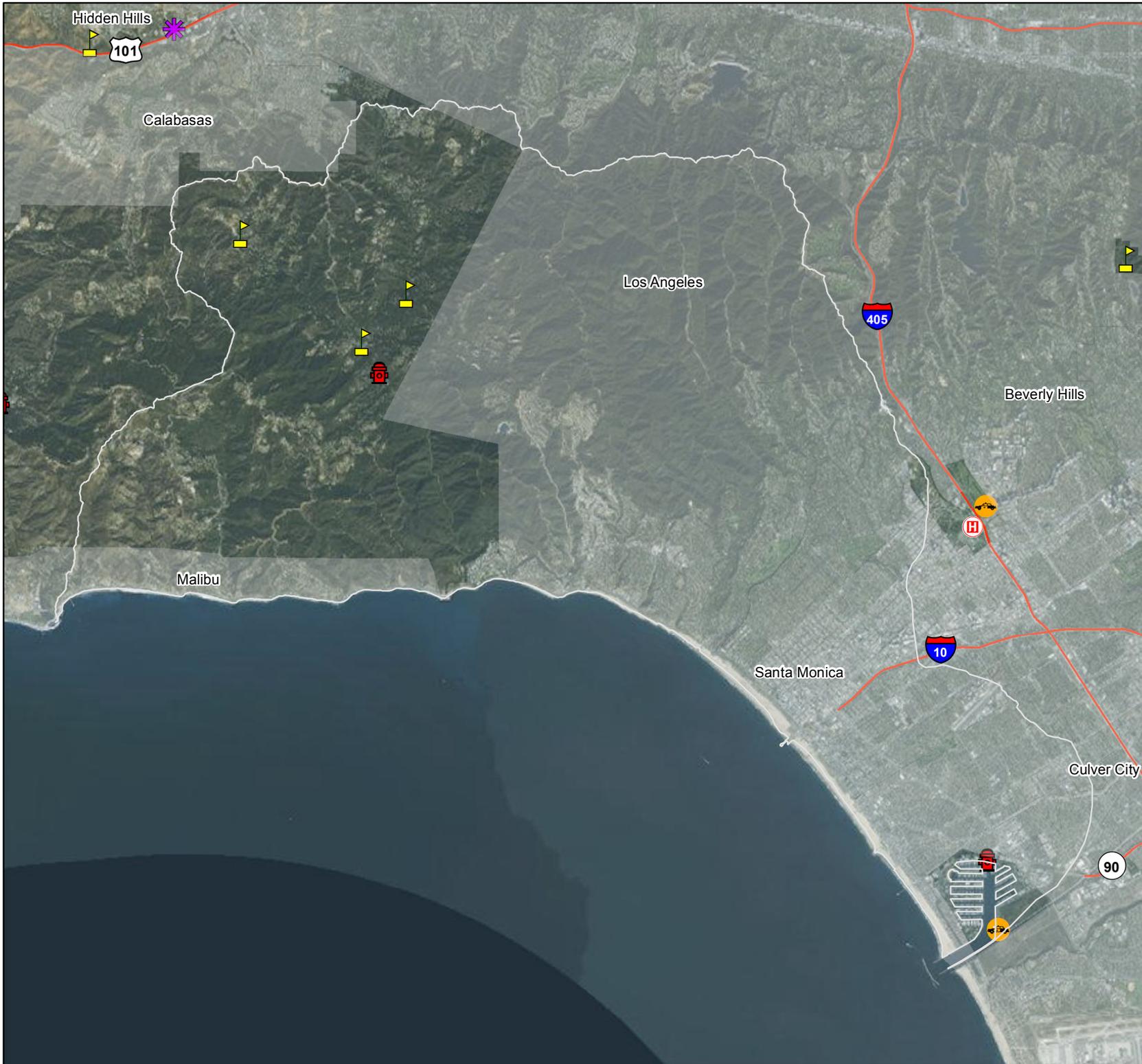
Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



0 1.5 3
Miles





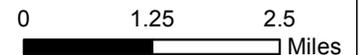
Garapito Creek-Frontal Santa Monica Bay Watershed

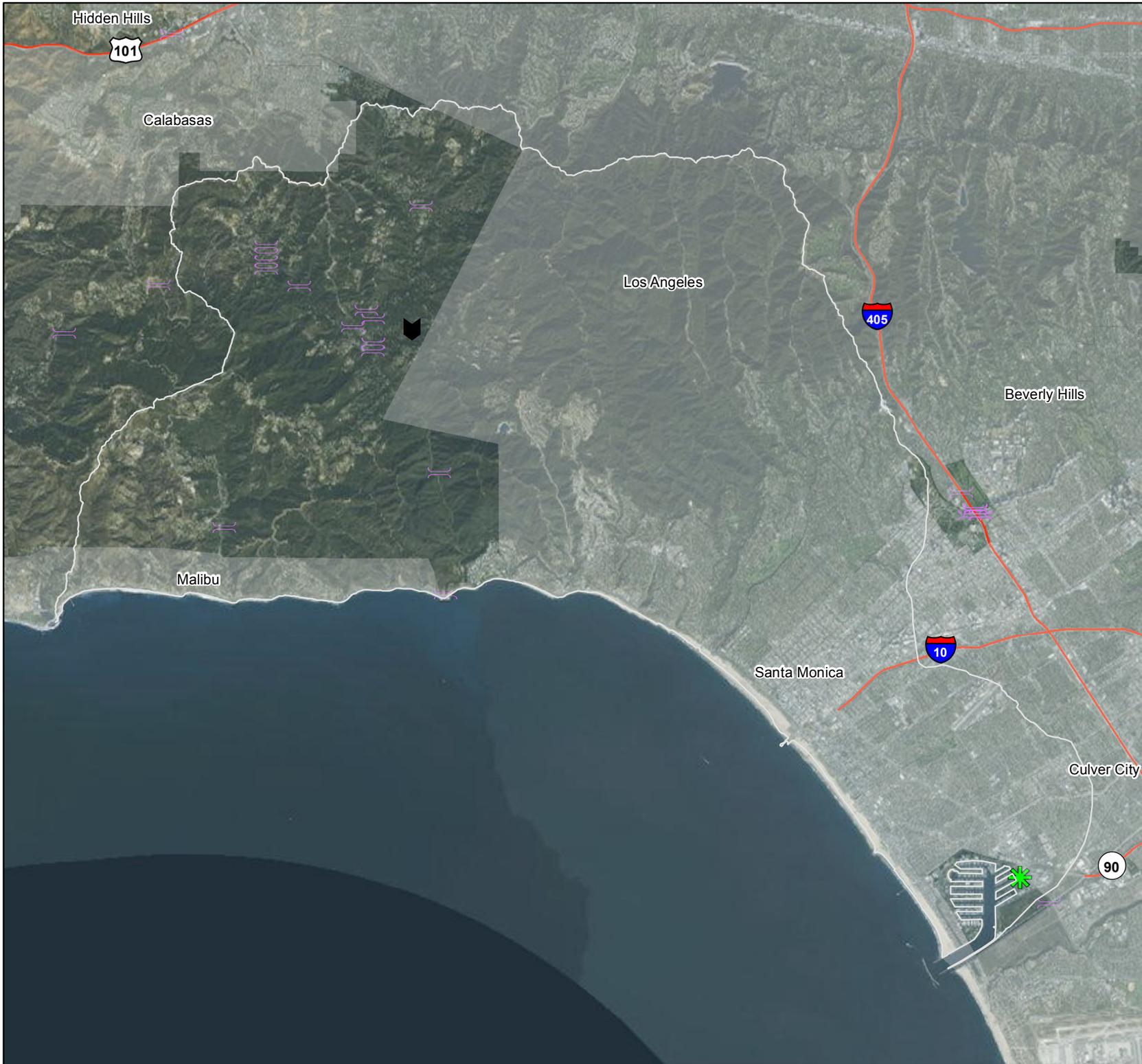
Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15





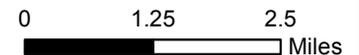
Garapito Creek-Frontal Santa Monica Bay Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



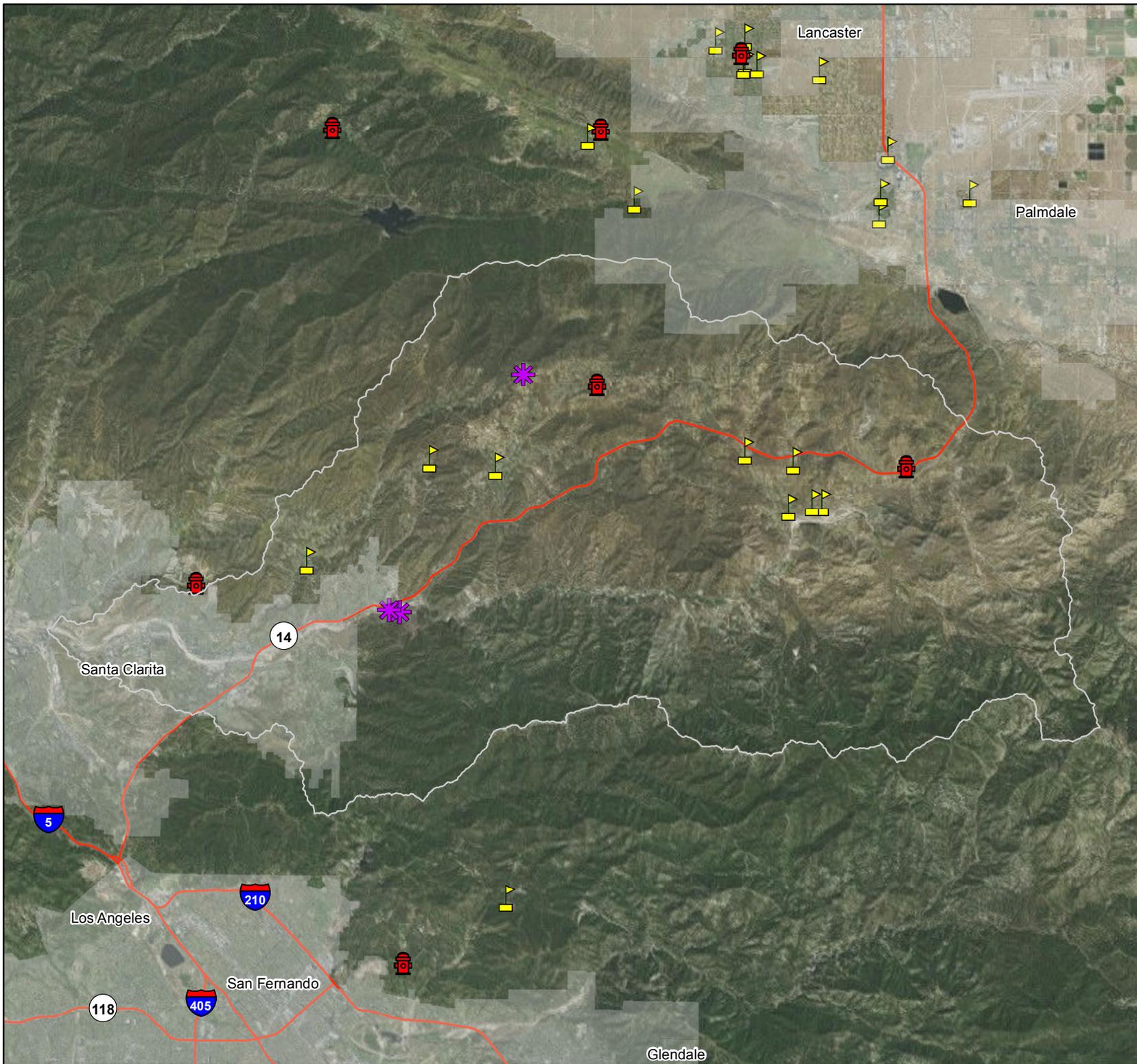
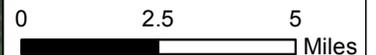
Headwaters Santa Clara River Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



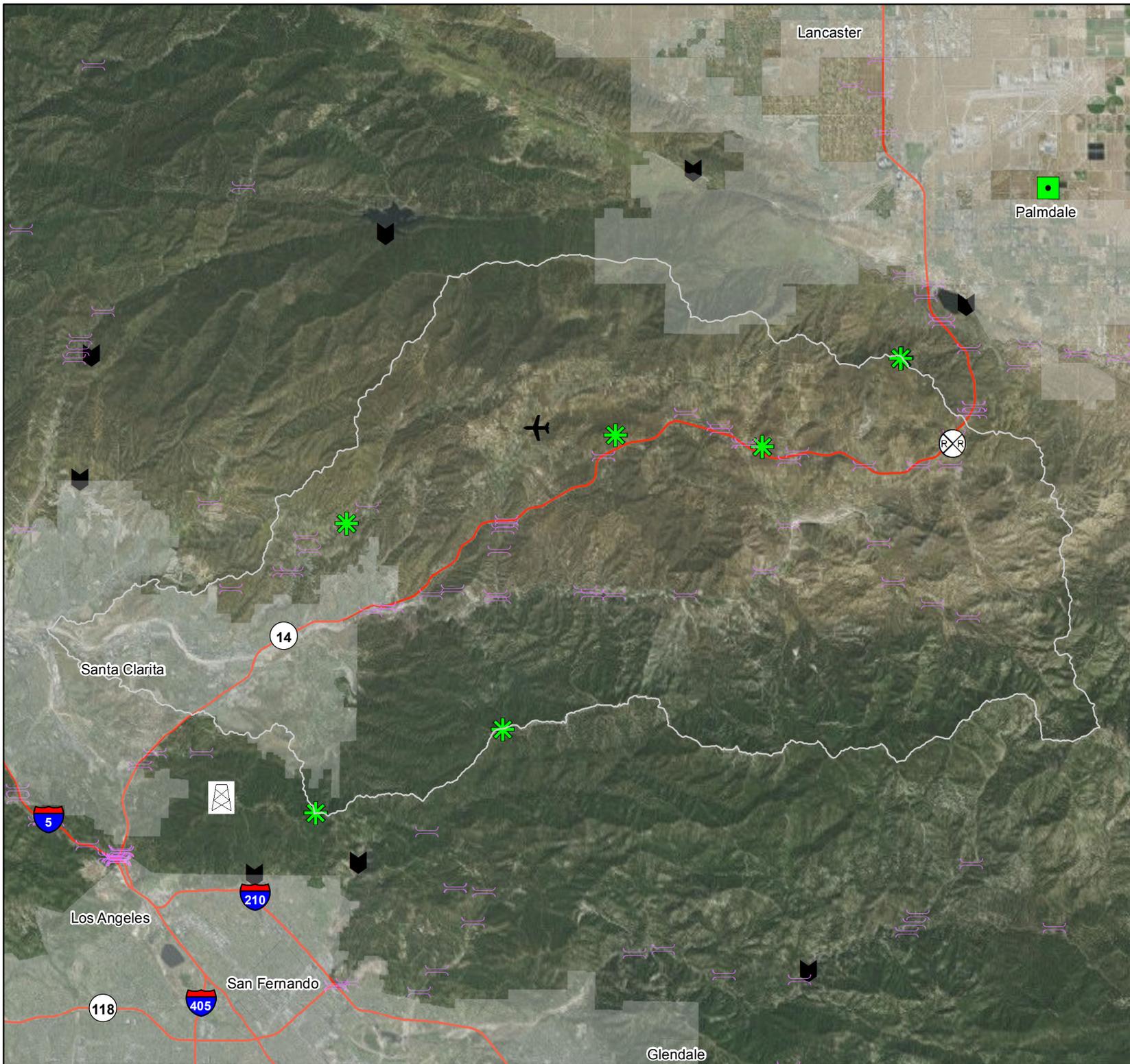
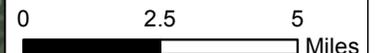
Headwaters Santa Clara River Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



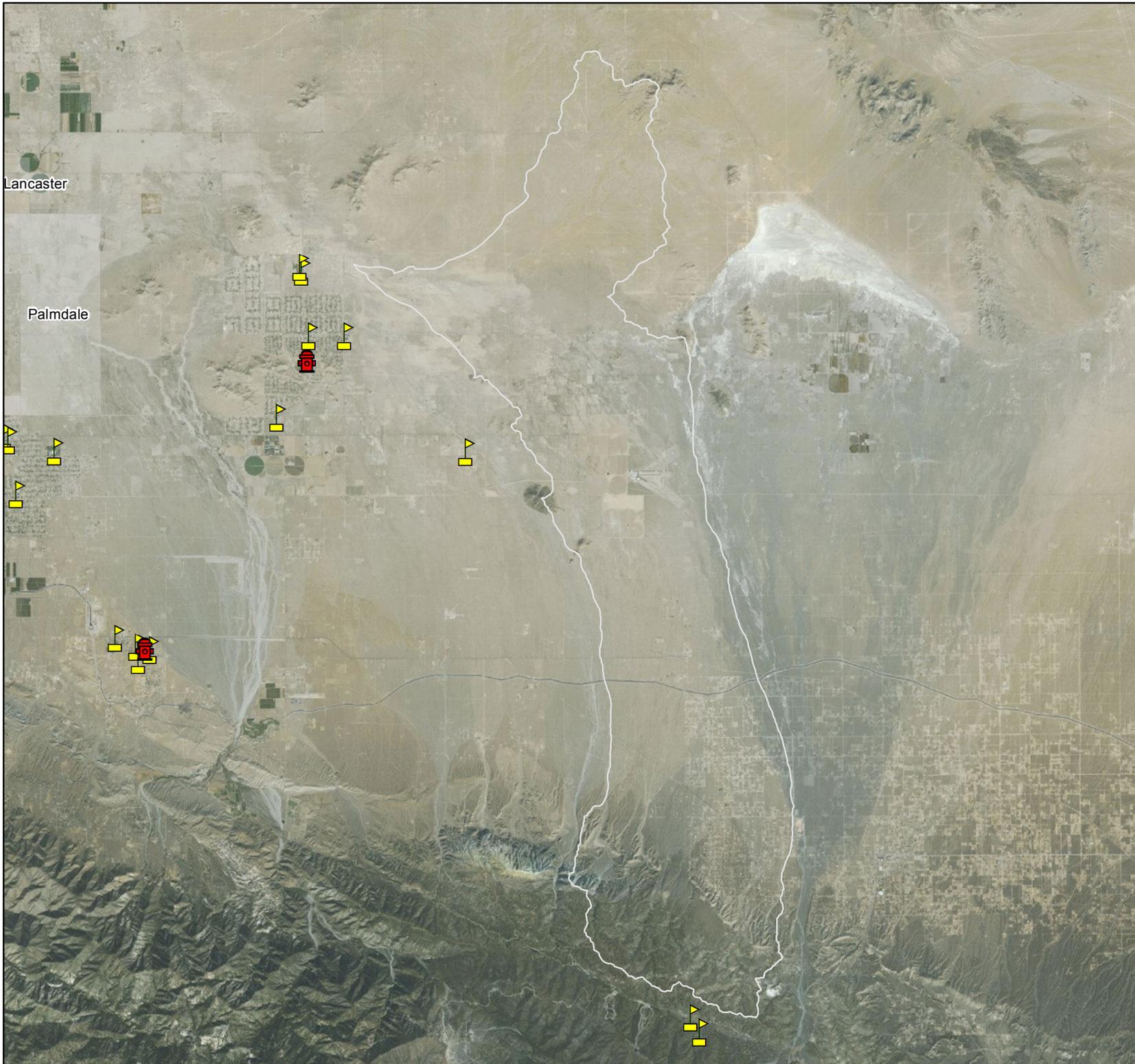
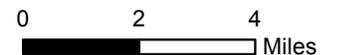
Le Montaine Creek- Eller Slough Watershed

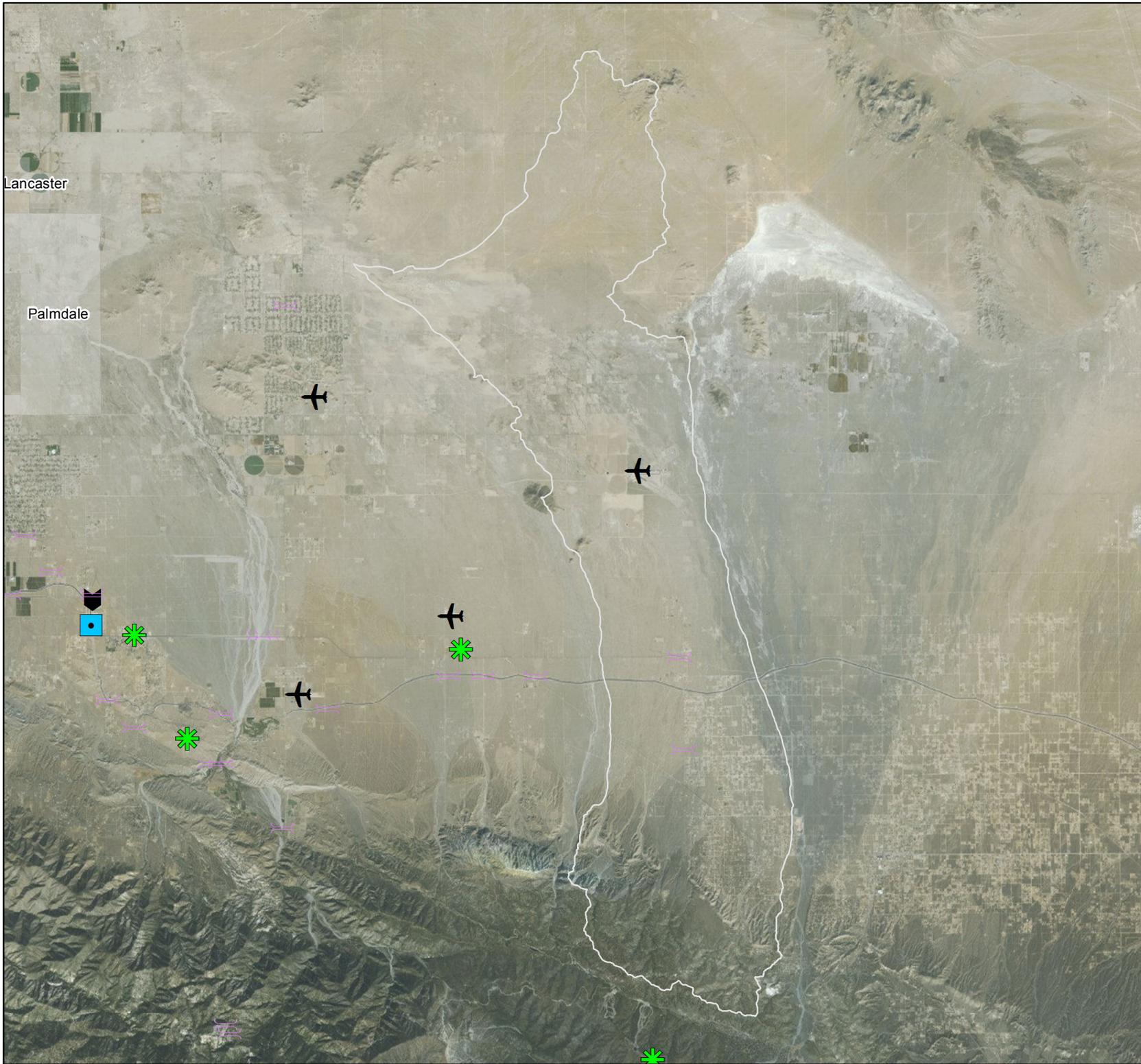
Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15





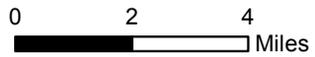
Le Montaine Creek- Eller Slough Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



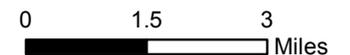
Upper Piru Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Upper Piru Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



0 1.5 3
Miles



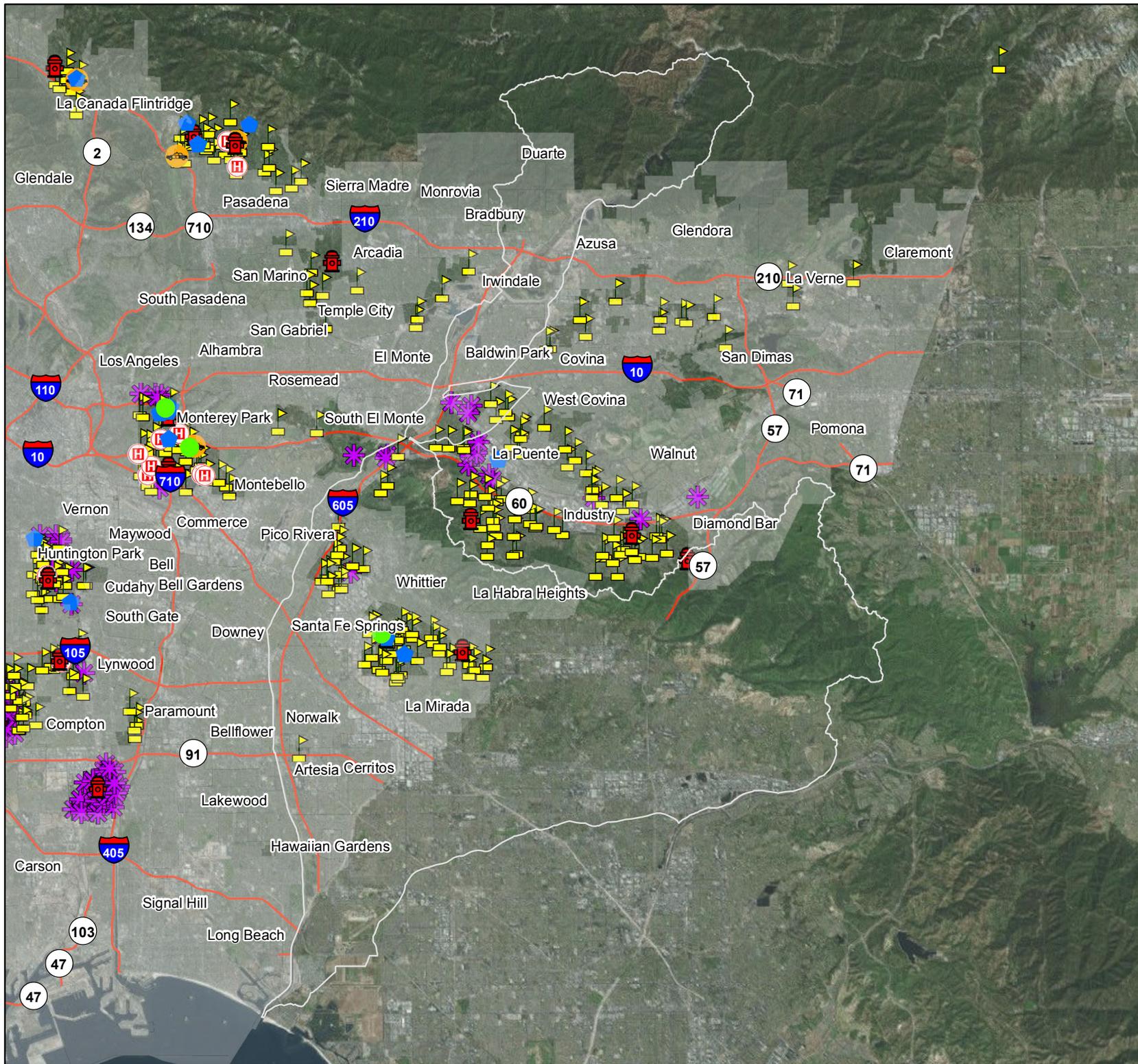
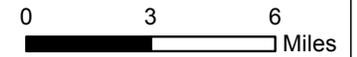
Lower San Gabriel River Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

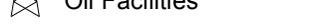
Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



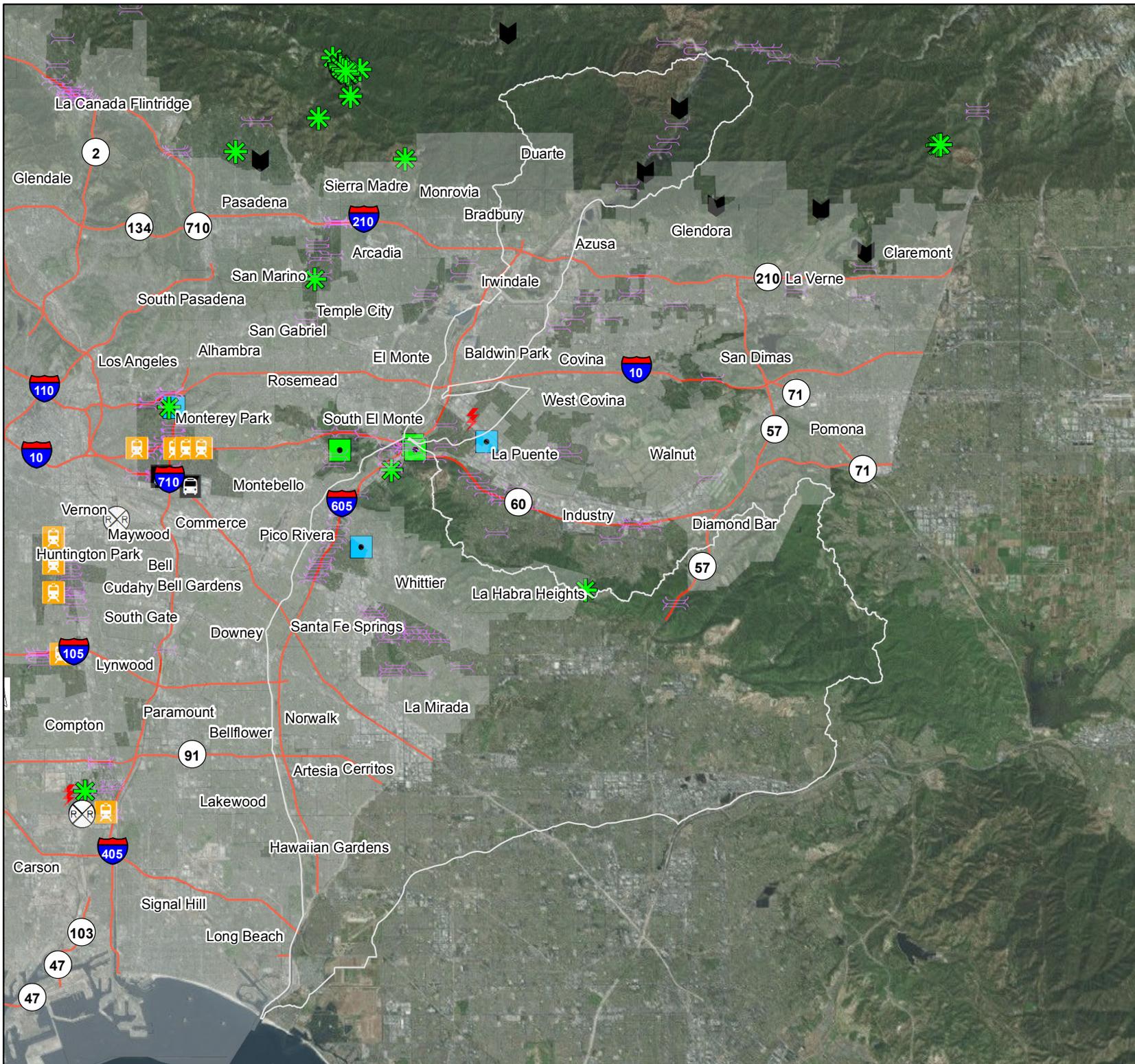
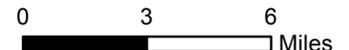
Lower San Gabriel River Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



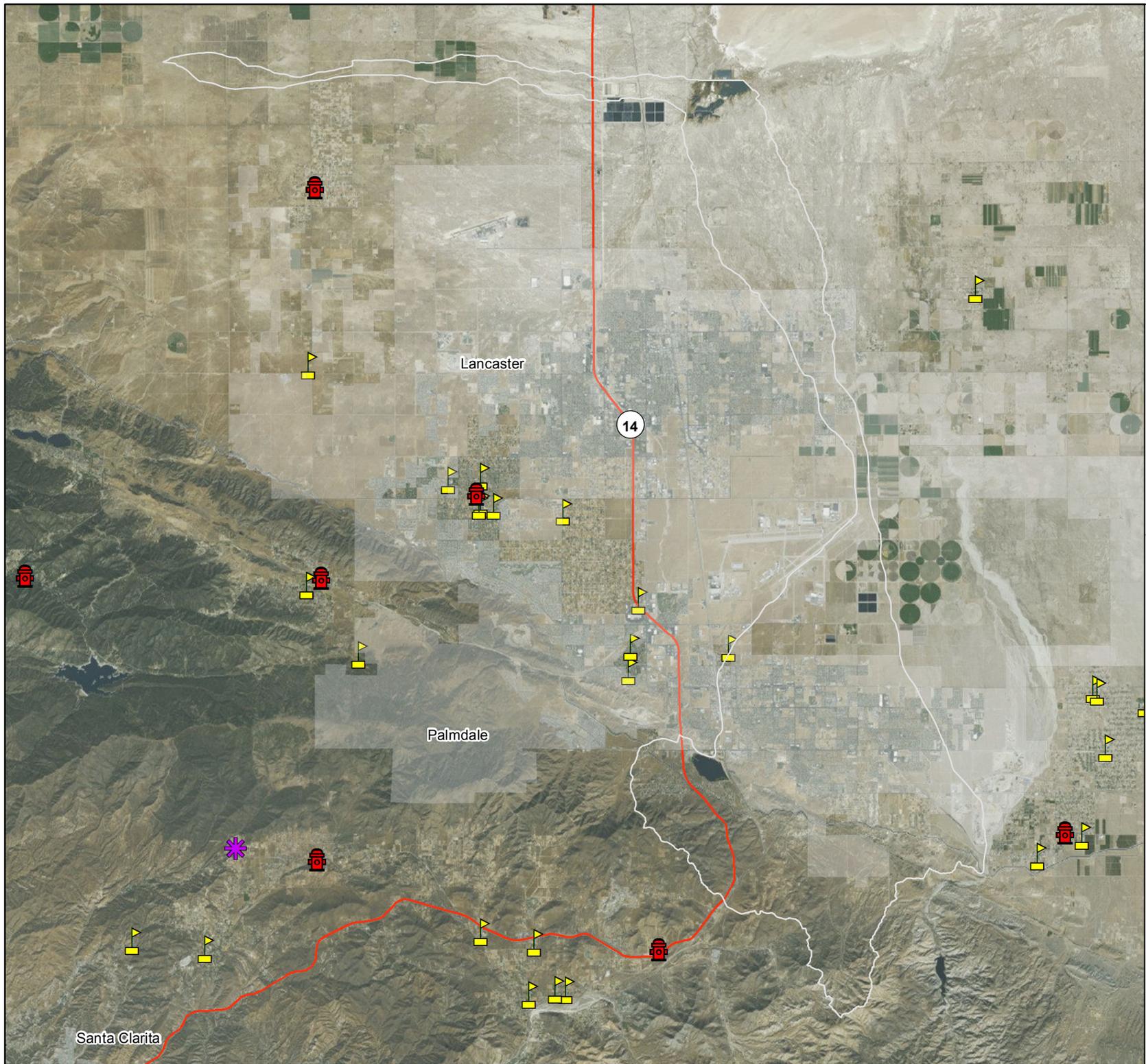
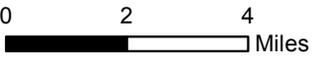
Lake Palmdale- Piute Ponds Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



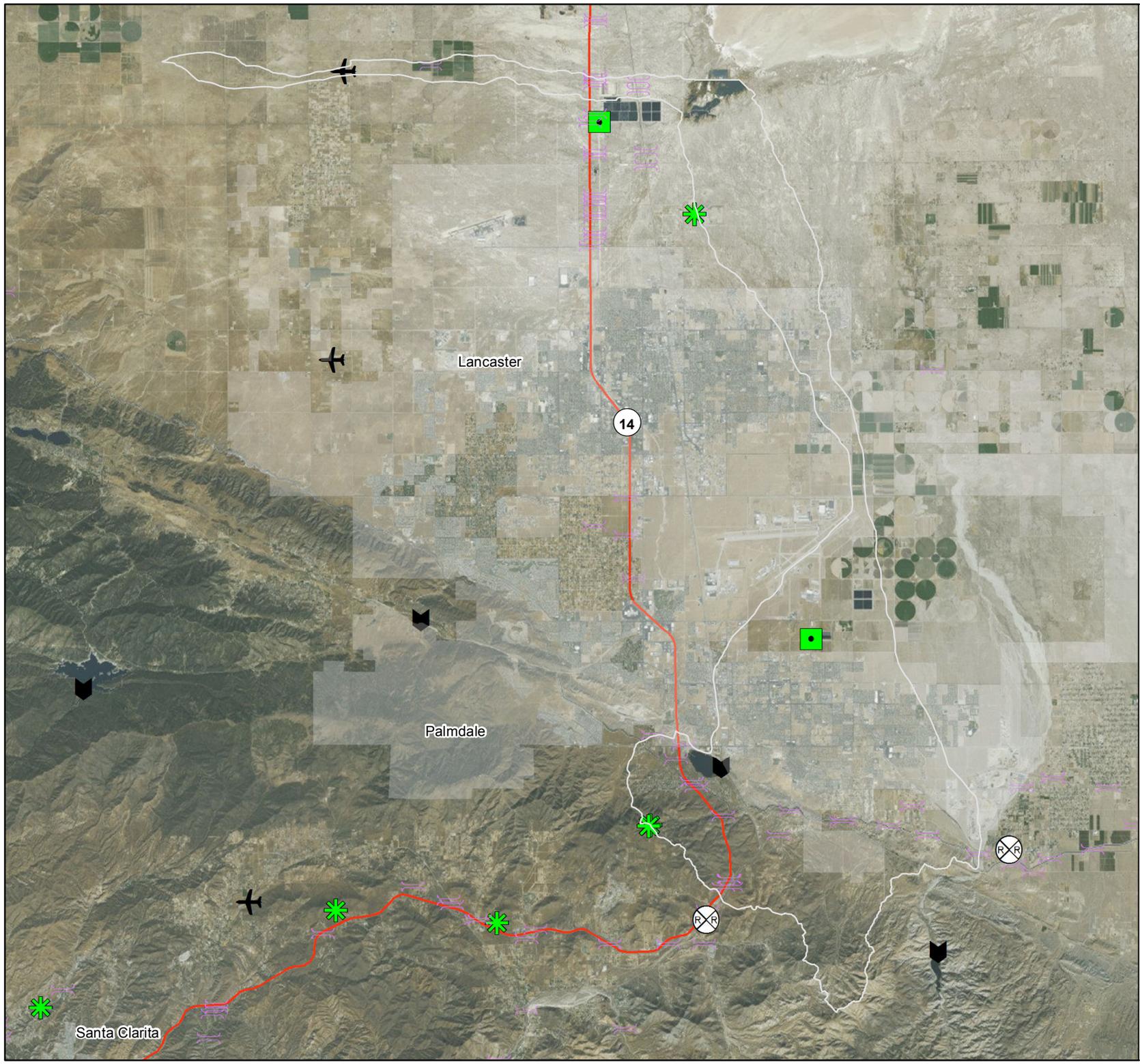
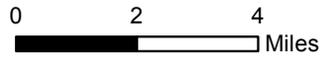
Lake Palmdale- Piute Ponds Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



Little Rock Wash Watershed

Critical Facilities

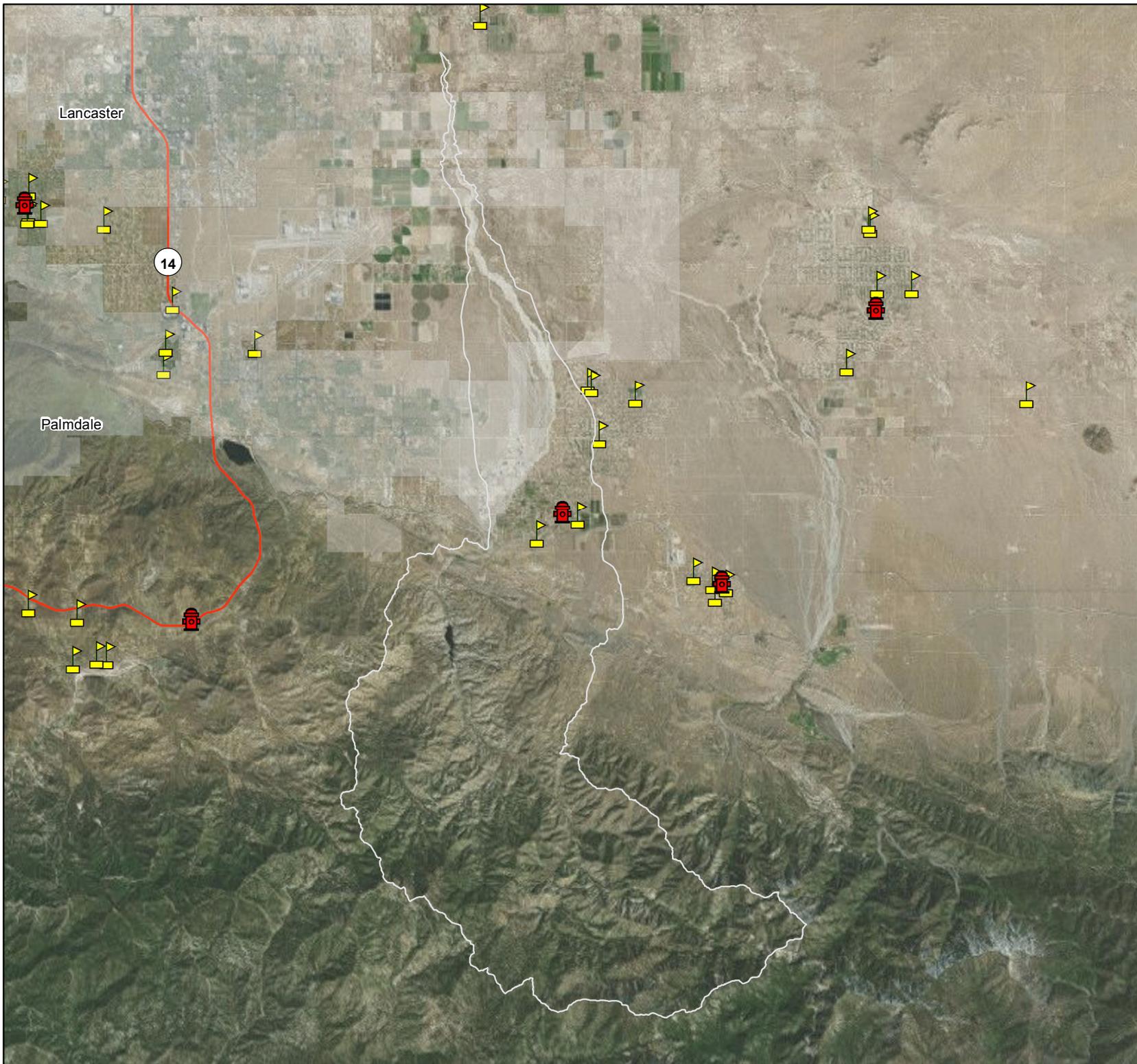
-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

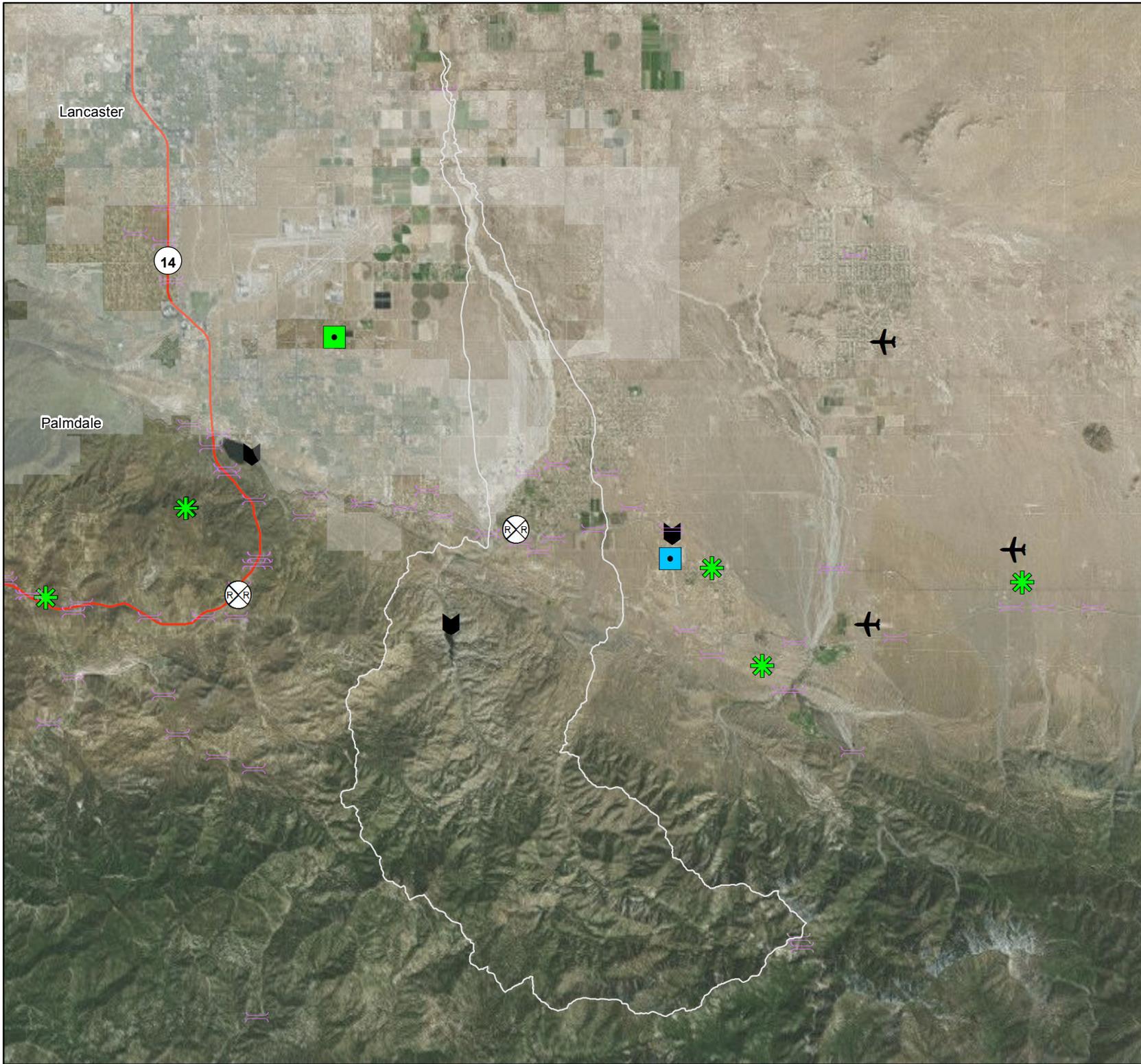
Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



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Miles





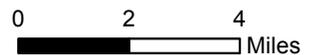
Little Rock Wash Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



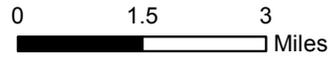
Malibu Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



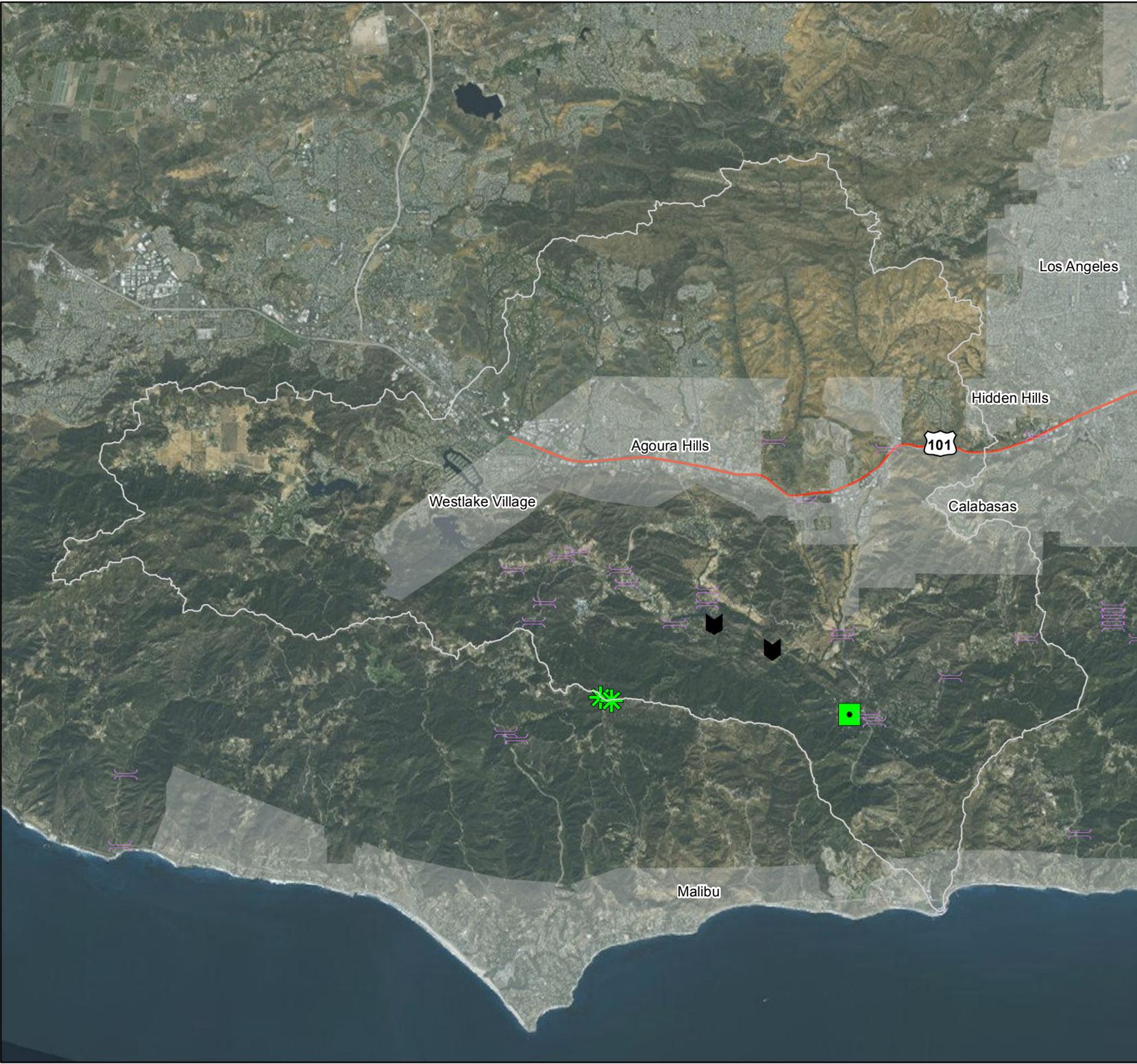
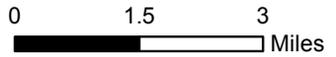
Malibu Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Mescal Creek-Rocky Buttes Watershed

Critical Facilities

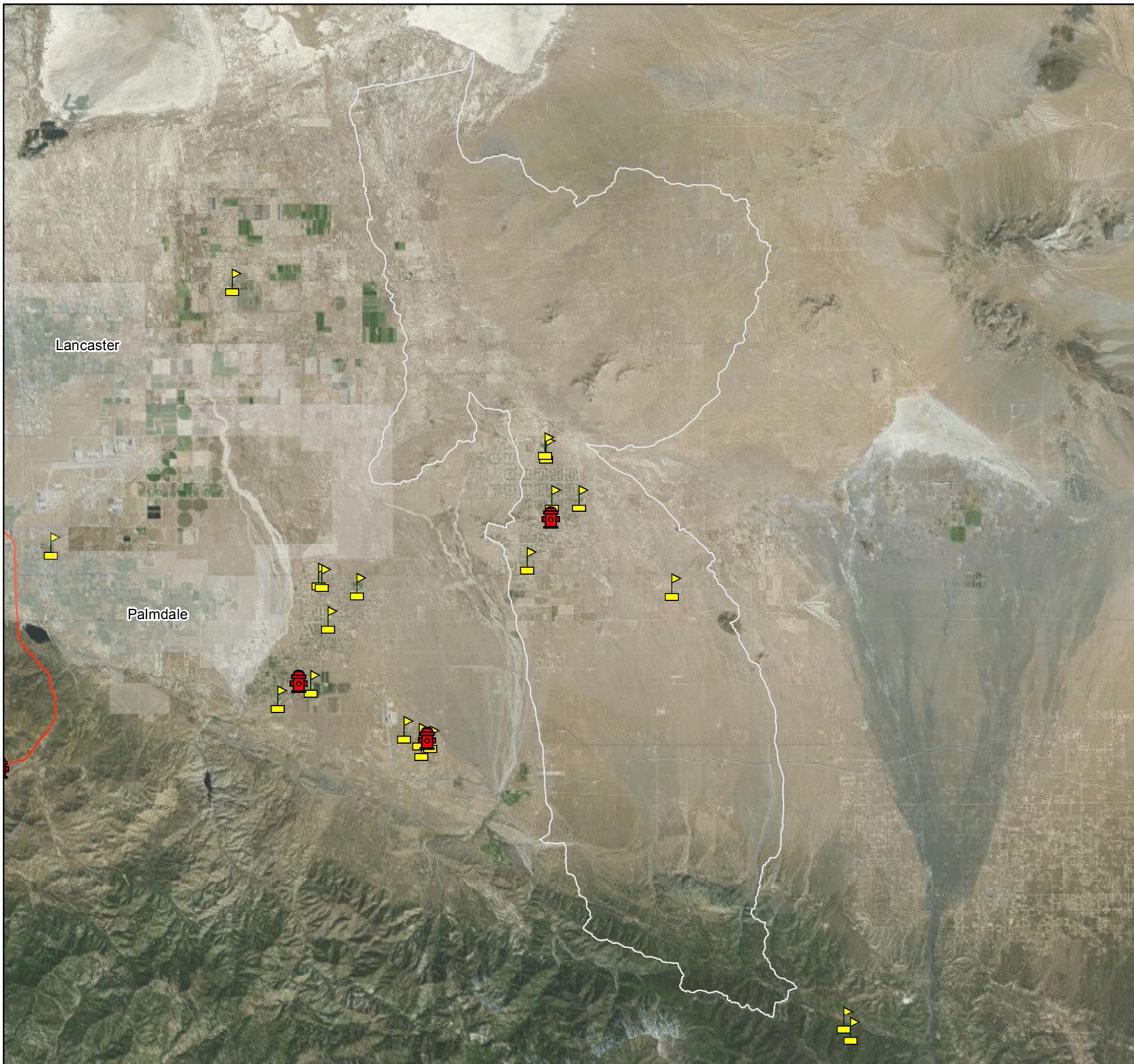
-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



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Miles



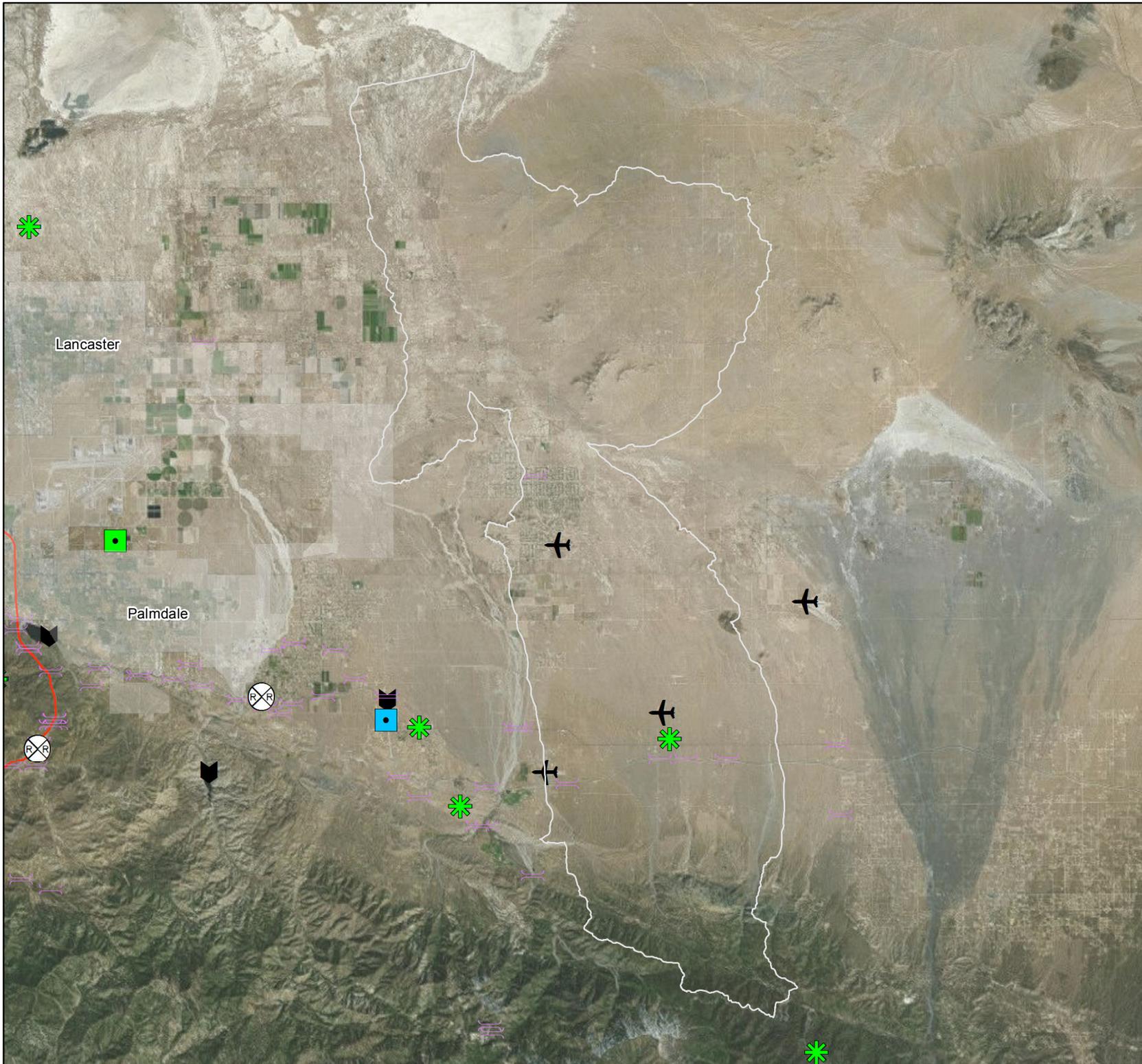
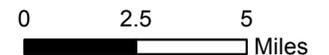
Mescal Creek-Rocky Buttes Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



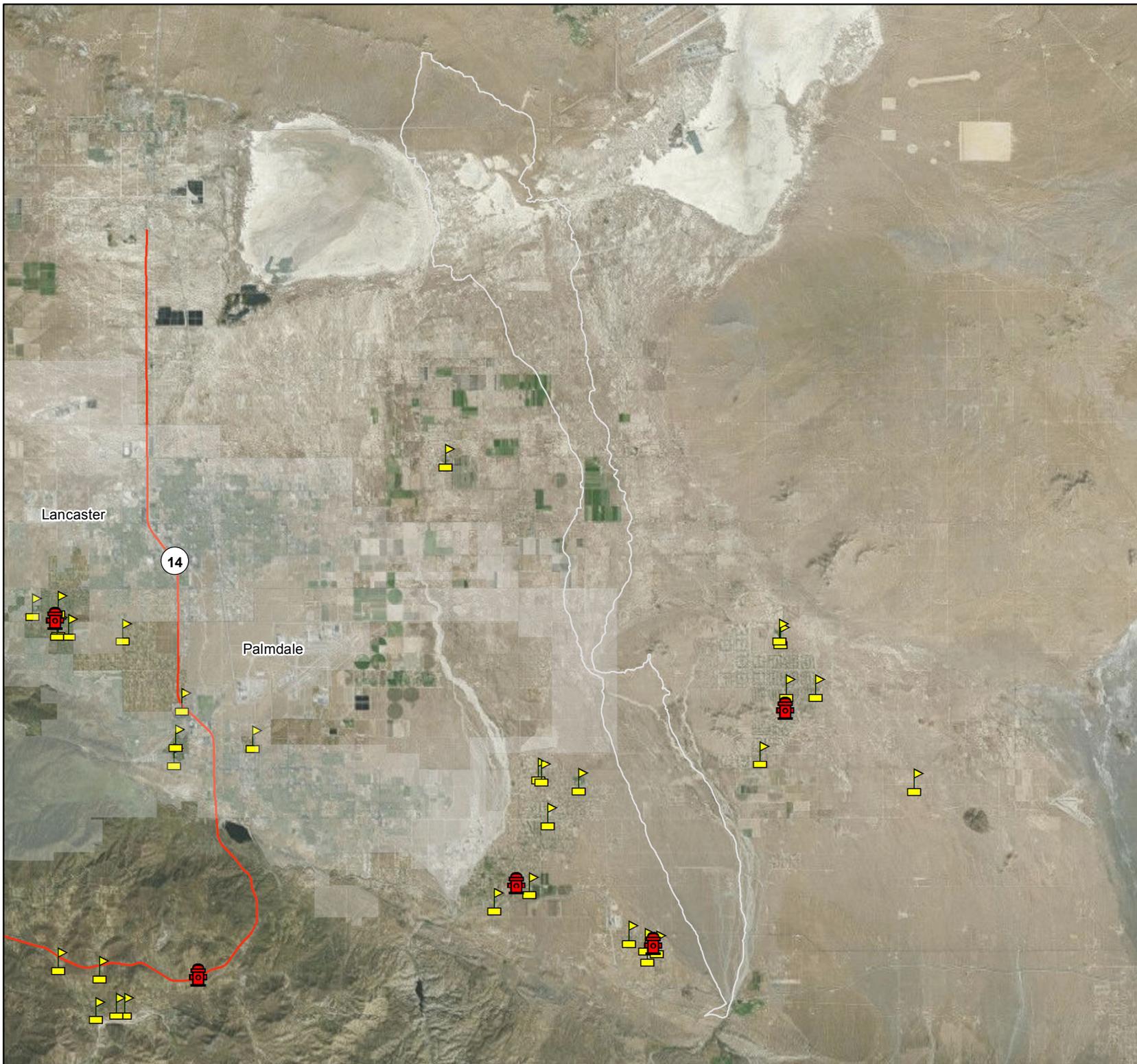
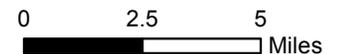
Rock Creek- Buckhorn Lake Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



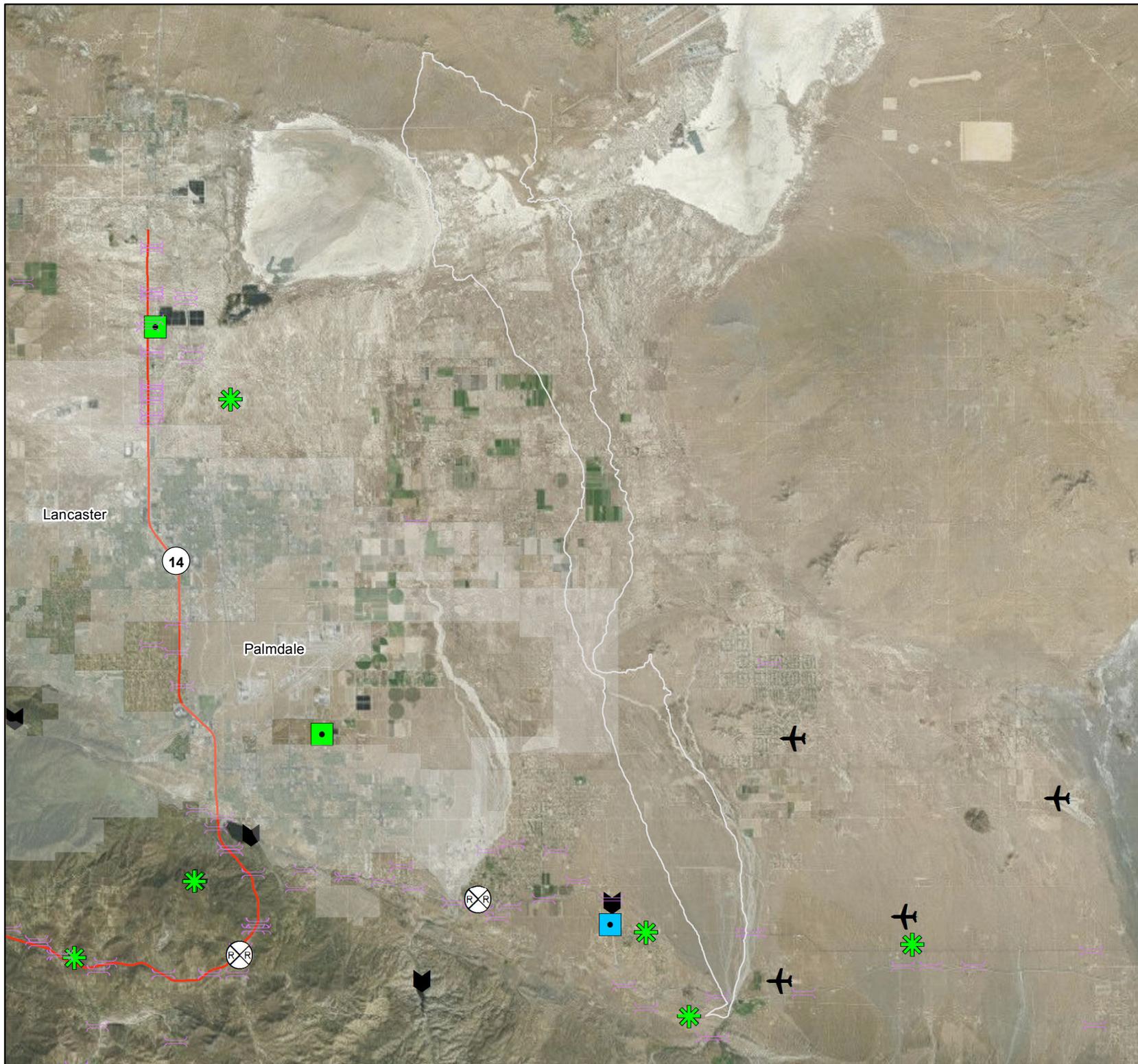
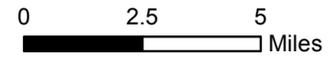
Rock Creek- Buckhorn Lake Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



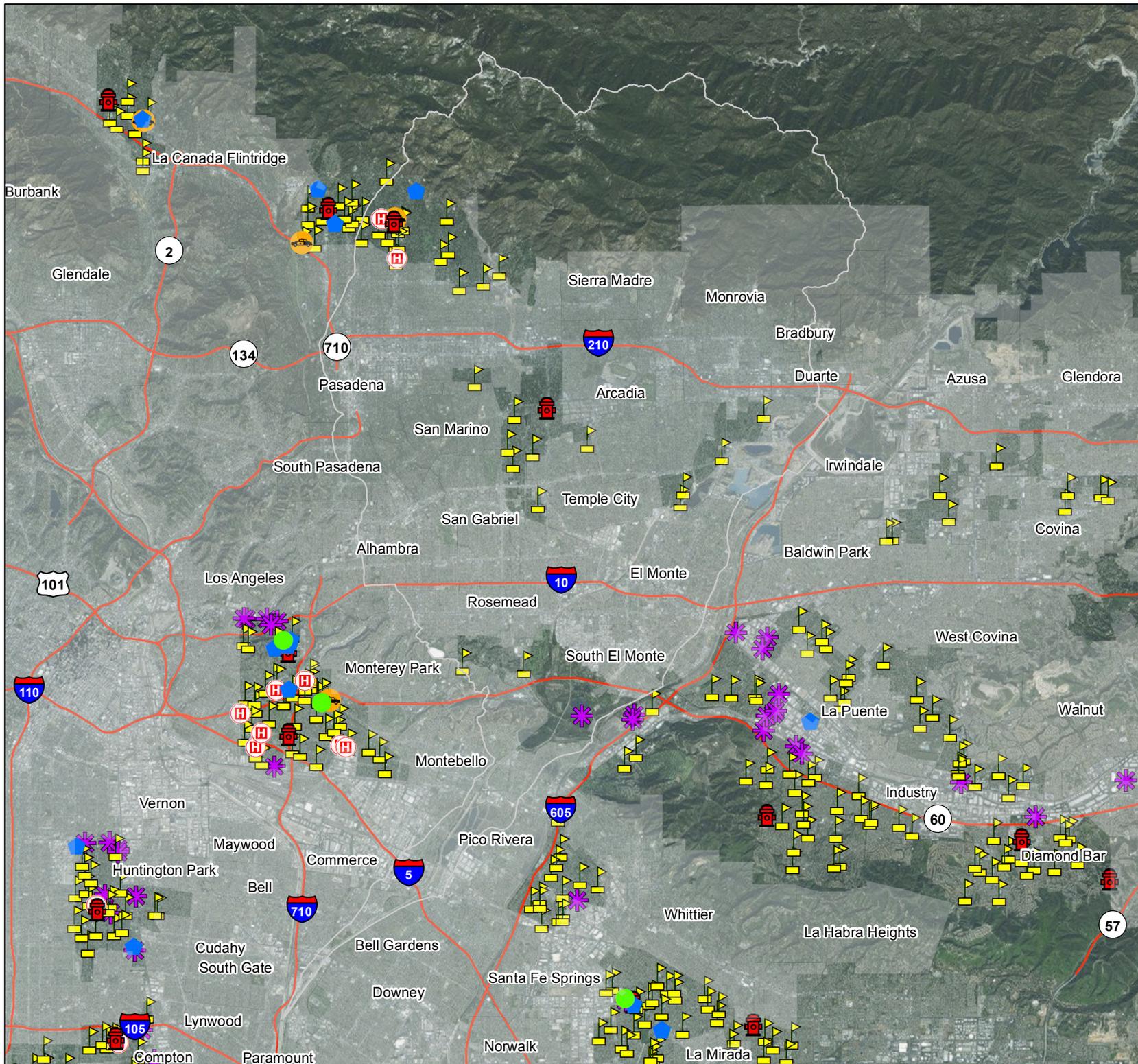
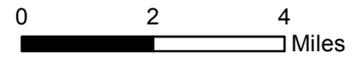
Rio Hondo Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



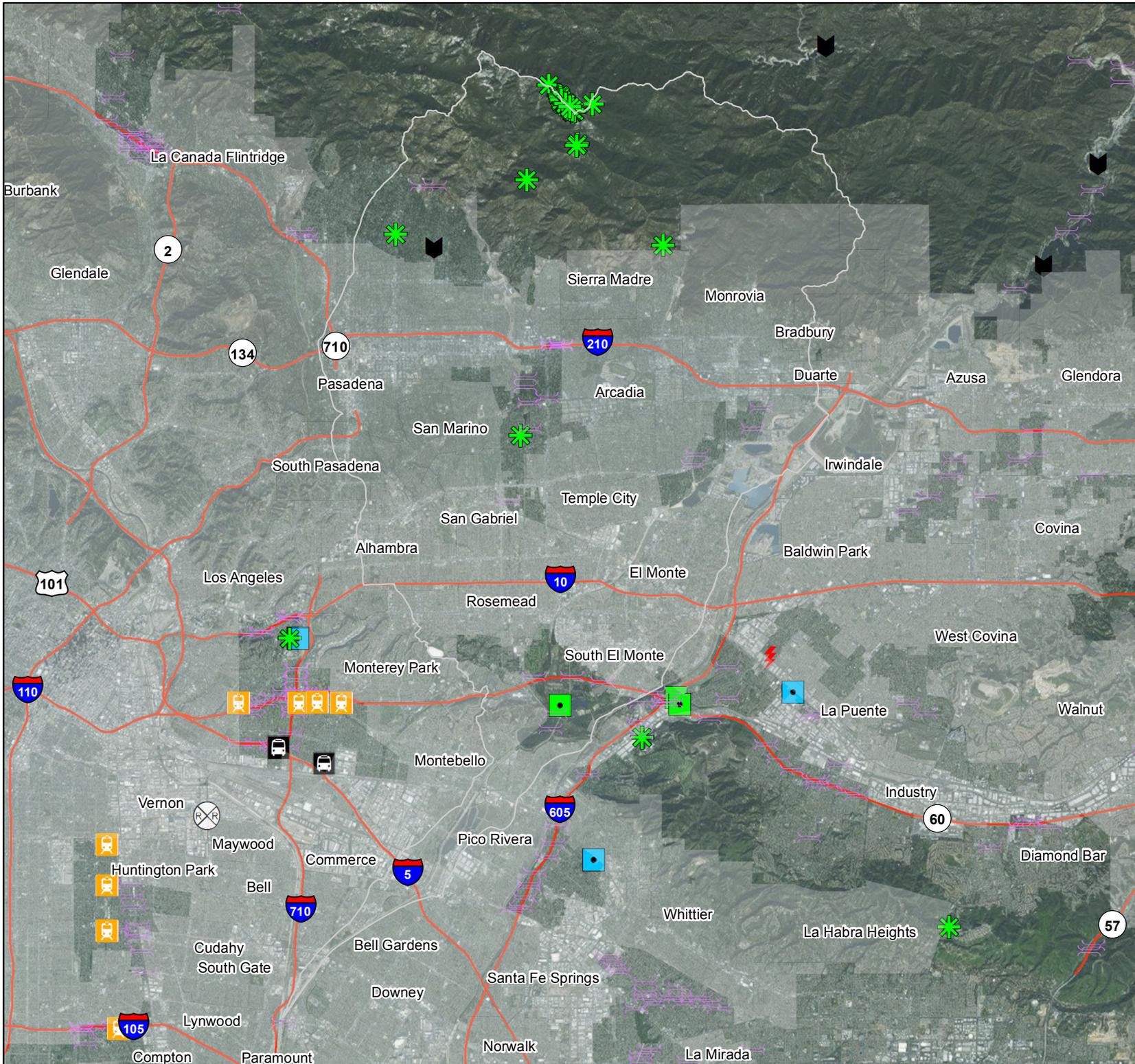
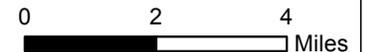
Rio Hondo Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Rogers Lake Watershed

Critical Facilities

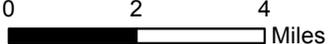
-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



0 2 4 Miles

A horizontal scale bar with markings at 0, 2, and 4 miles.



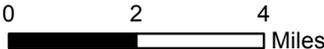
Rogers Lake Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



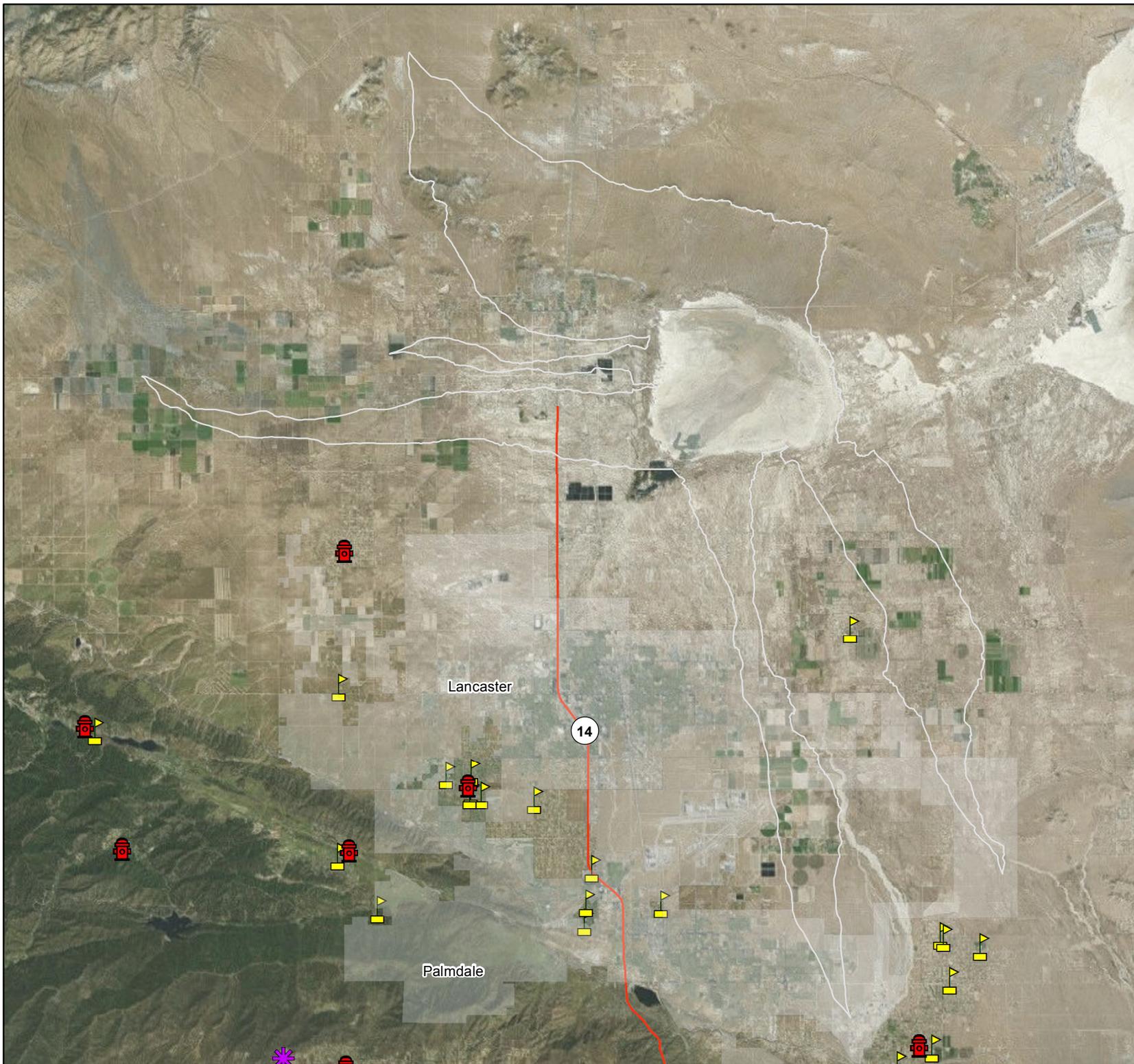
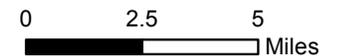
Rosamond Lake Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



Rosamond Lake Watershed

Critical Infrastructure

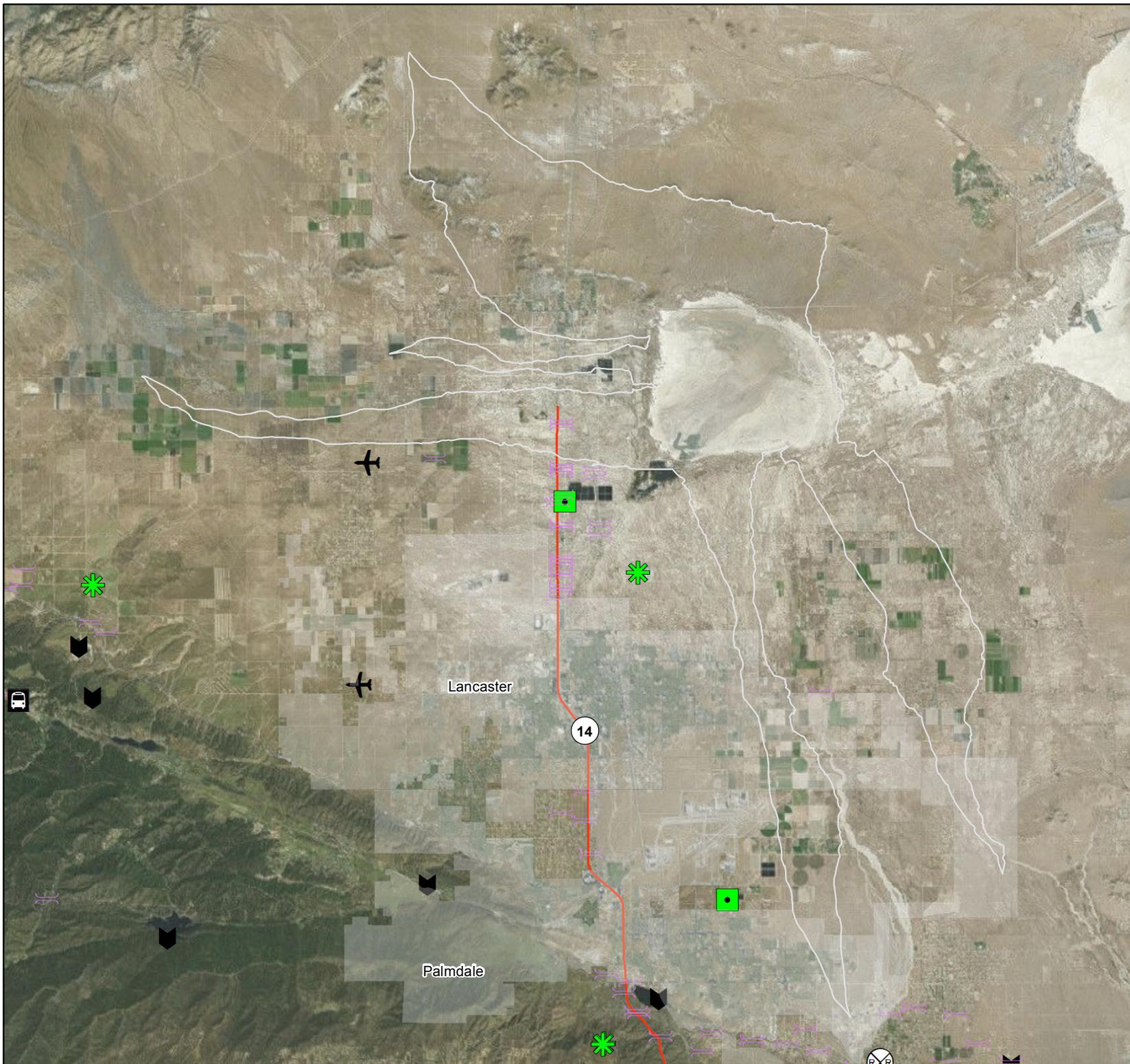
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



0 2.5 5
Miles



San Jose Creek Watershed

Critical Facilities

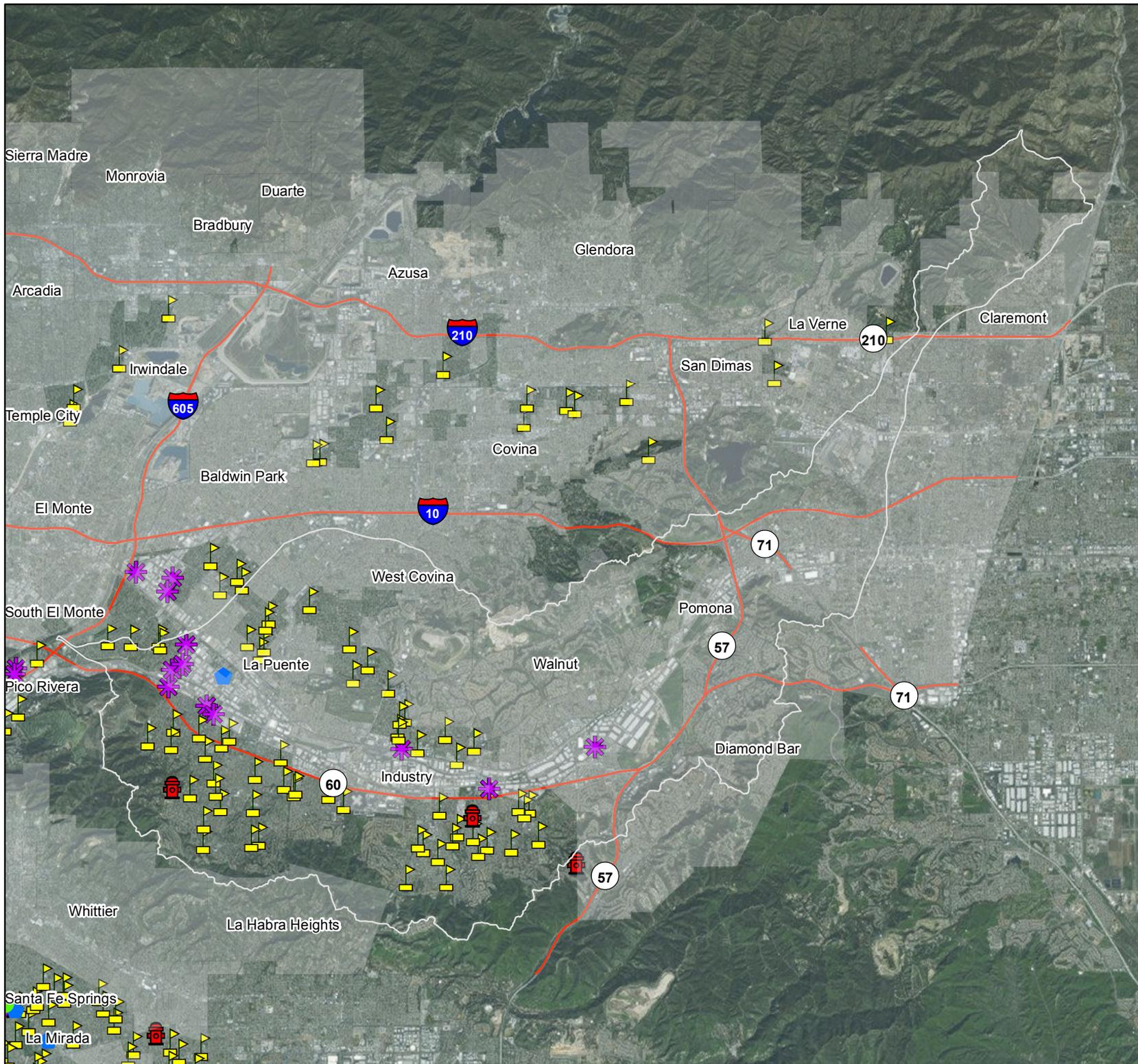
-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15

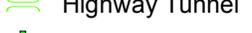
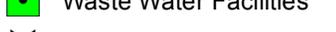


0 1.5 3
Miles



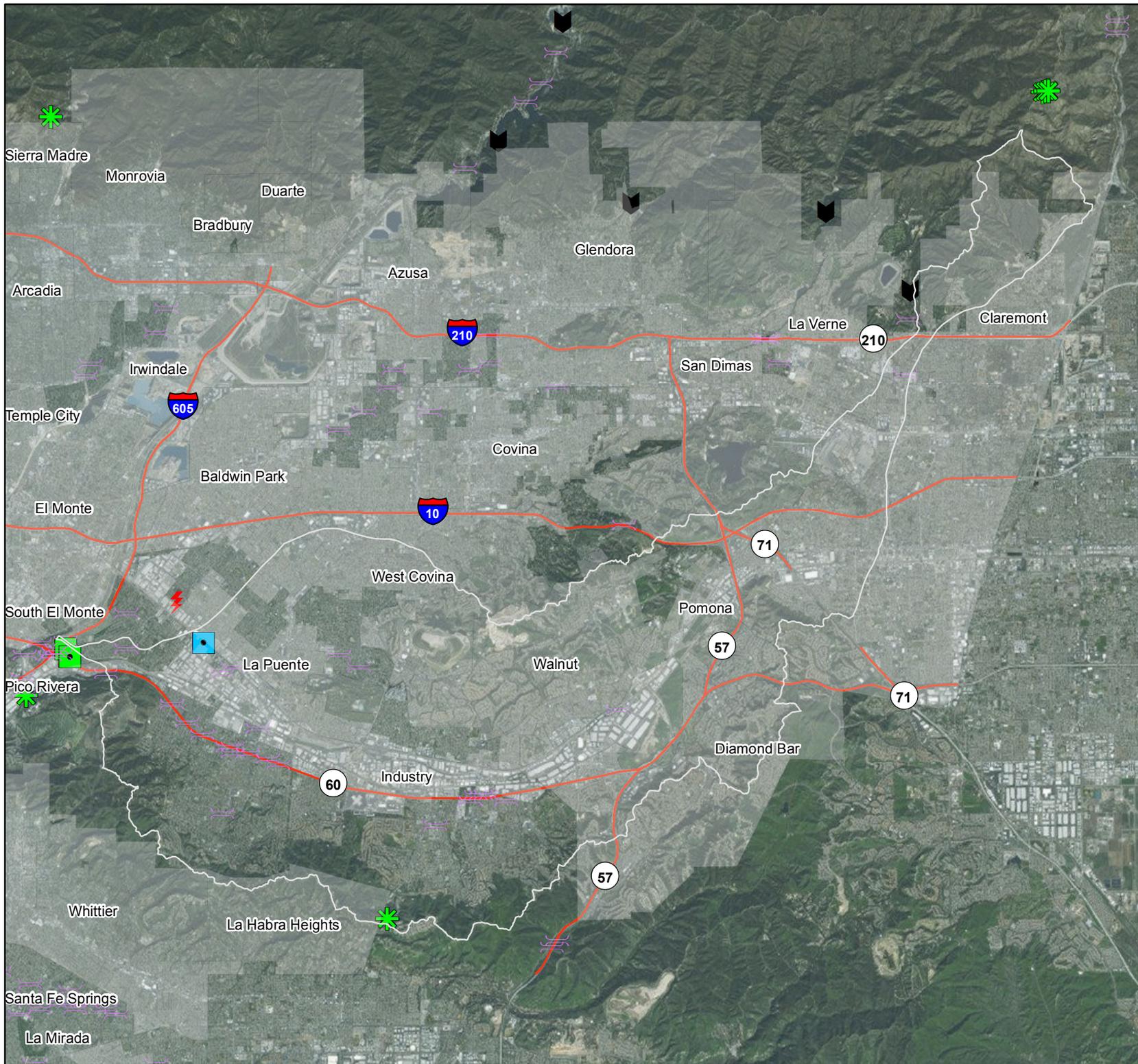
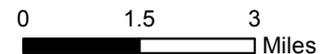
San Jose Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Sacatara Creek-Kings Canyon Watershed

Critical Facilities

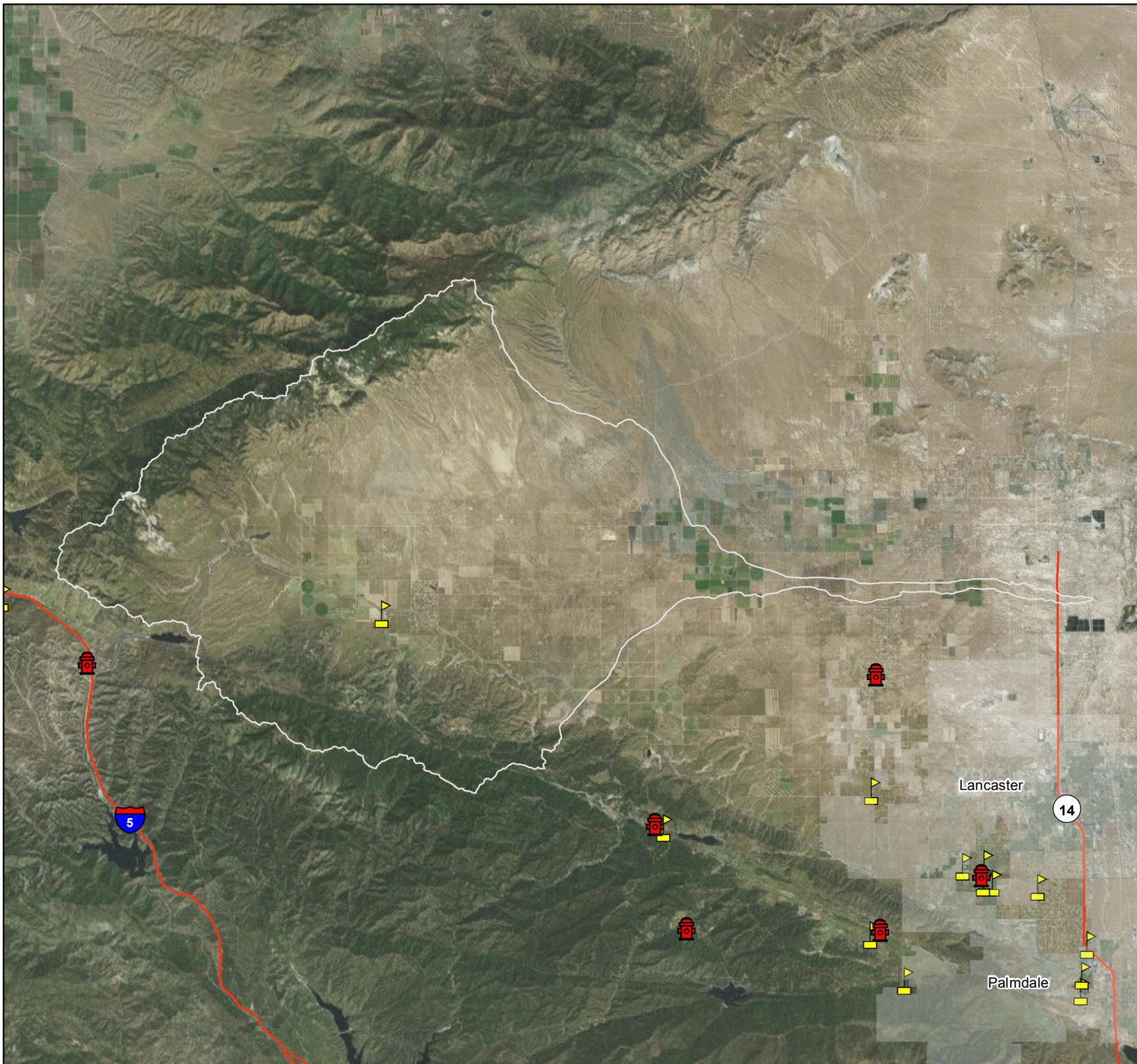
-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



0 2.5 5
Miles



Sacatara Creek-Kings Canyon Watershed

Critical Infrastructure

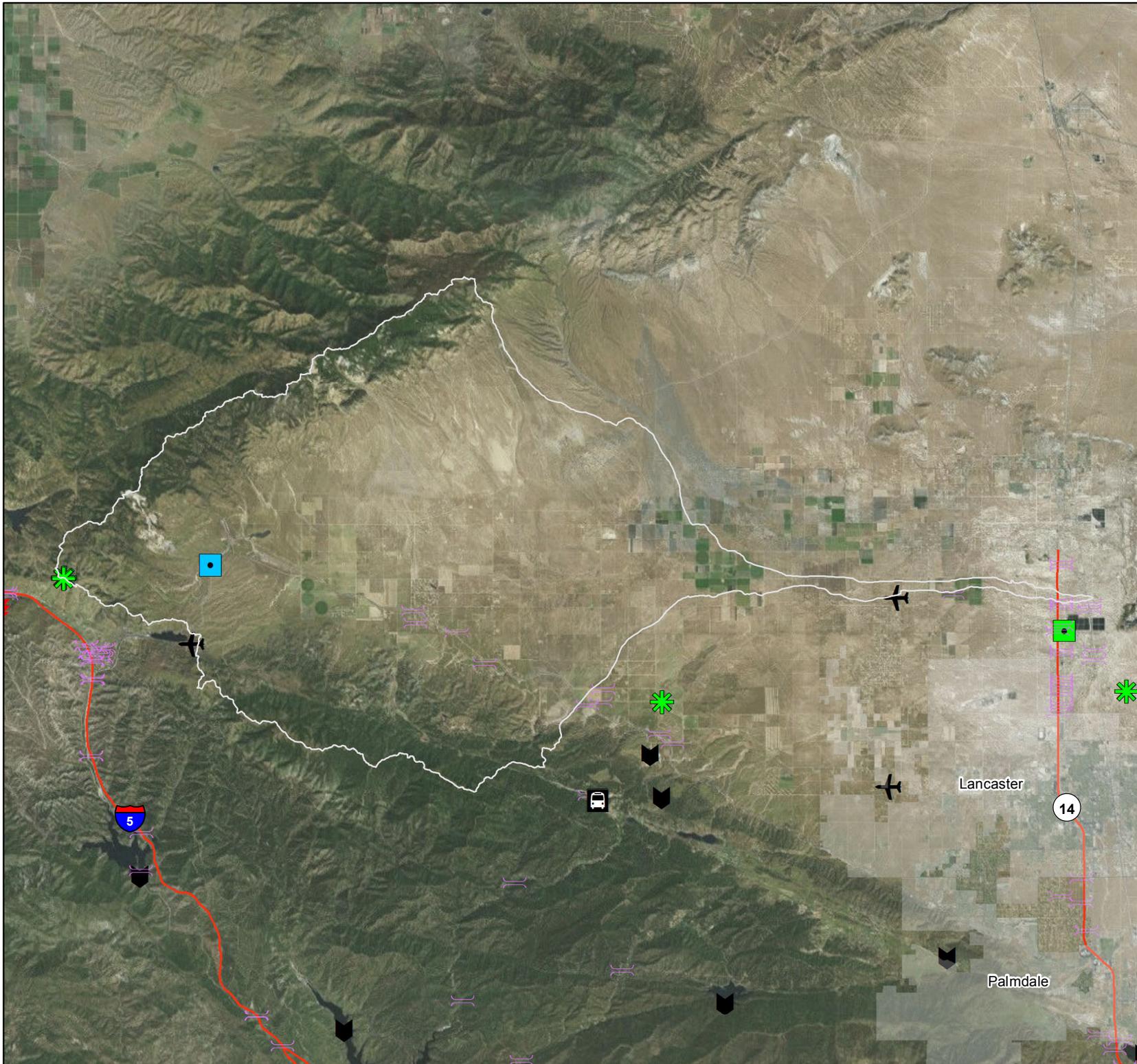
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/8/15



0 2.5 5
Miles



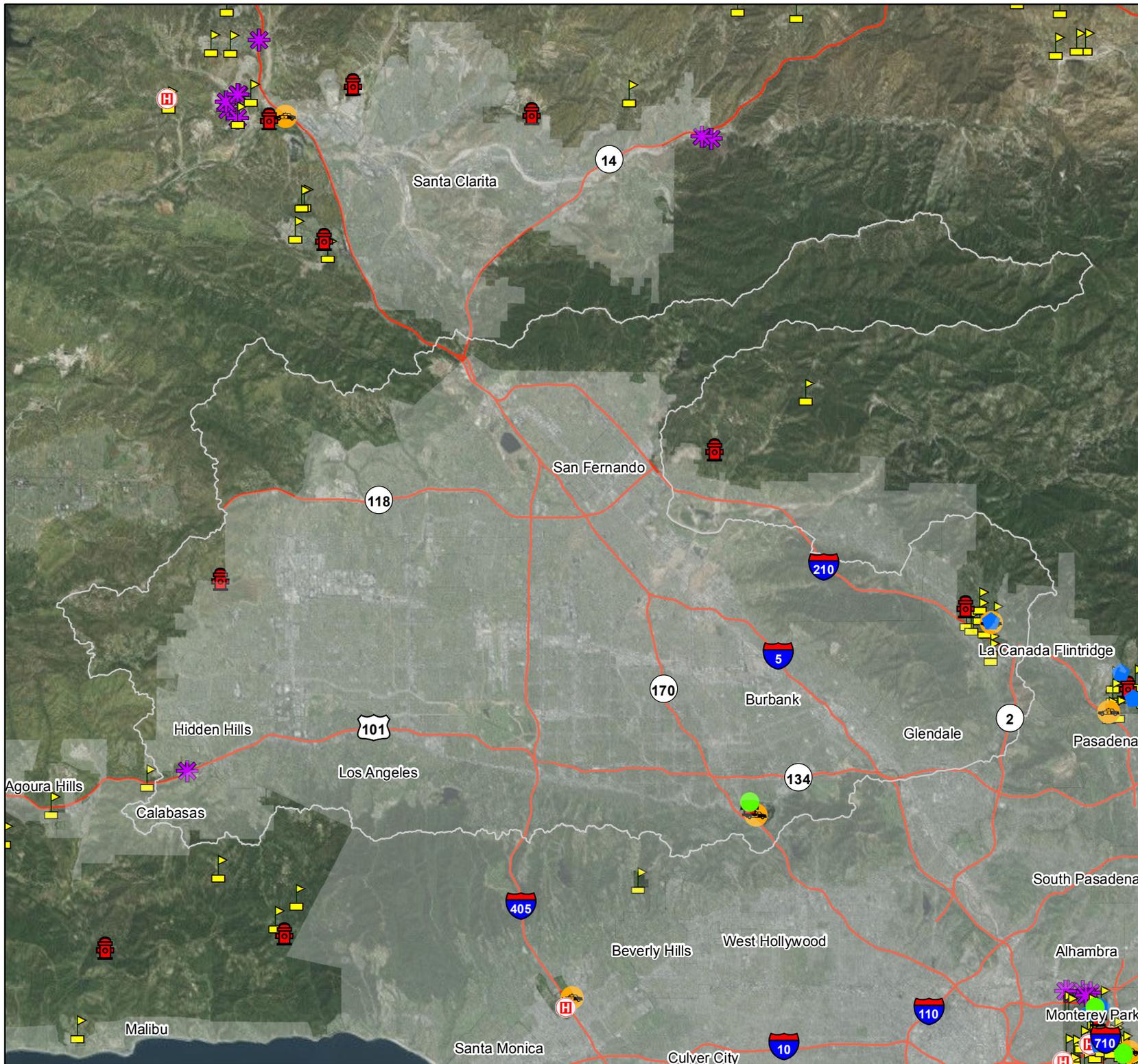
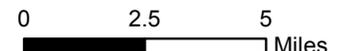
Upper Los Angeles River Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Upper Los Angeles River Watershed

Critical Infrastructure

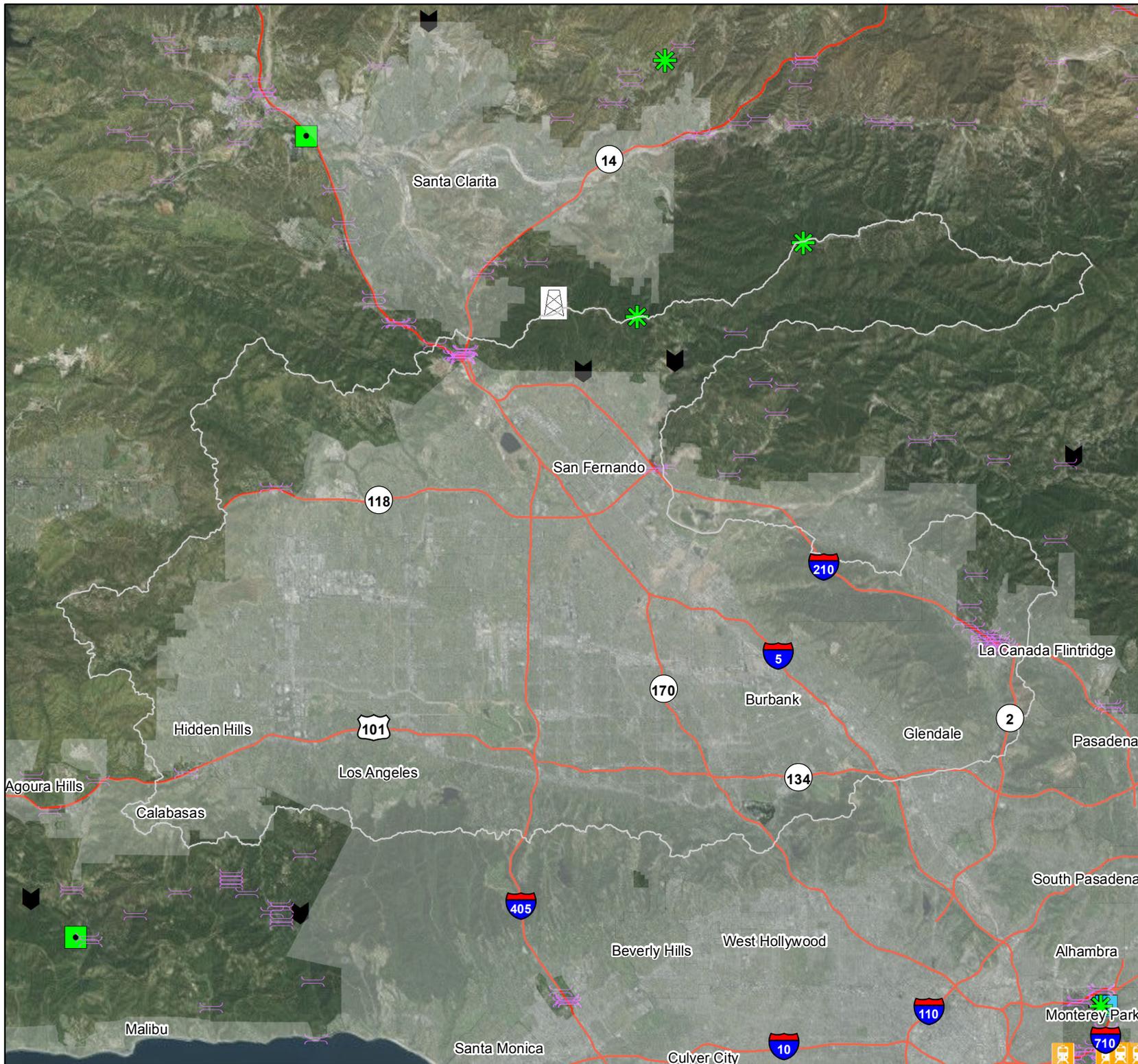
-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



0 2.5 5
Miles



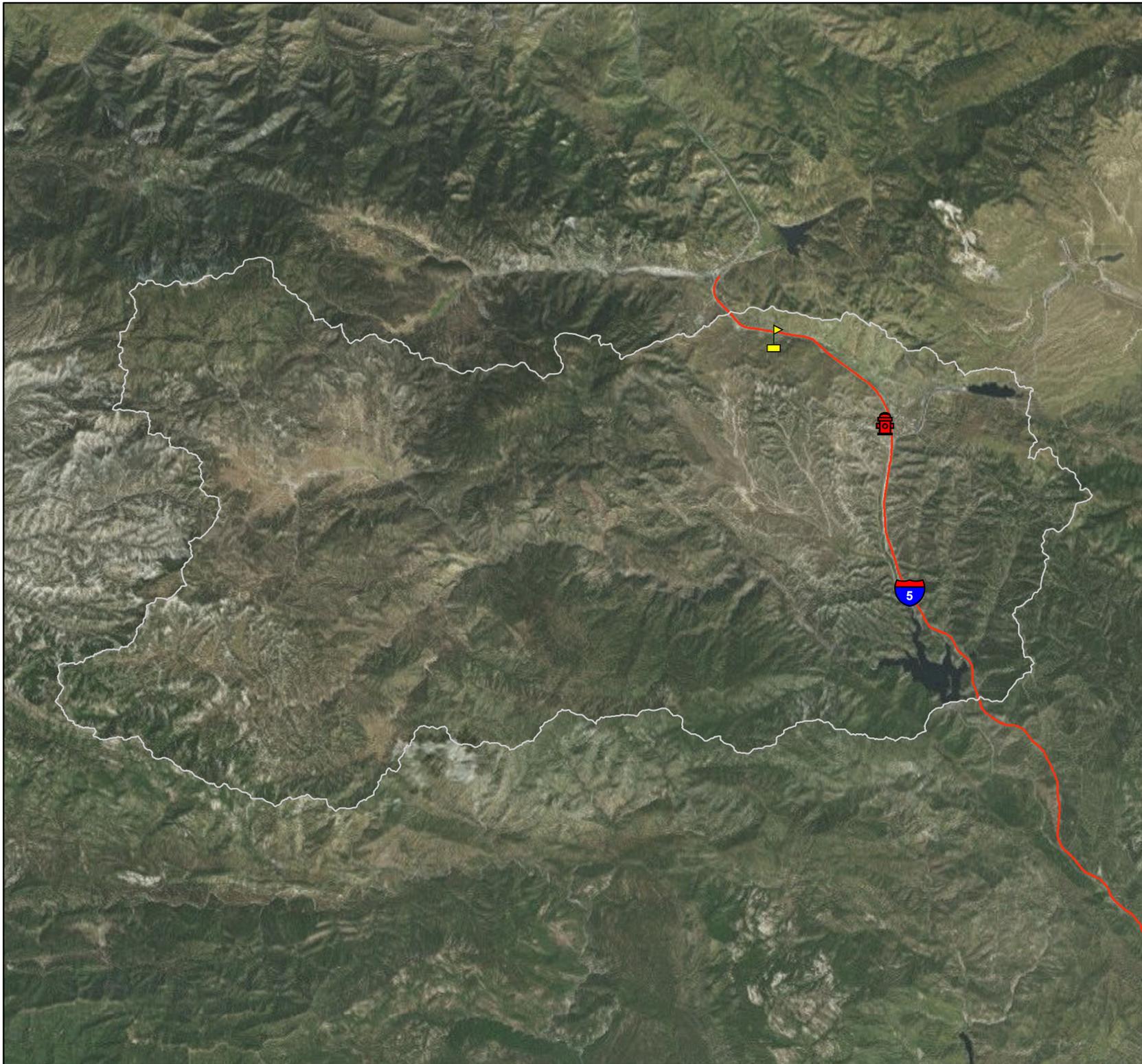
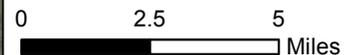
Upper Piru Creek Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



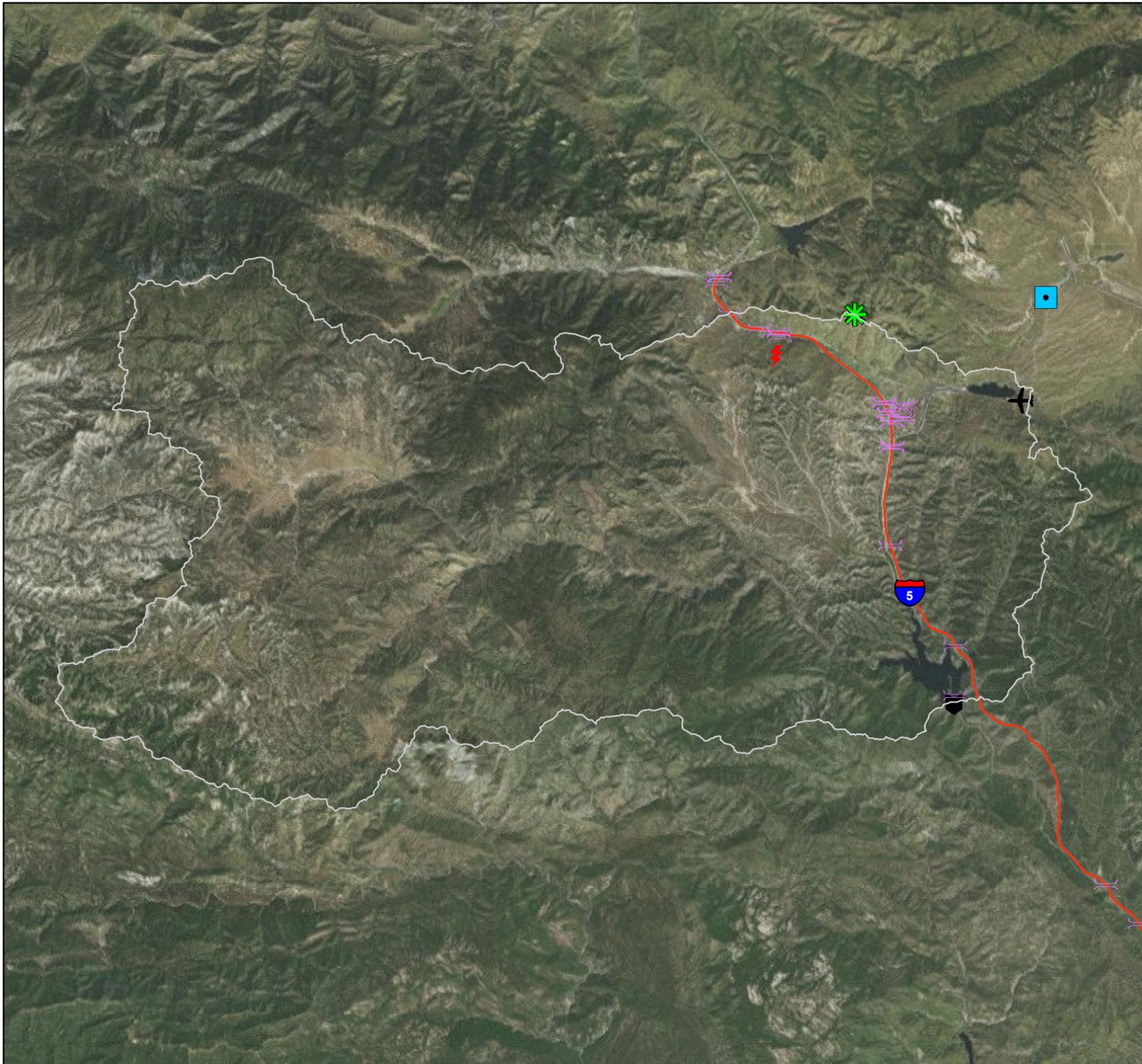
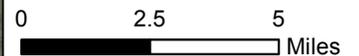
Upper Piru Creek Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



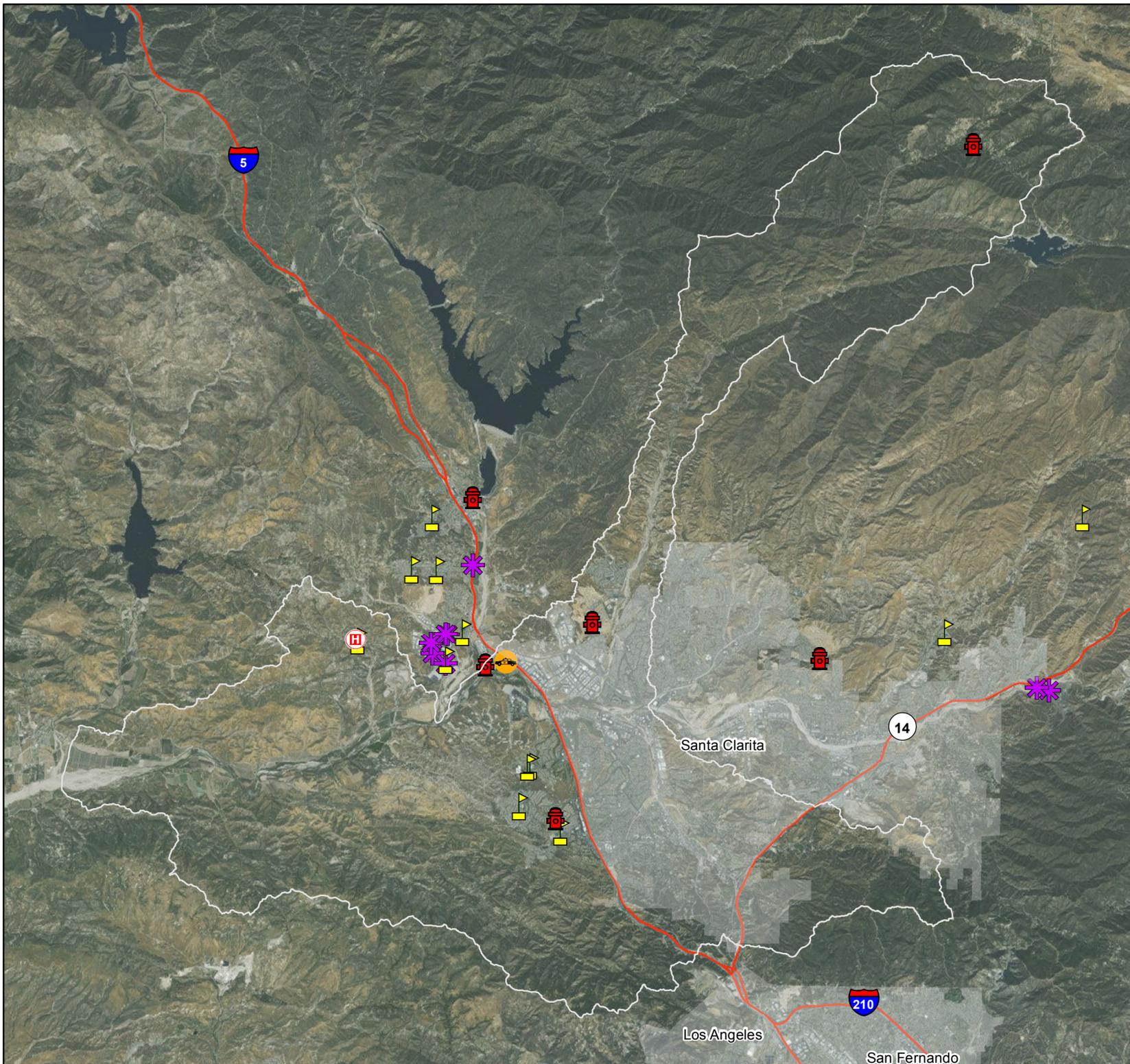
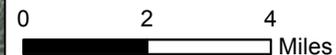
Upper Santa Clara River Watershed

Critical Facilities

-  Incorporated Cities
-  Watershed Boundary
-  EOC Facilities
-  Other
-  Fire Stations
-  Medical Care Facilities
-  Police Stations
-  Schools
-  Hazardous Materials

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



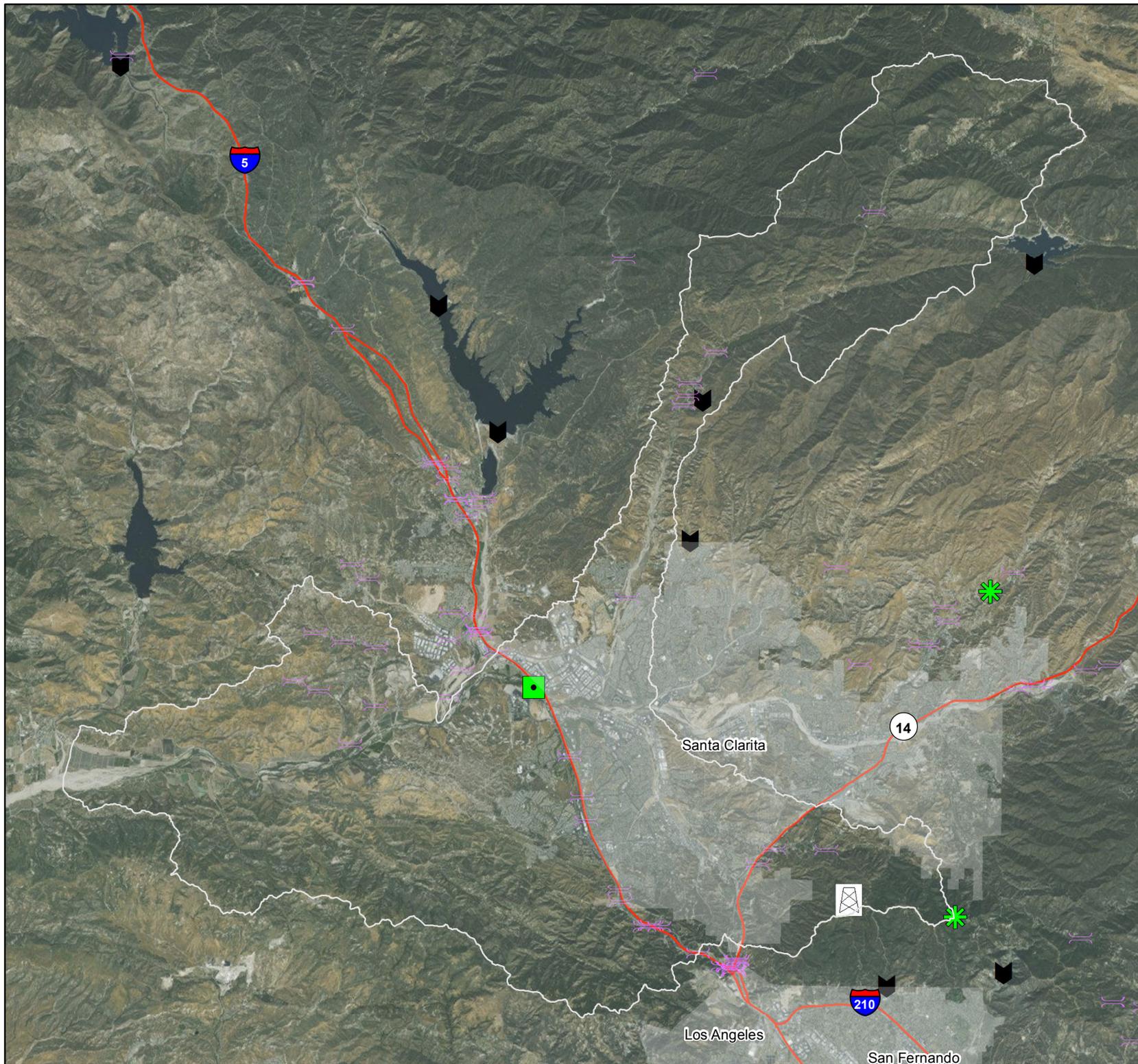
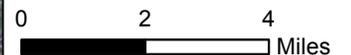
Upper Santa Clara River Watershed

Critical Infrastructure

-  Incorporated Cities
-  Watershed Boundary
-  Airports
-  Bus Facilities
-  Rail Facilities
-  Light Rail Facilities
-  Ferry Facilities
-  Bridges
-  Highway Tunnel
-  Communication Facilities
-  Electric Power Facilities
-  Oil Facilities
-  Potable Water Facilities
-  Waste Water Facilities
-  Dams

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 6/5/15



Los Angeles County
Comprehensive Floodplain Management Plan

**APPENDIX F.
FEMA FLOOD ZONE MAPS**

1809020616 Watershed

FEMA DFIRM Flood Hazard Areas

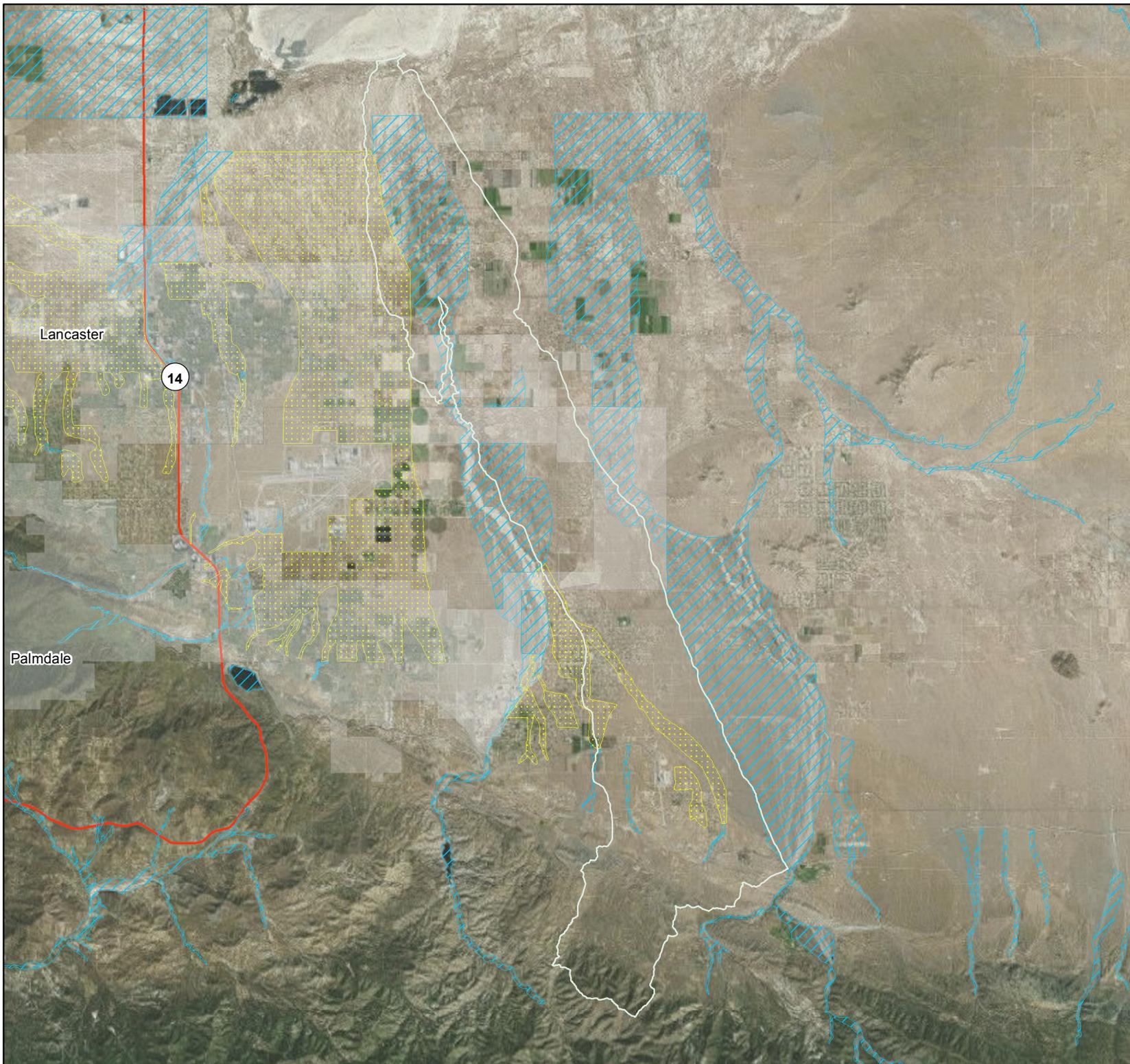
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created:5/28/15



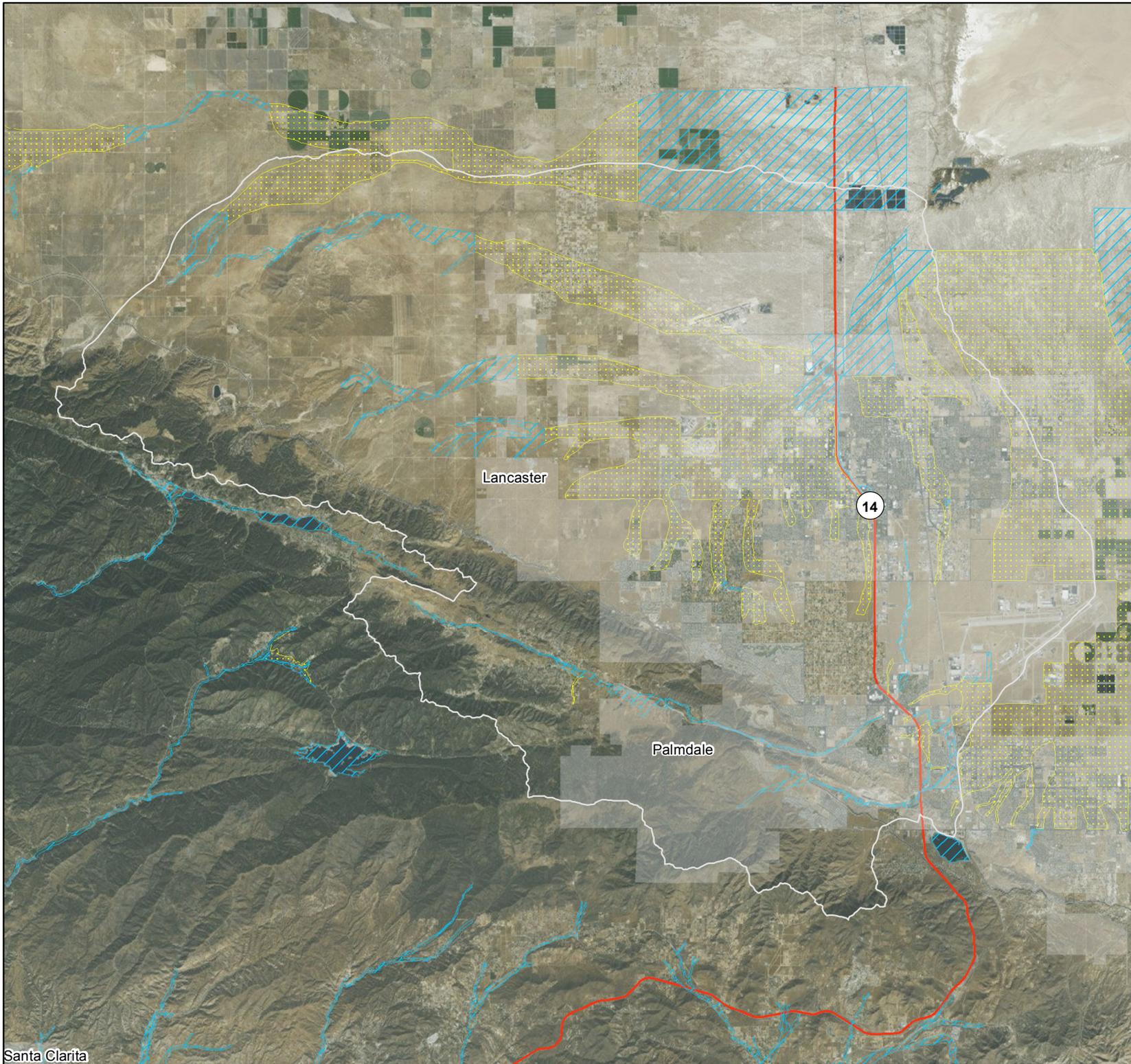
0 2 4
Miles



Amargosa Creek Watershed

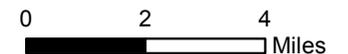
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



Santa Clarita

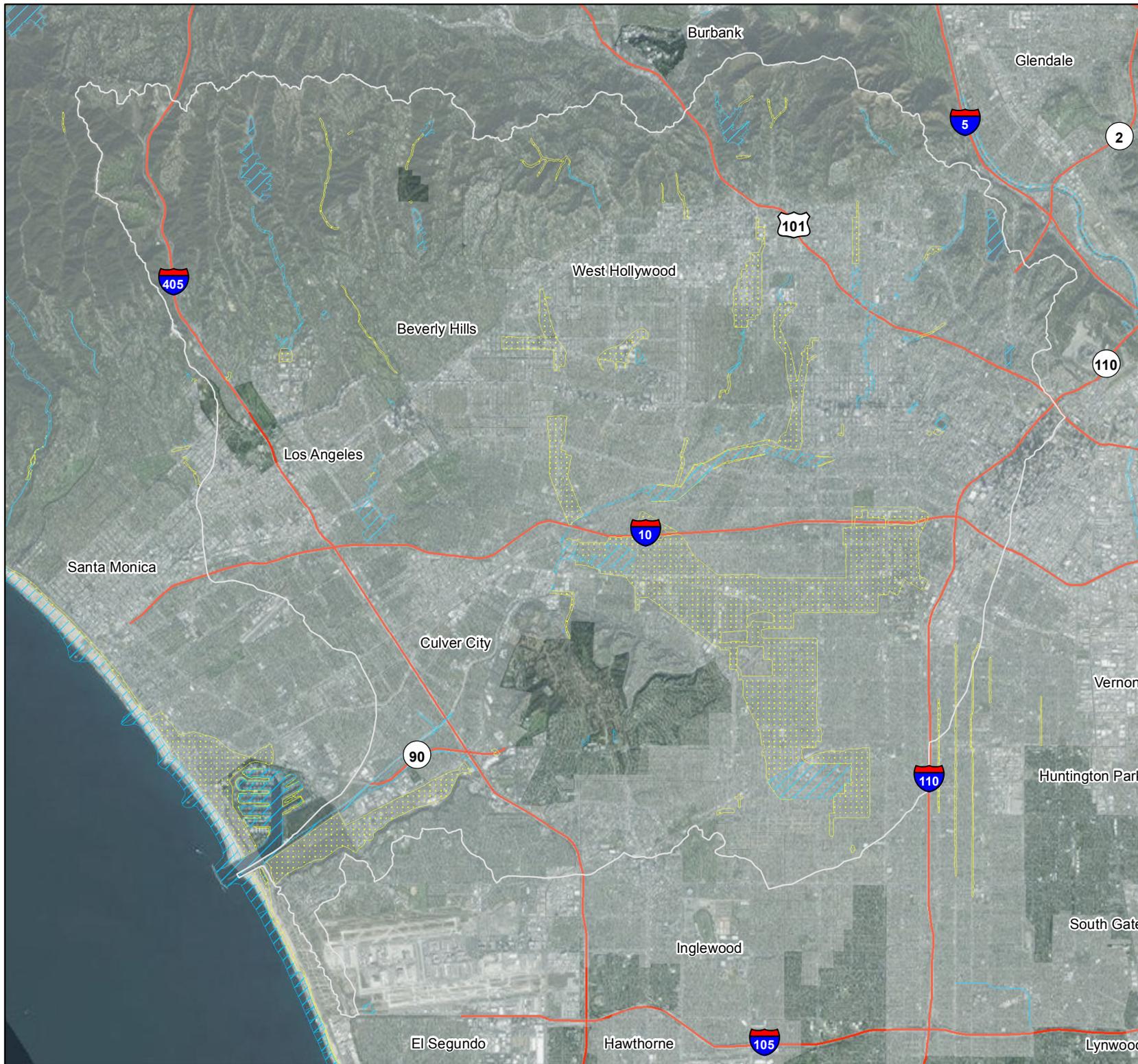
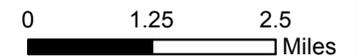
Ballona Creek Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Big Tujunga Creek Watershed

FEMA DFIRM Flood Hazard Areas

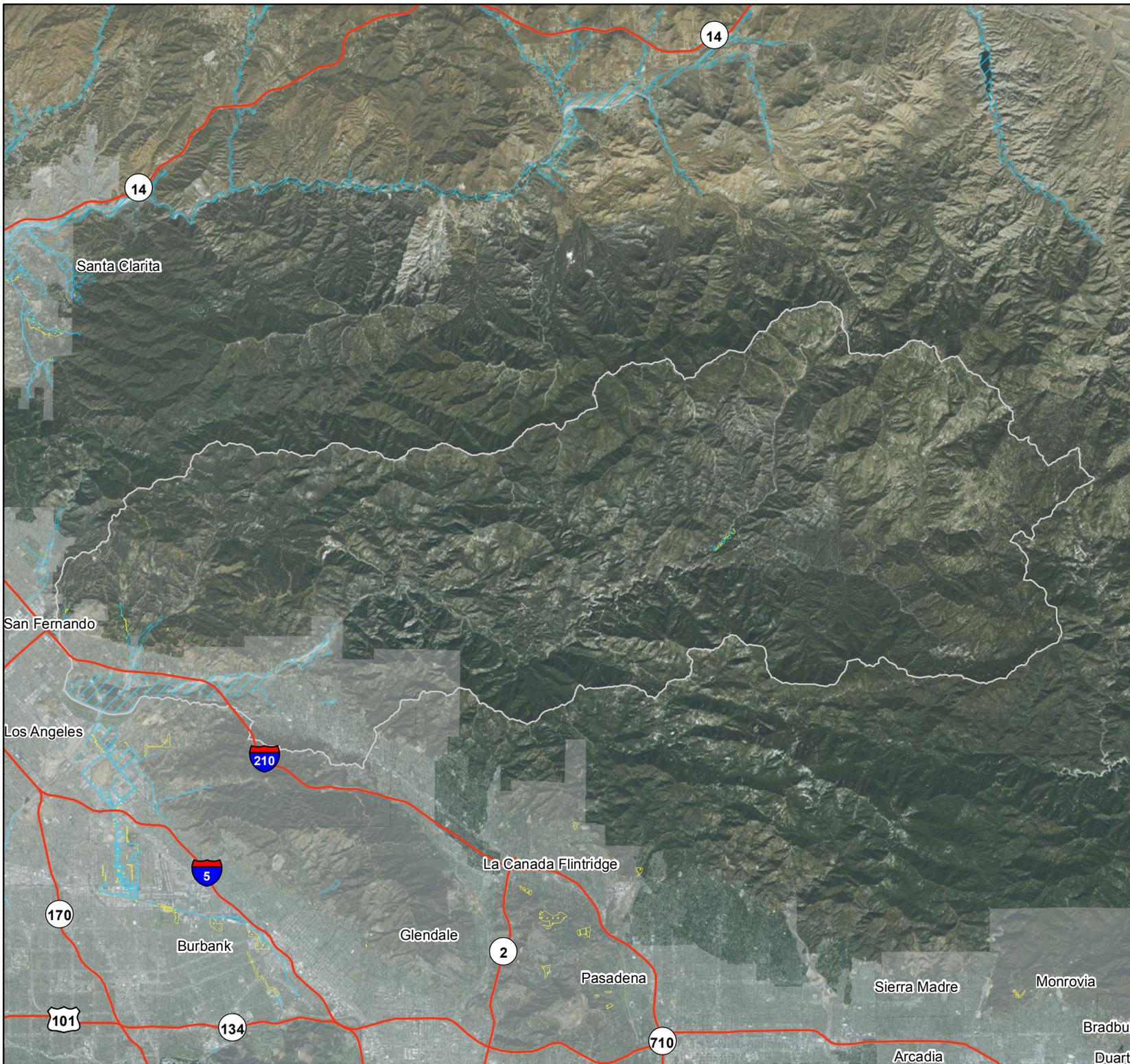
-  Incorporated Areas
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



0 2 4 Miles



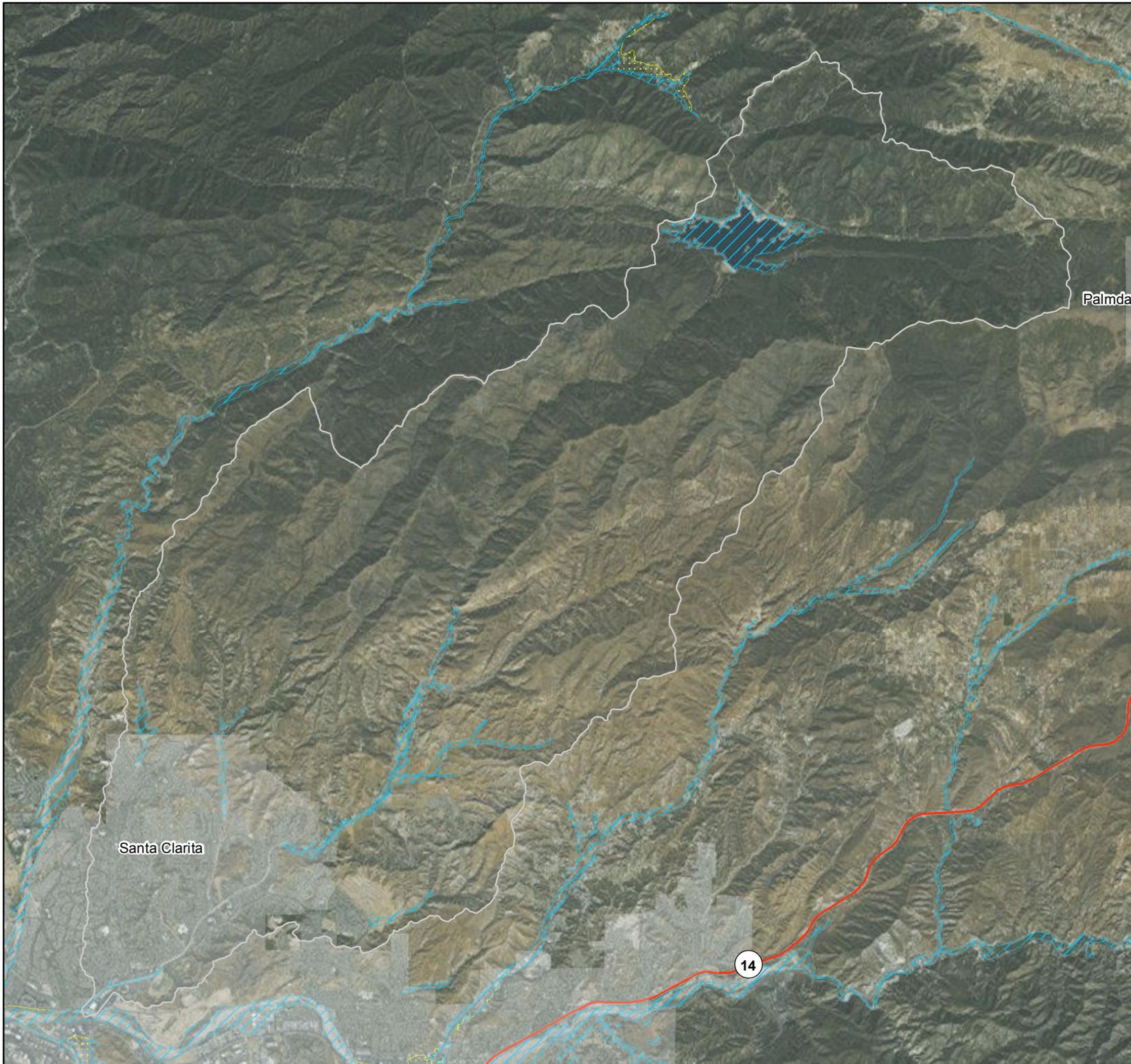
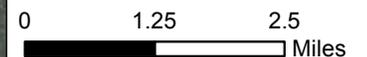
Bouquet Canyon Watershed

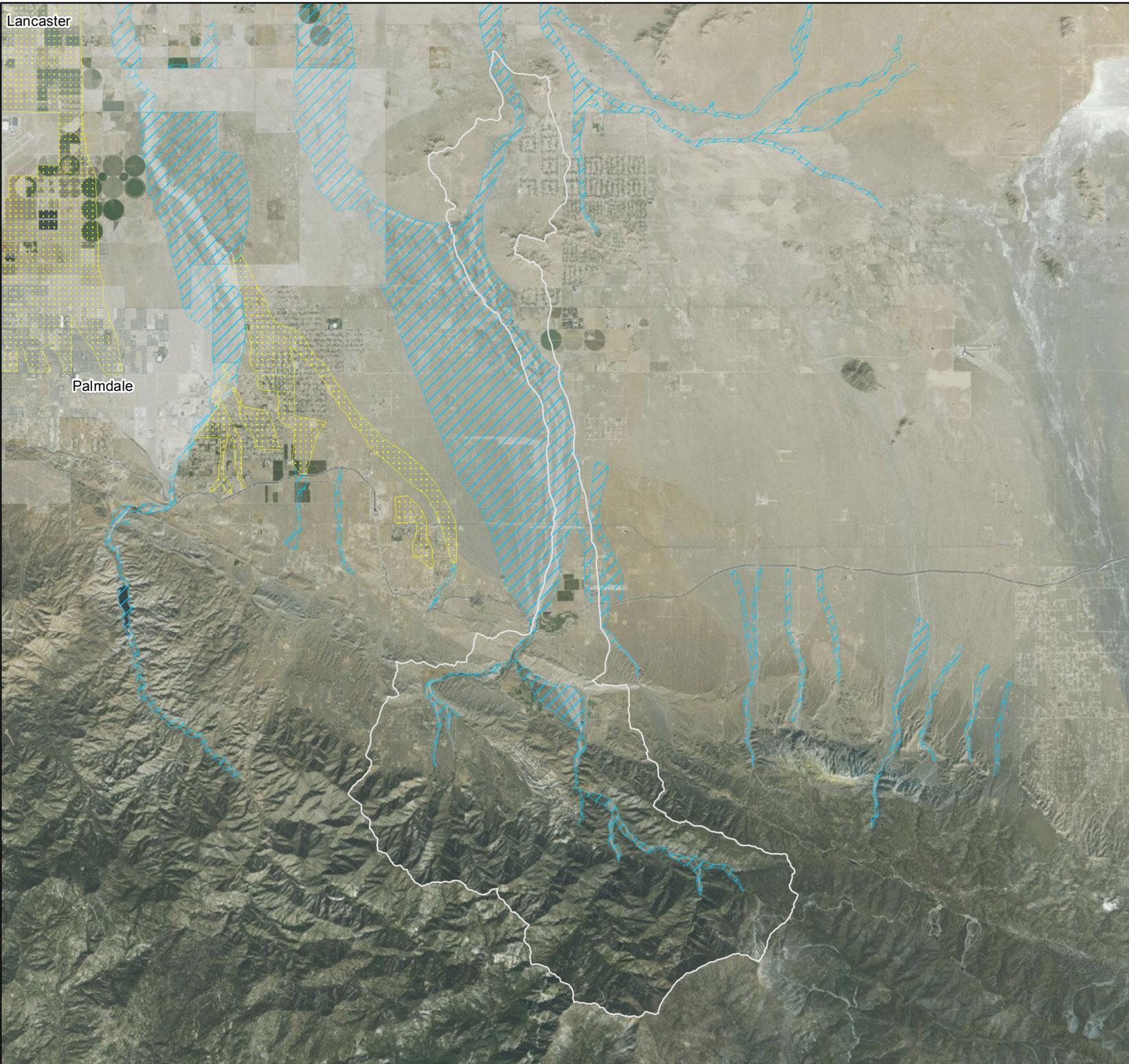
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15





Big Rock Creek- Big Rock Wash Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



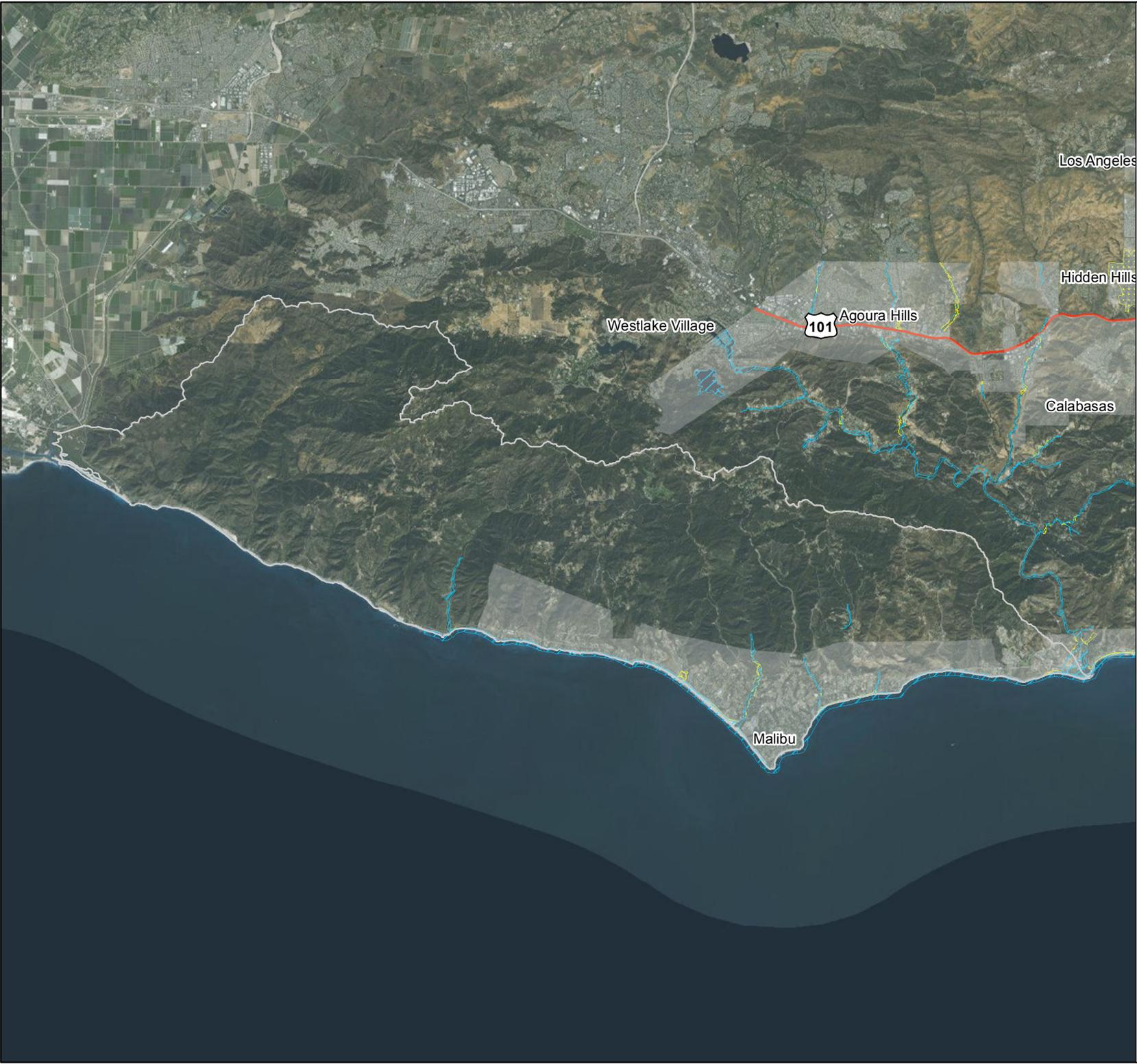
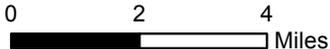
Big-Sycamore Canyon-Frontal Santa Monica Bay Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



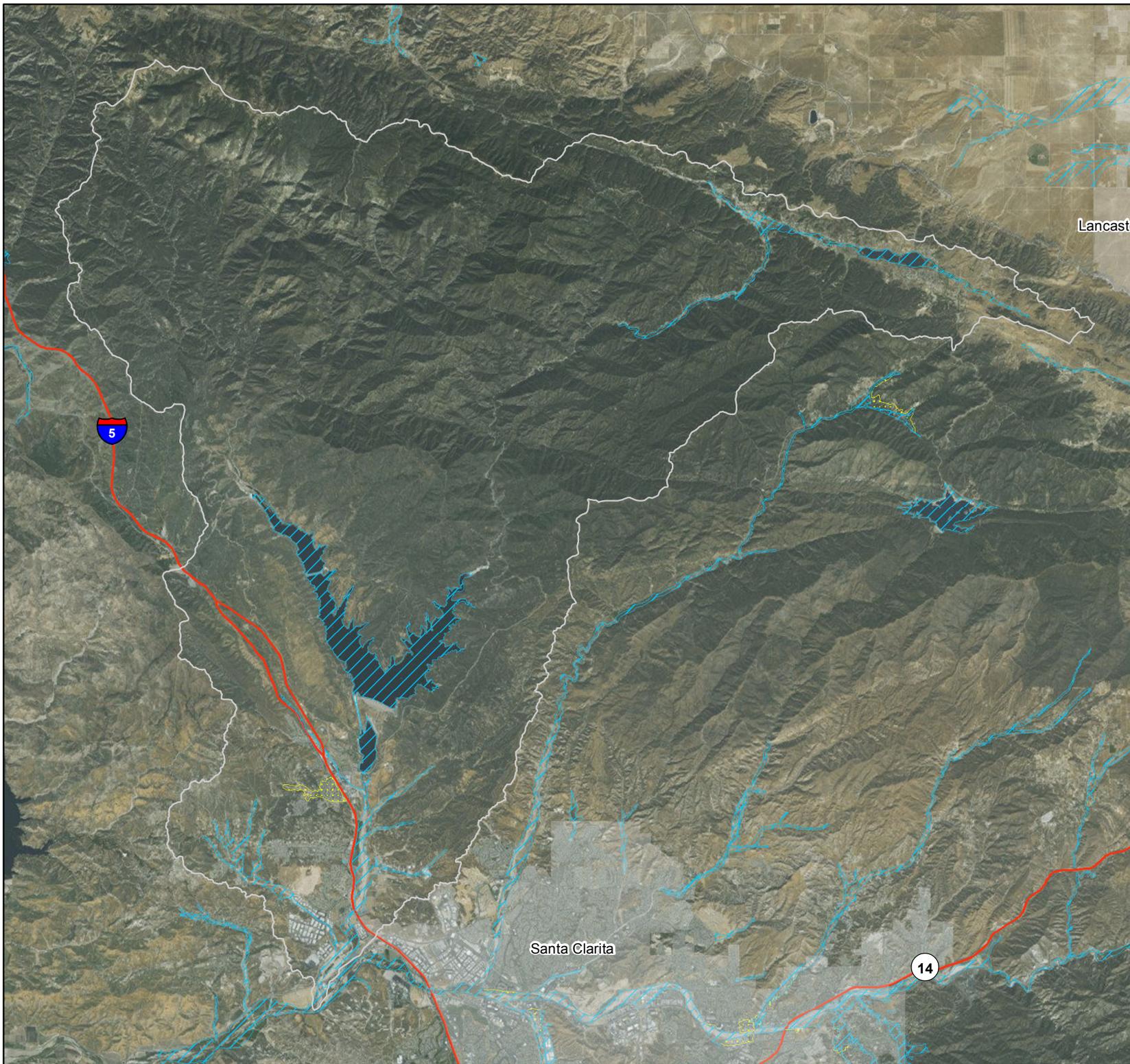
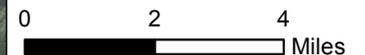
Castaic Creek Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Areas
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

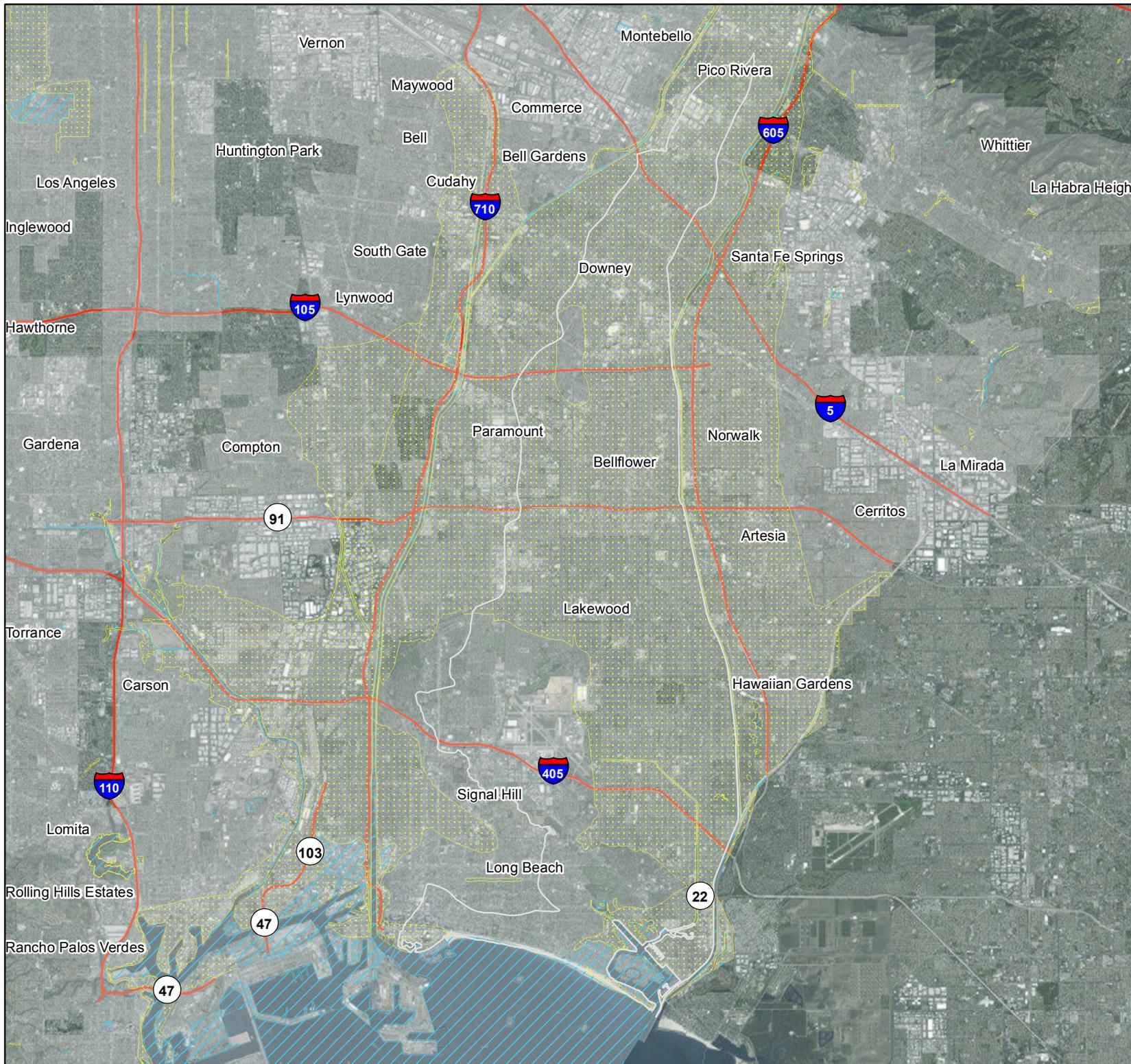
Map created: 5/27/15



Colorado Lagoon-Frontal Alamitos Bay Watershed

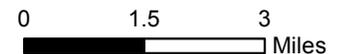
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

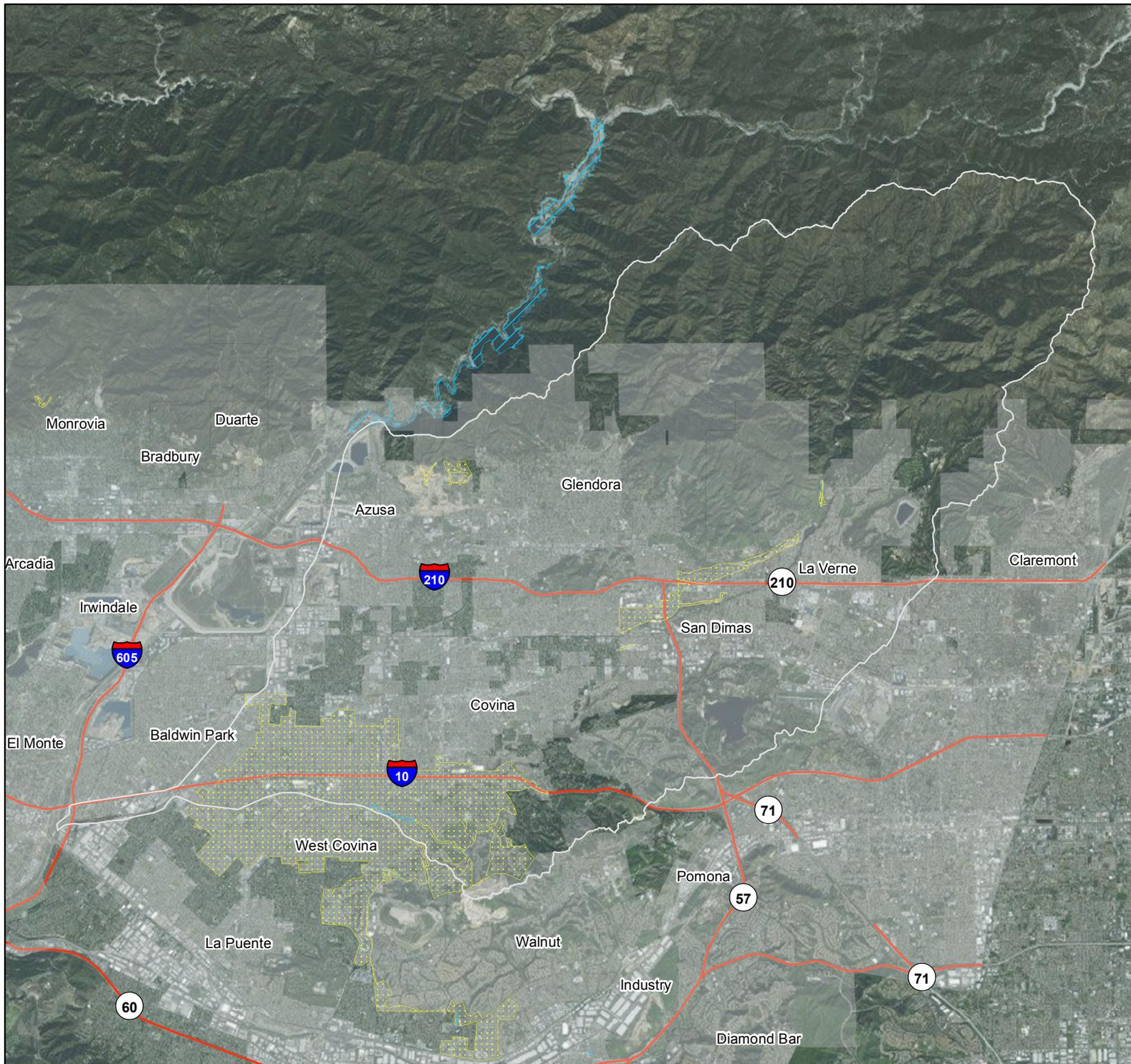
Map created: 5/2715



Dalton Wash Watershed

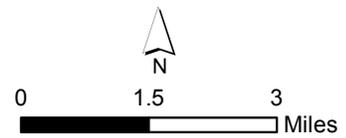
FEMA DFIRM Flood Hazard Areas

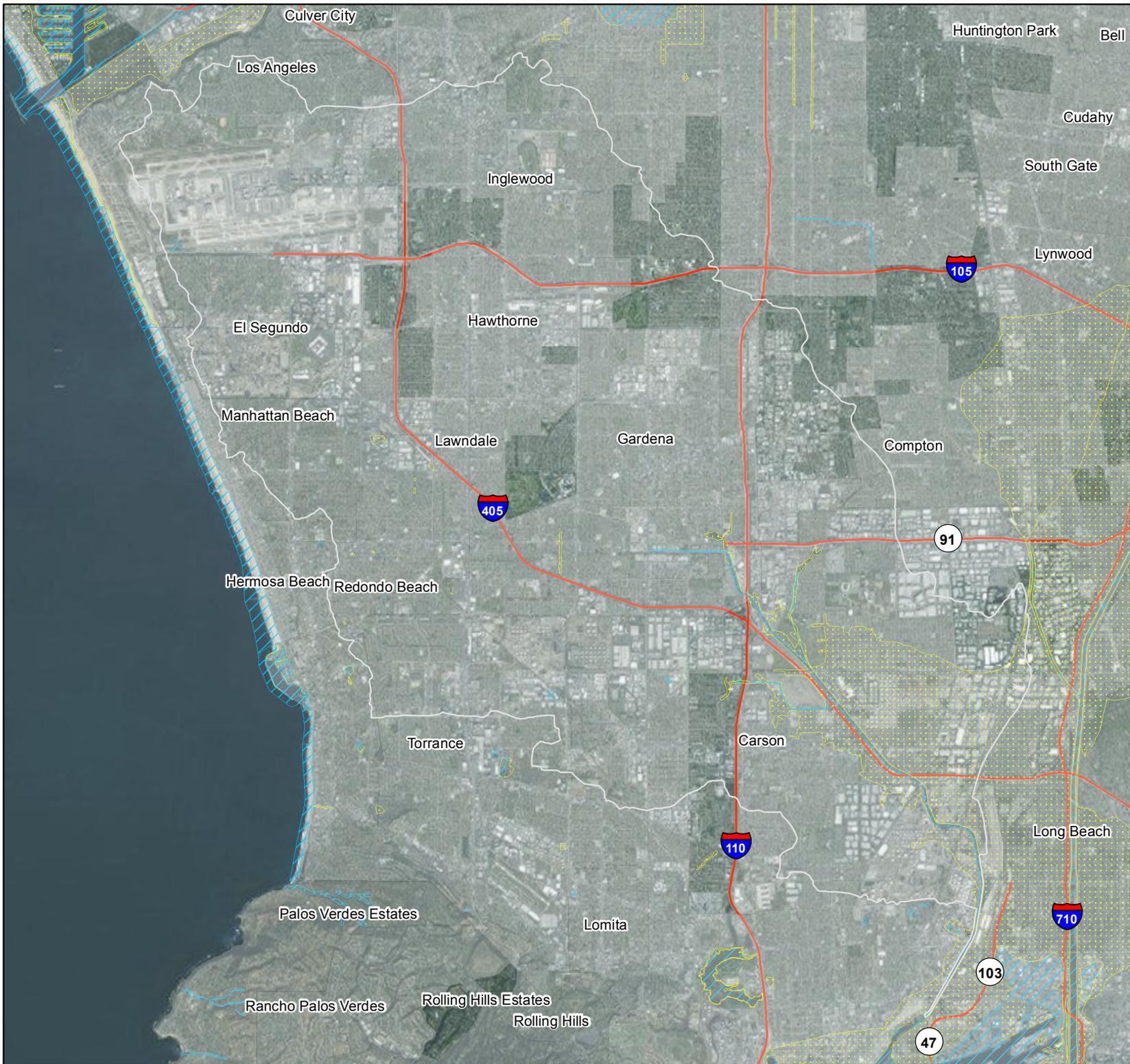
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15





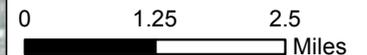
Dominguez Channel Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  1% Annual Chance Flood
-  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



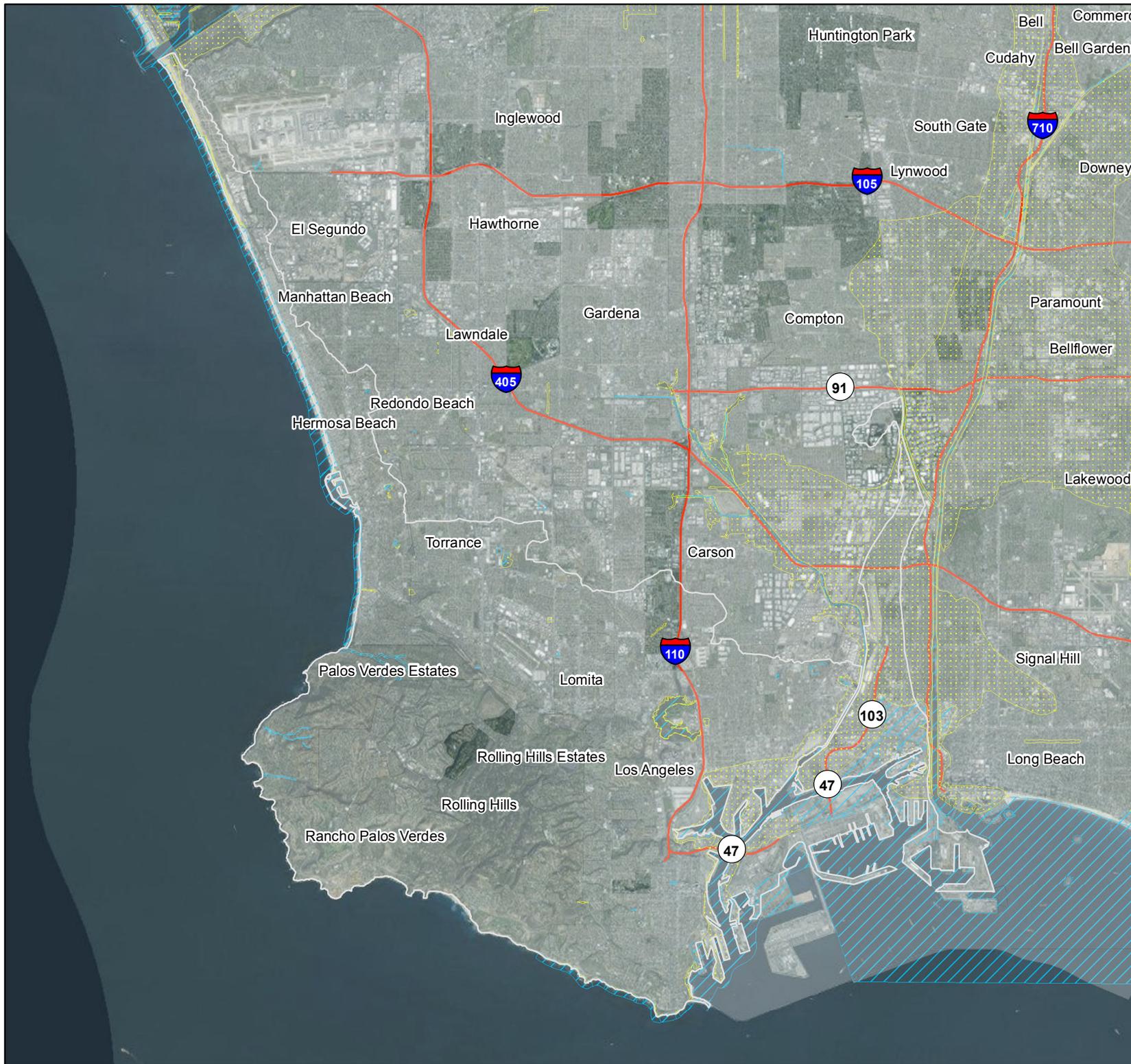
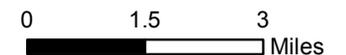
Frontal Santa Monica Bay-San Pedro Bay Watershed

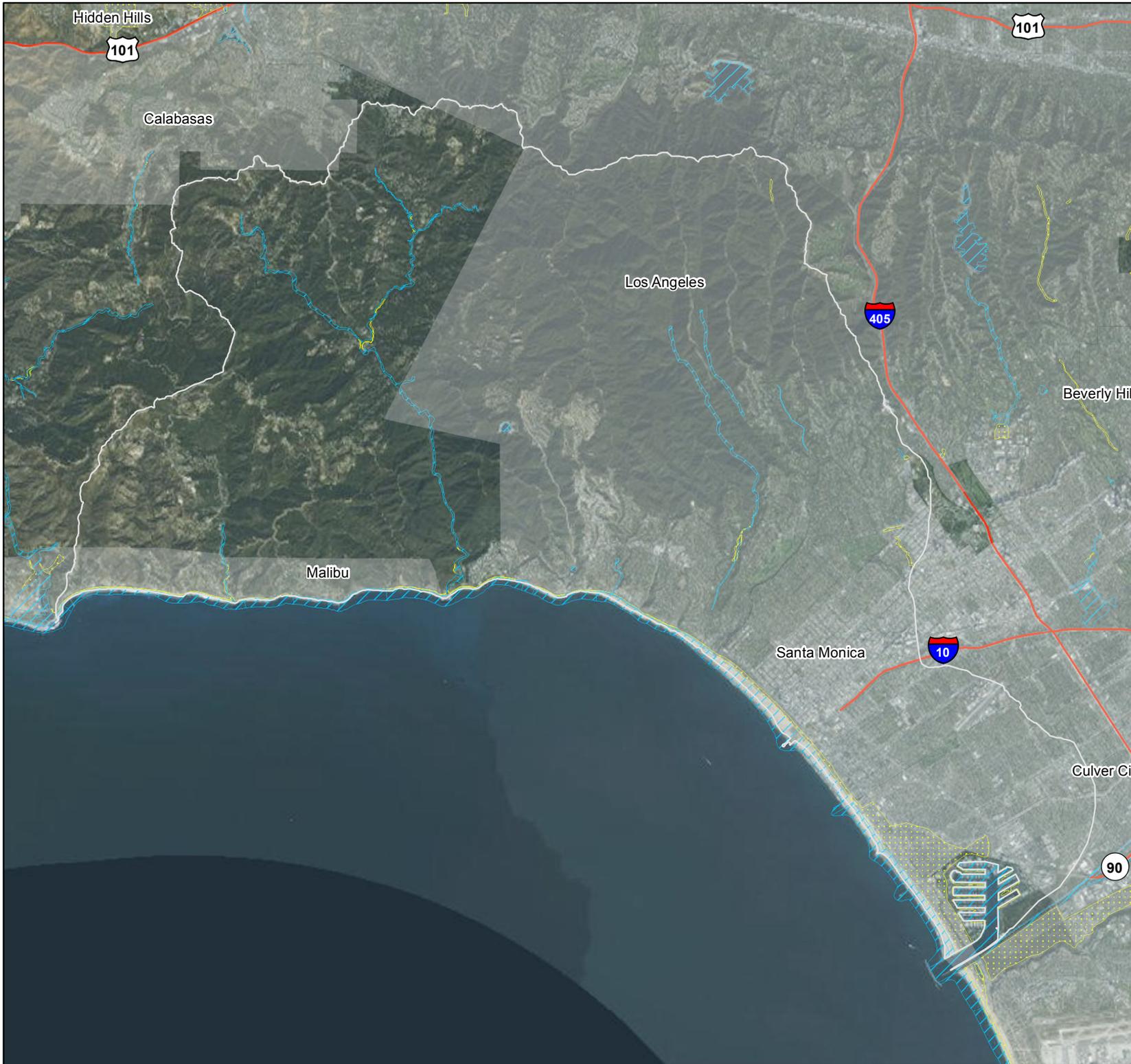
FEMA DFIRM Flood Hazard Areas

-  Incorporated Areas
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15





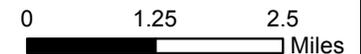
Garapito Creek-Frontal Santa Monica Bay Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



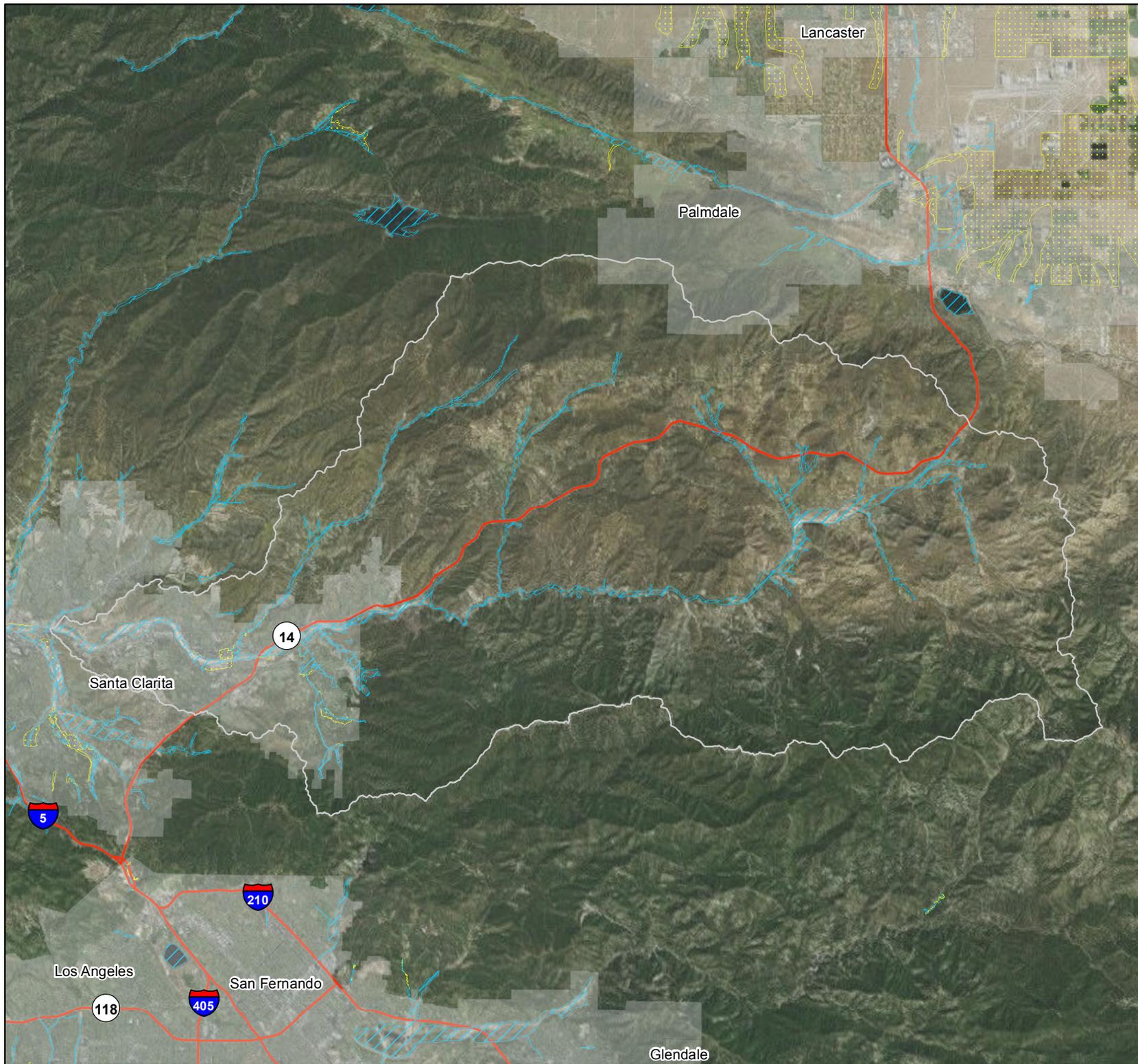
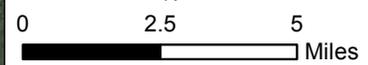
Headwaters Santa Clara River Watershed

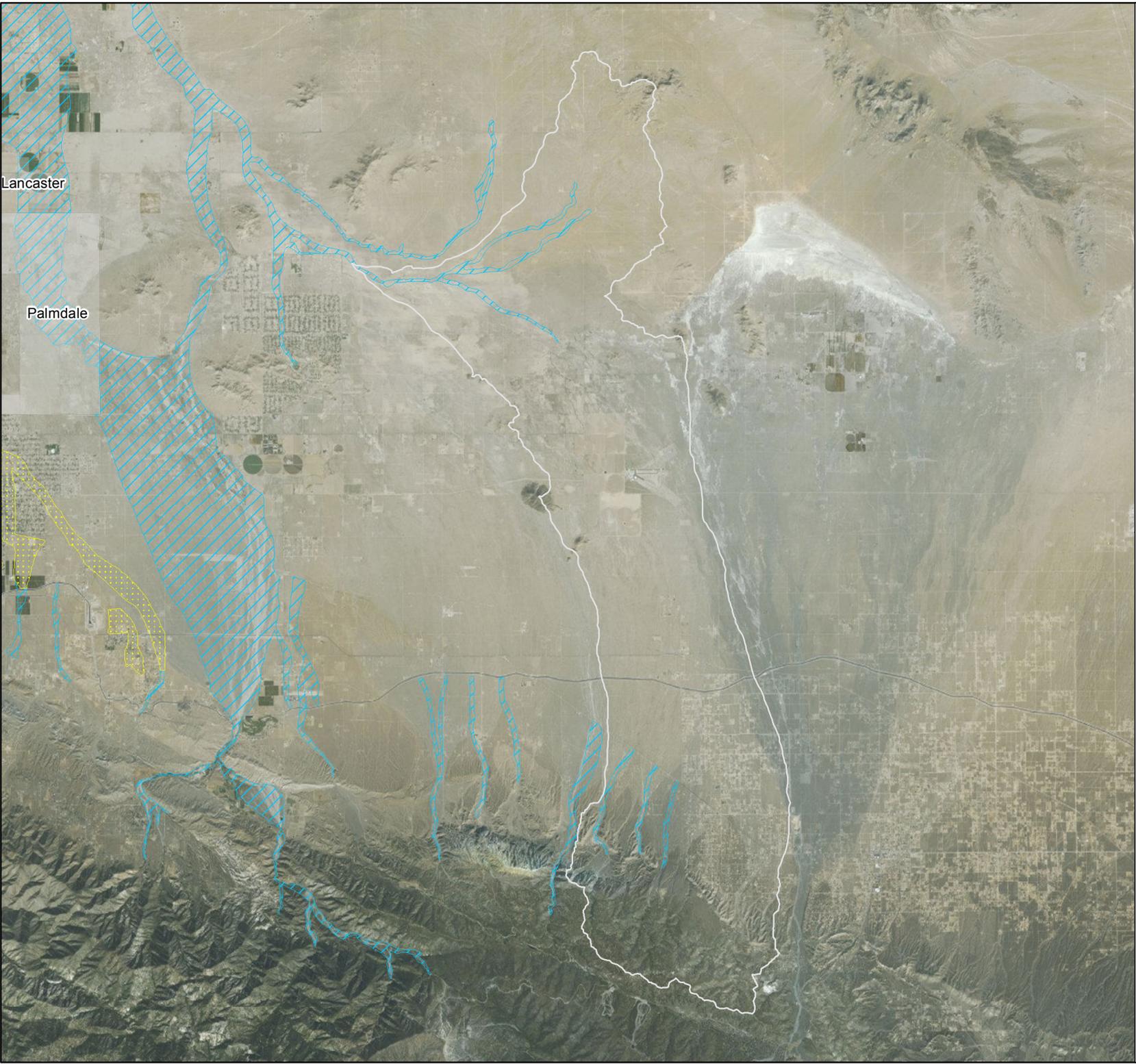
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15





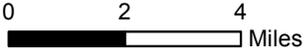
Le Montaine Creek-Eller Slough Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



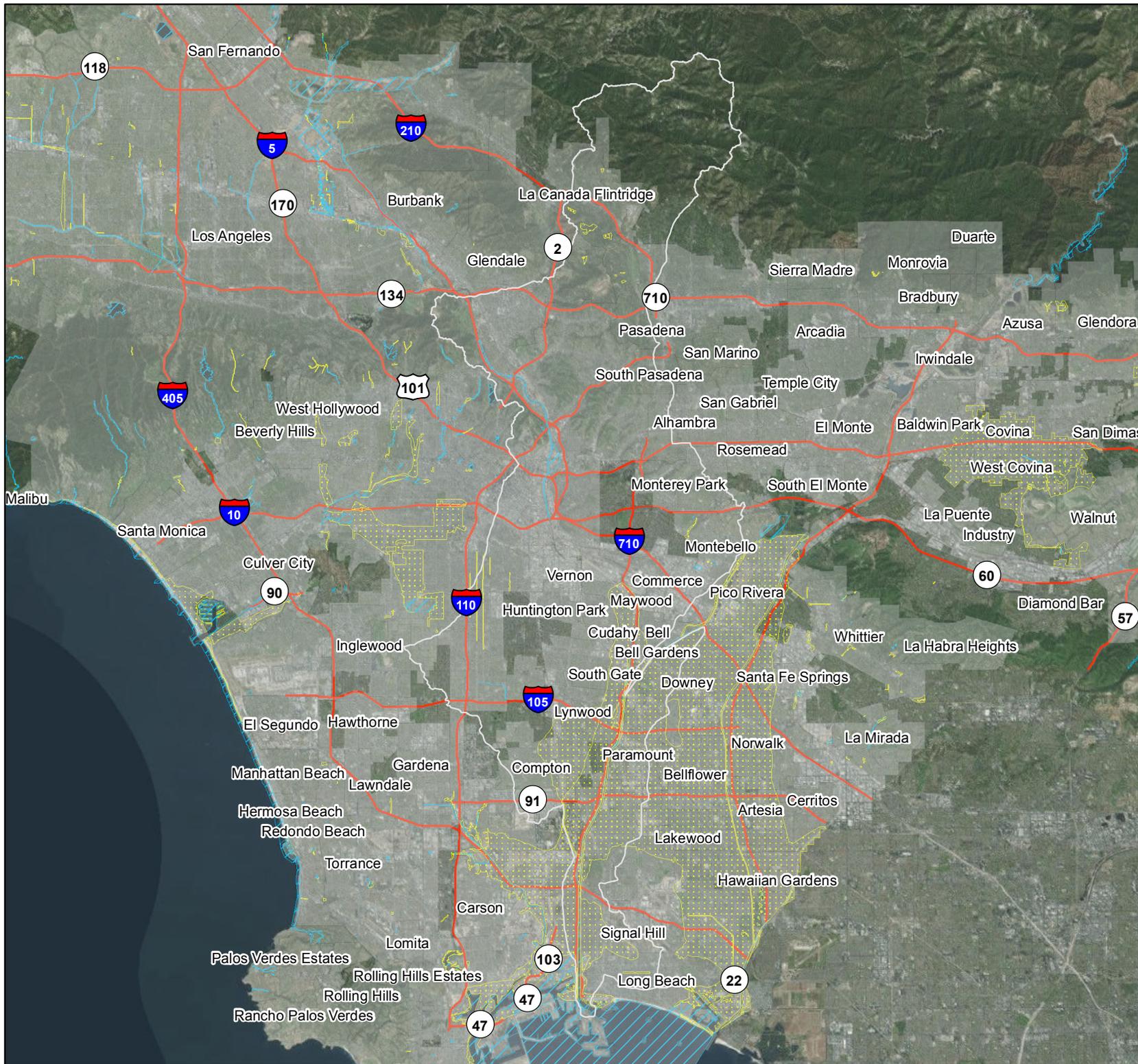
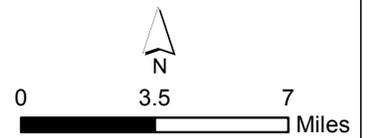
Lower Los Angeles River Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Lower Piru Creek Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Areas
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



0 1.5 3
Miles



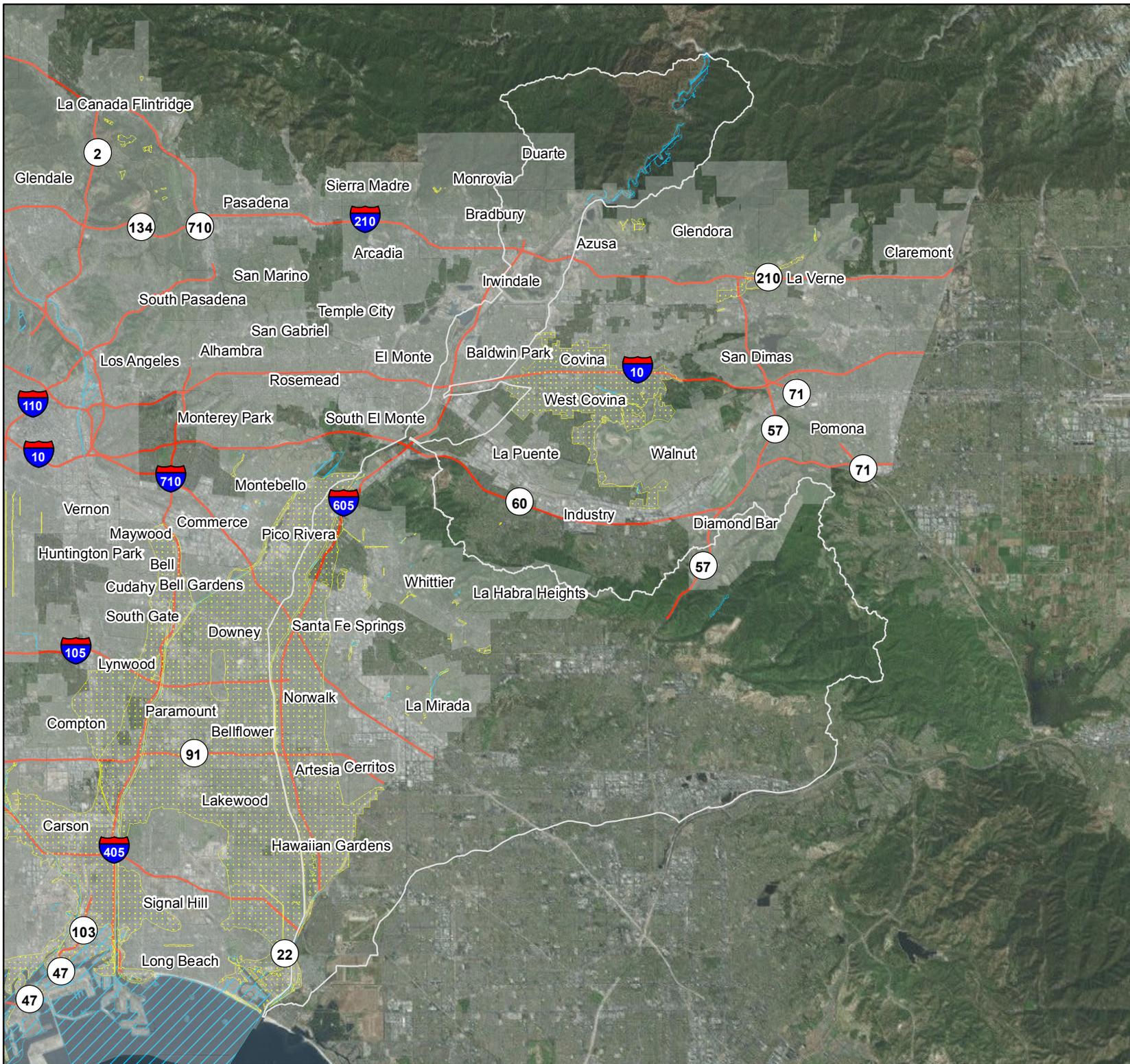
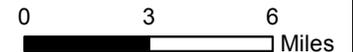
Lower San Gabriel River Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

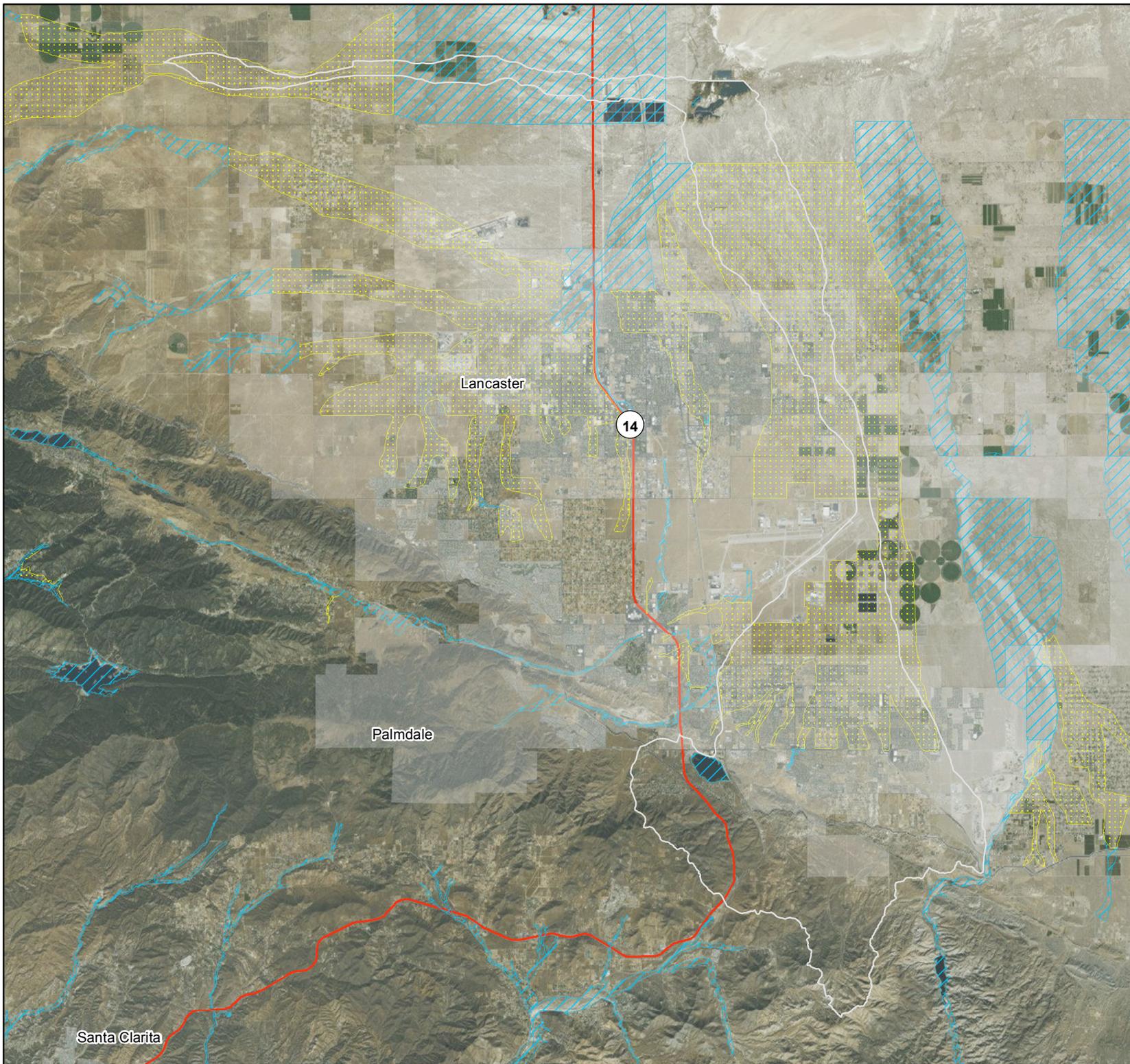
Map created: 5/27/15



Lake Palmdale- Piute Ponds Watershed

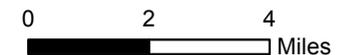
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



Little Rock Wash Watershed

FEMA DFIRM Flood Hazard Areas

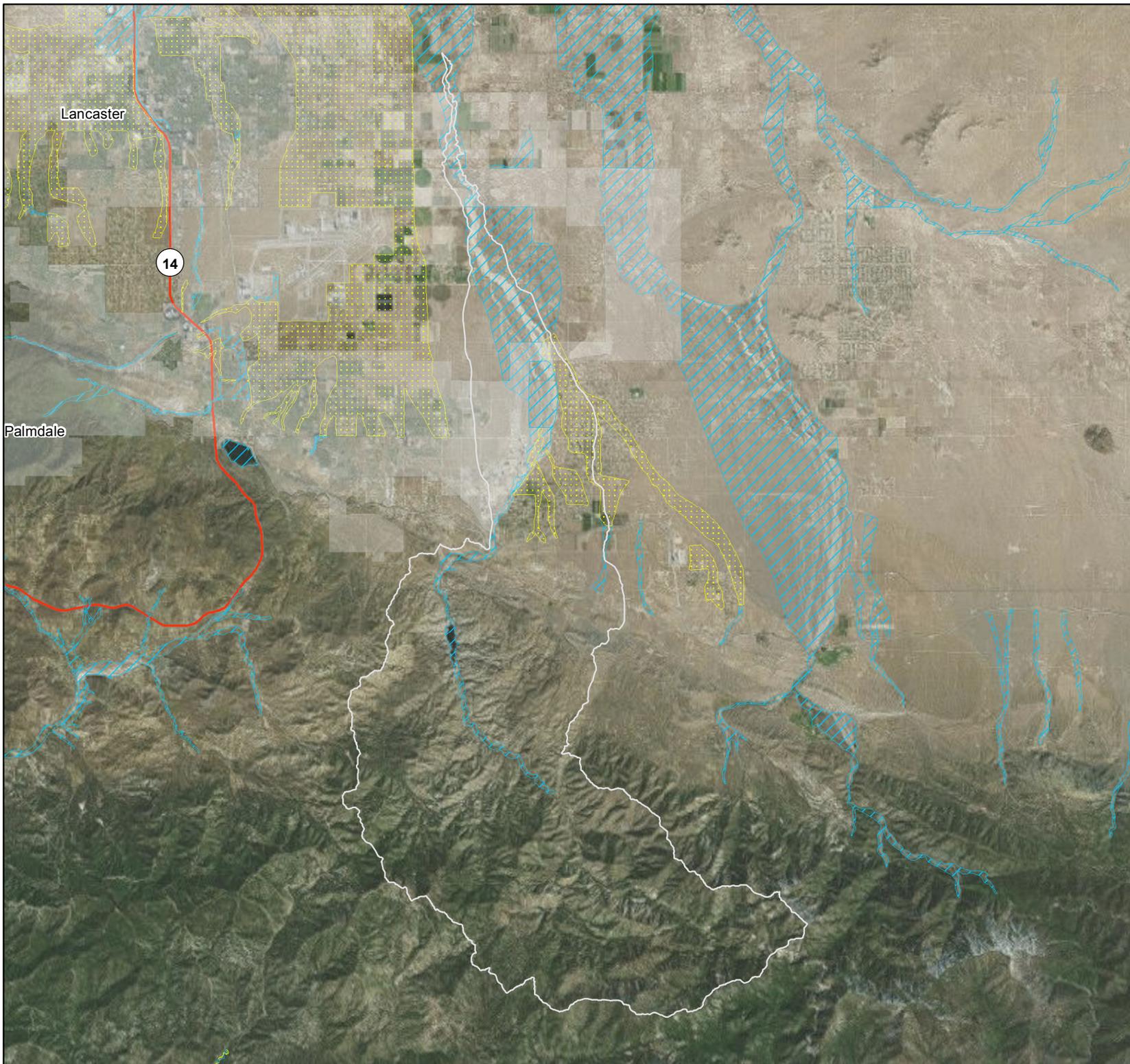
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



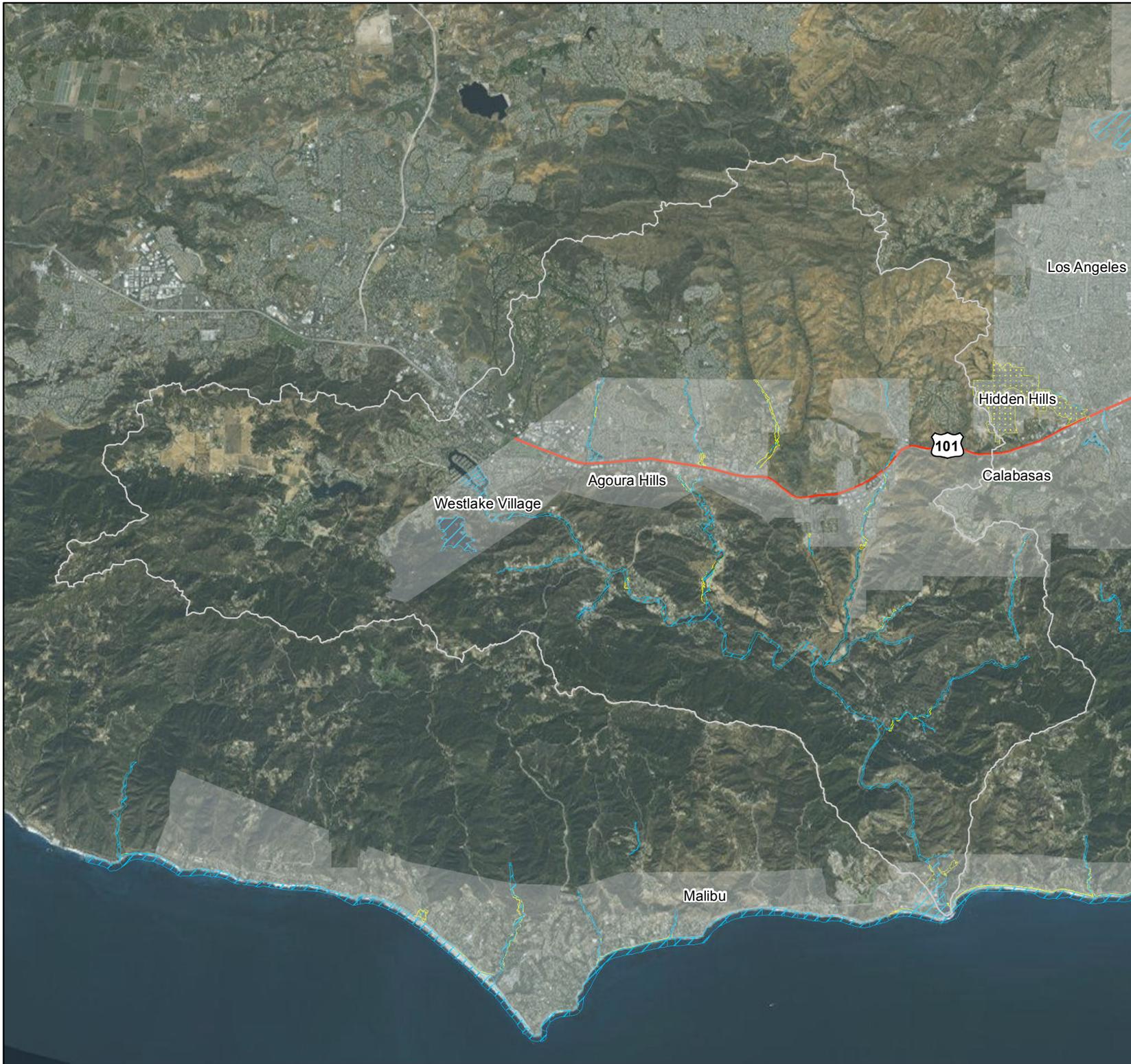
0 2 4
Miles



Malibu Creek Watershed

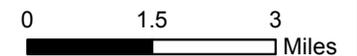
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

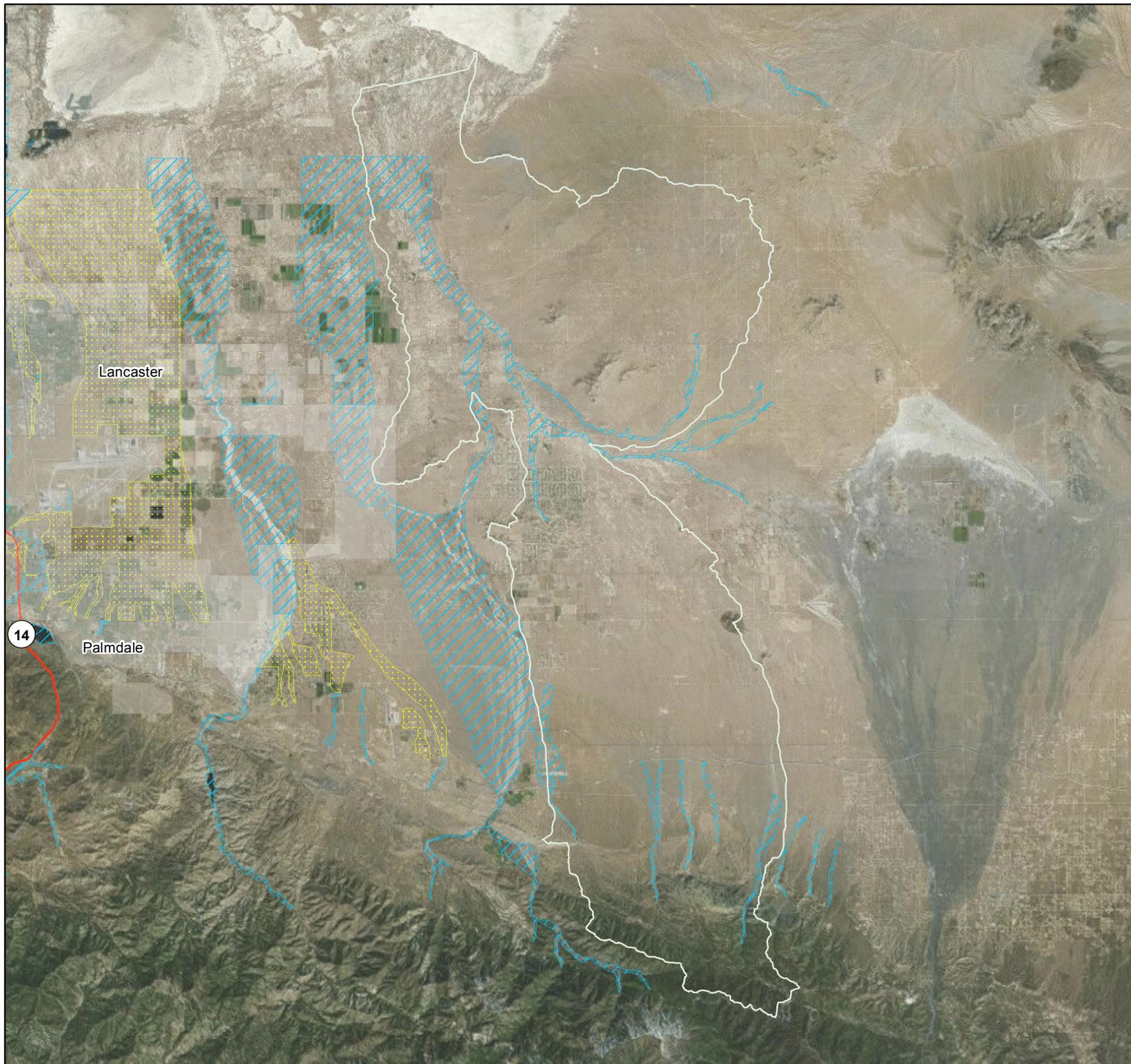
Map created: 5/27/15



Mescal Creek-Rocky Buttes Watershed

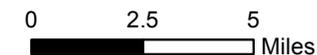
FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

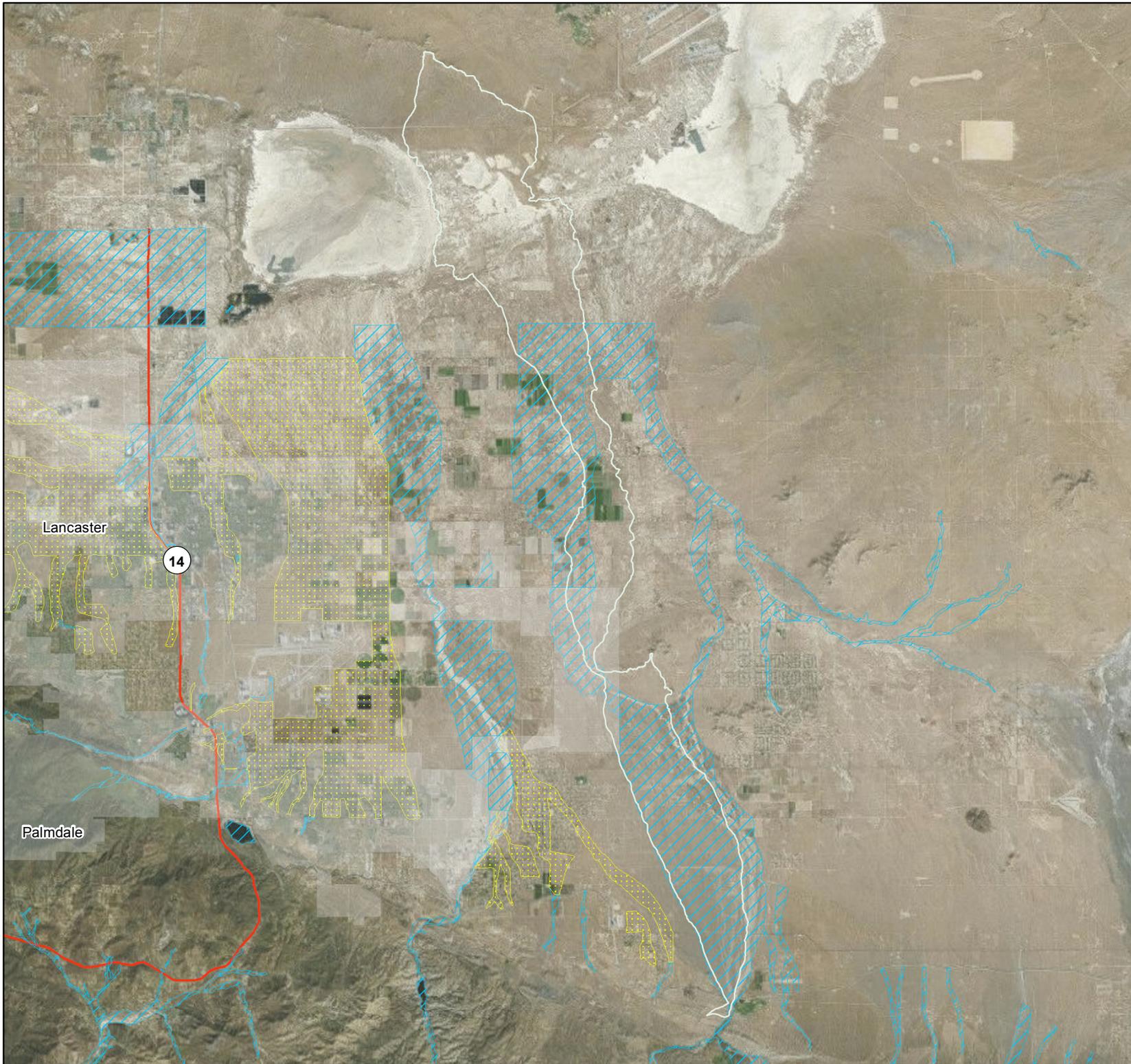
Map created: 5/28/15



Rock Creek- Buckhorn Lake Watershed

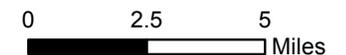
FEMA DFIRM Flood Hazard Areas

-  Incorporated Areas
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood



Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



Rogers Lake Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



0 2 4 Miles



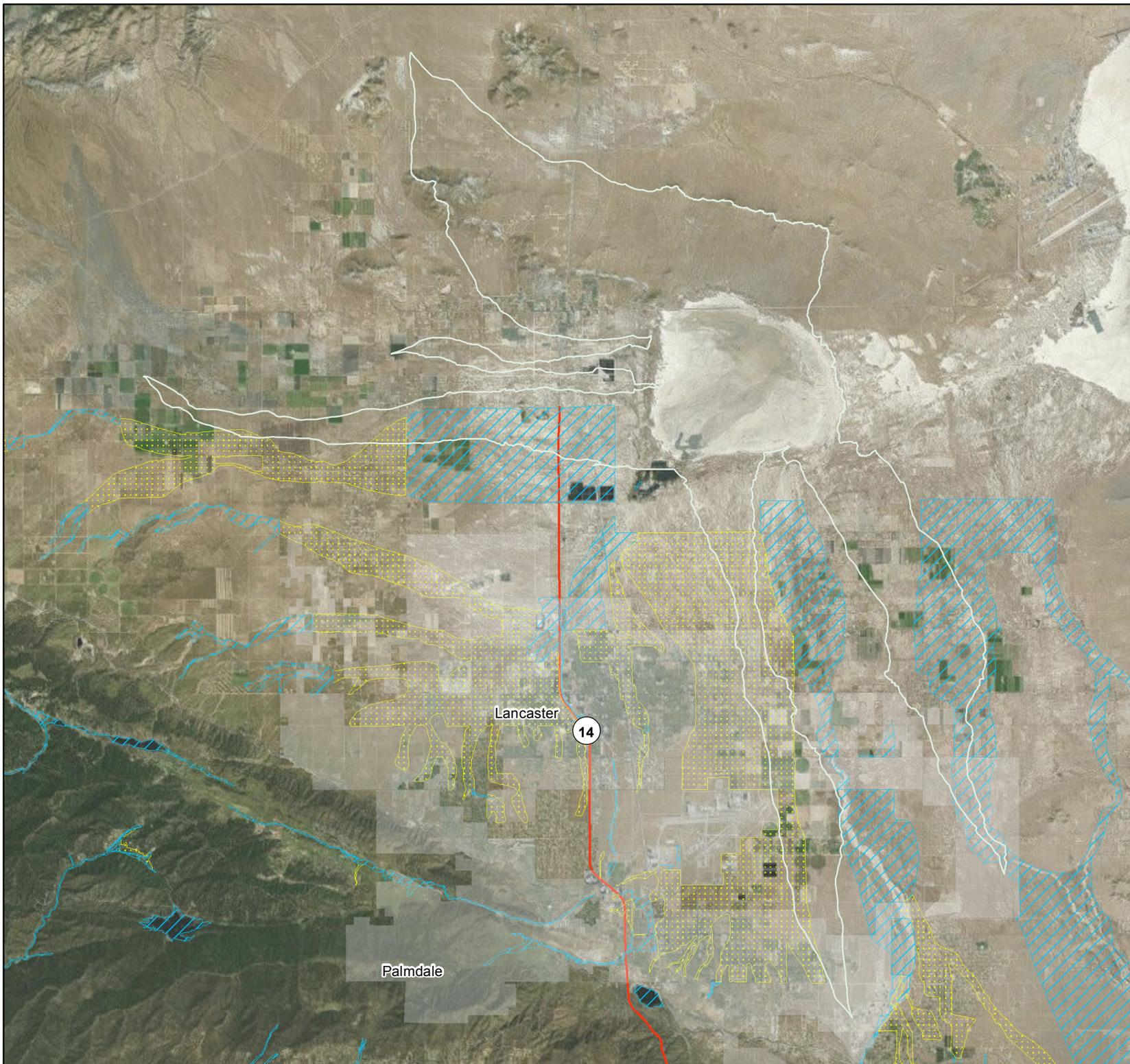
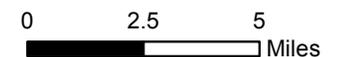
Rosamond Lake Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



San Jose Creek Watershed

FEMA DFIRM Flood Hazard Areas

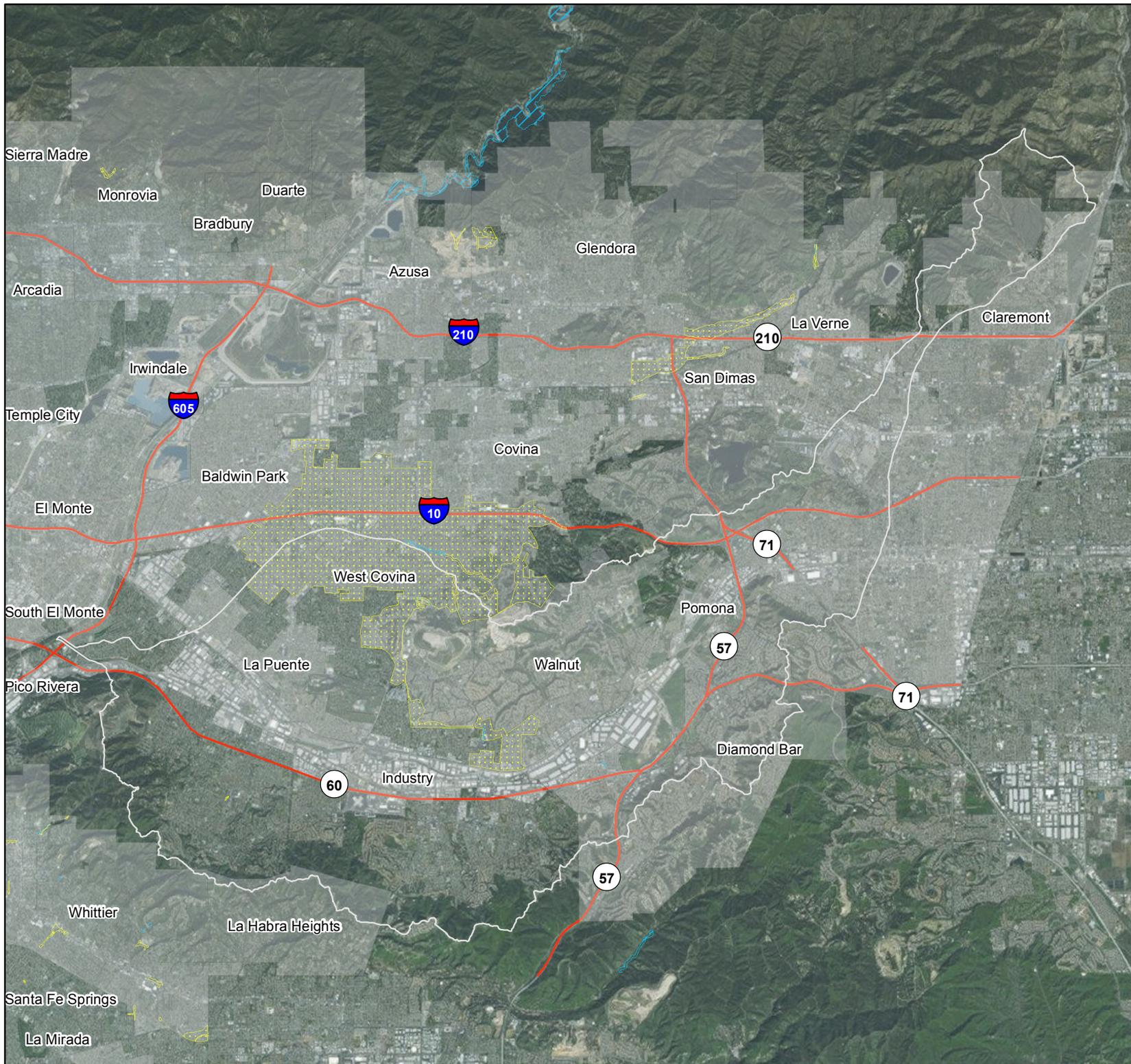
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



0 1.5 3
Miles



Sacatara Creek-Kings Canyon Watershed

FEMA DFIRM Flood Hazard Areas

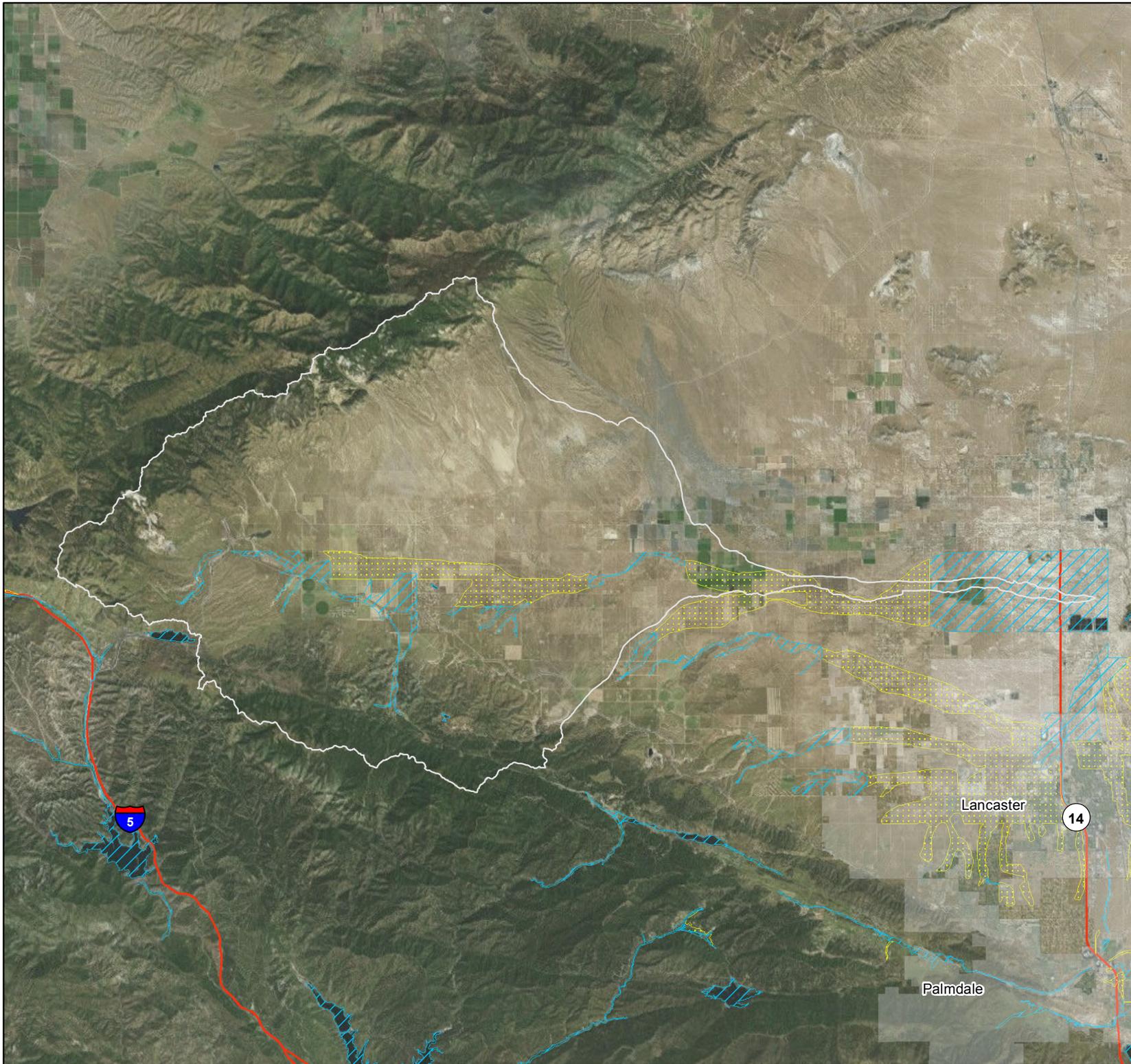
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/28/15



0 2.5 5
Miles



Upper Los Angeles River Watershed

FEMA DFIRM Flood Hazard Areas

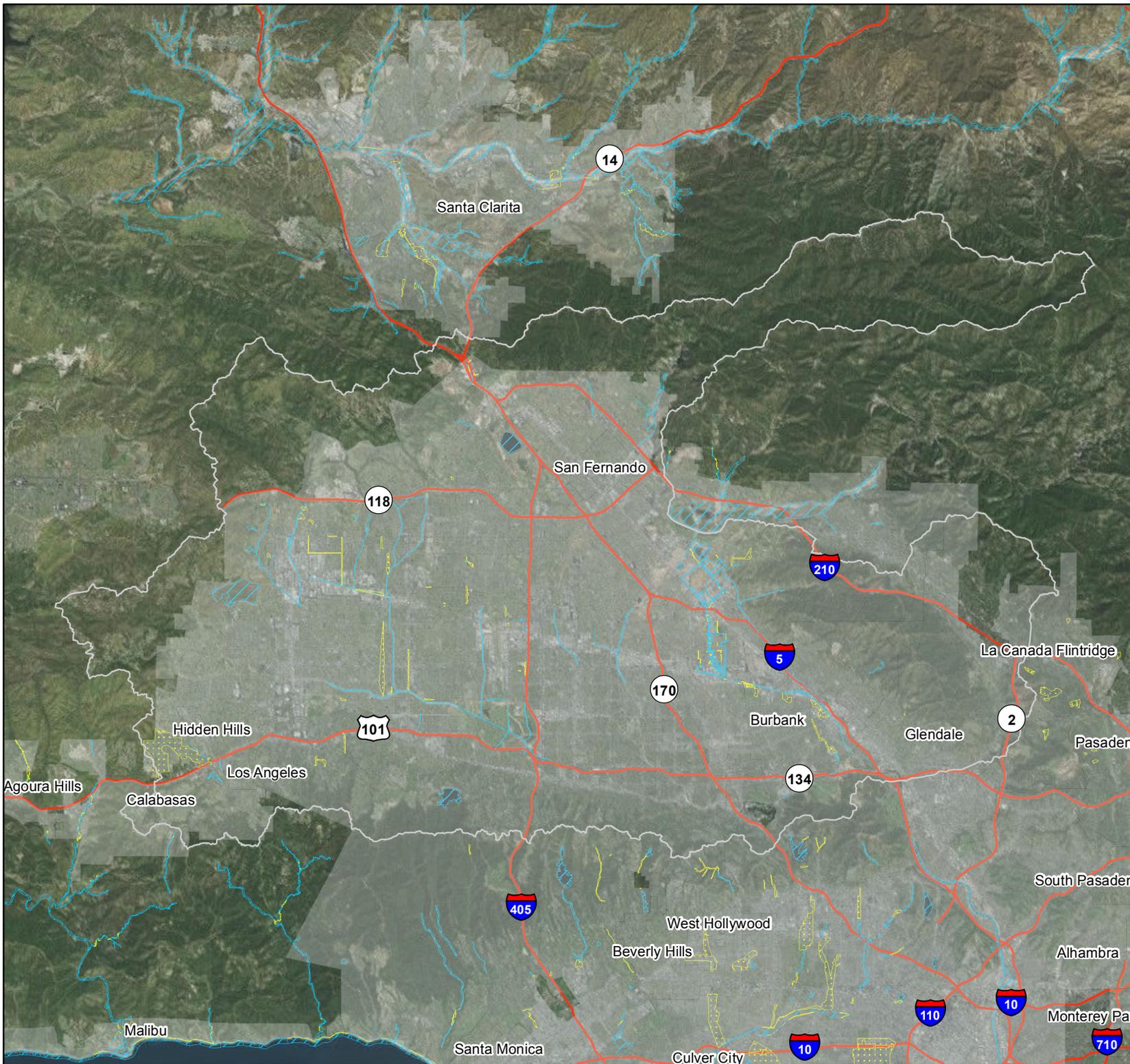
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



0 2.5 5
Miles



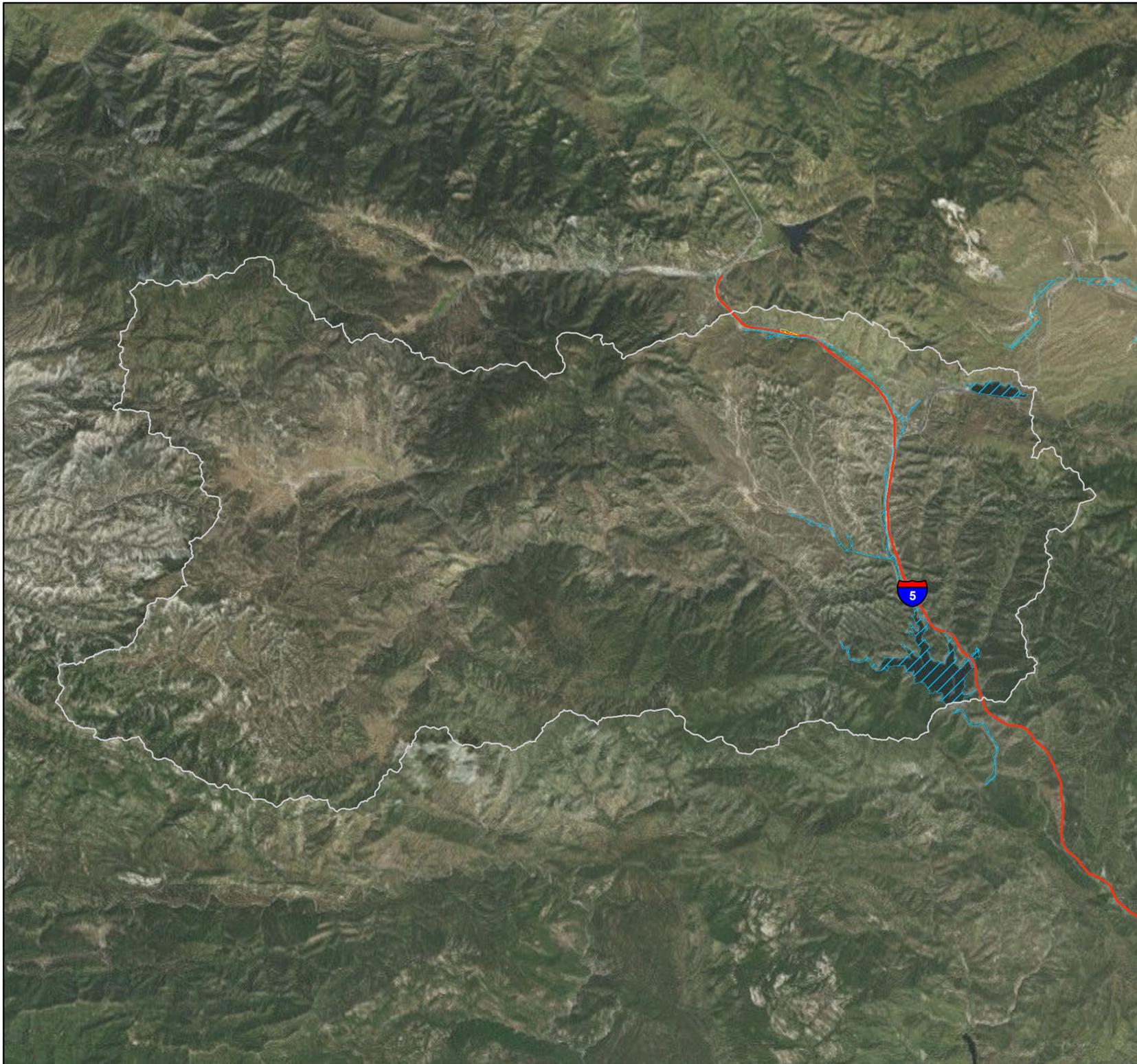
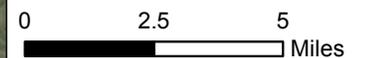
Upper Piru Creek Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/2715



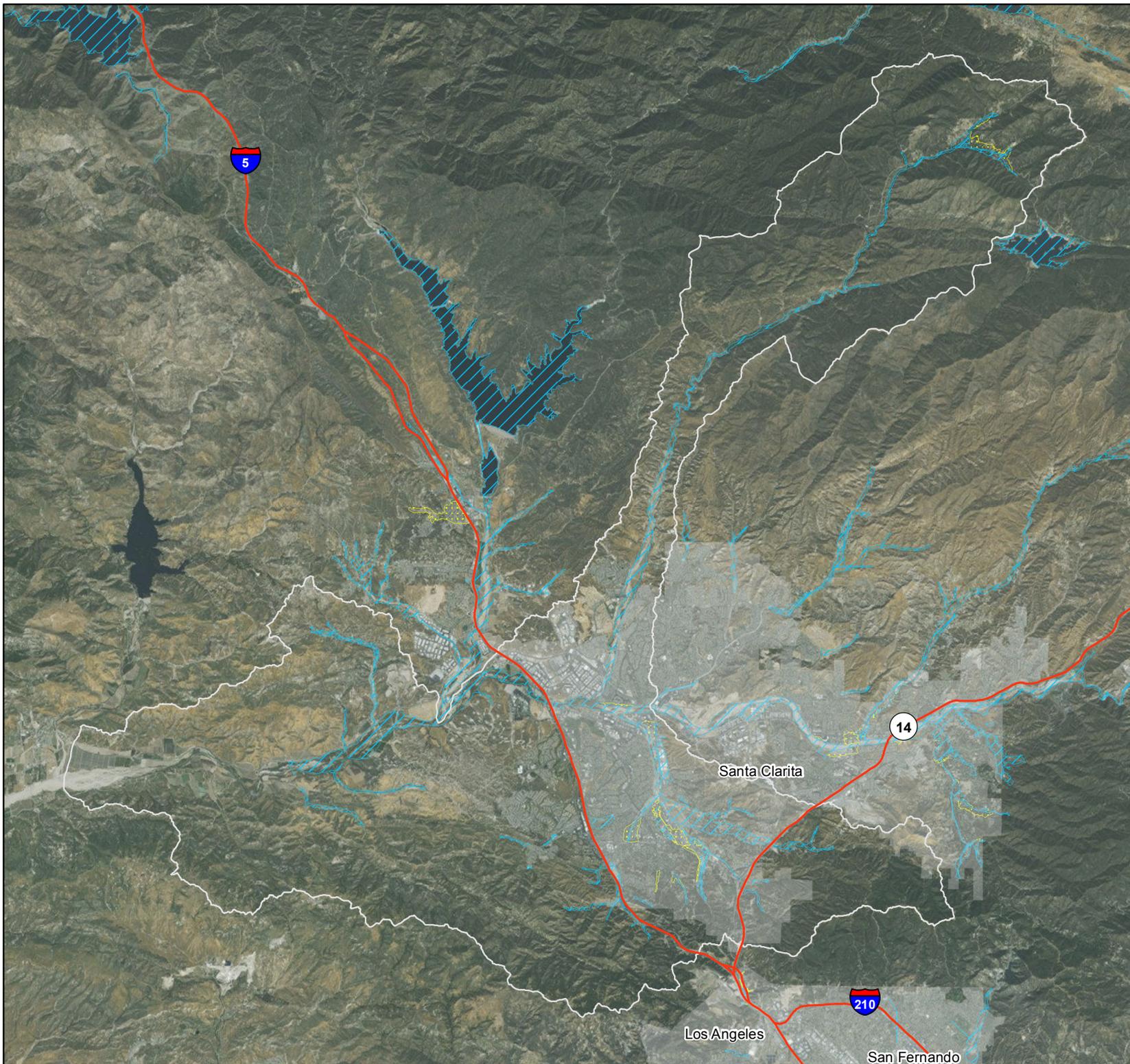
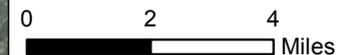
Upper Santa Clara River Watershed

FEMA DFIRM Flood Hazard Areas

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
 -  1% Annual Chance Flood
 -  0.2% Annual Chance Flood

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX G.
LOS ANGELES COUNTY FLOODWAY MAPS

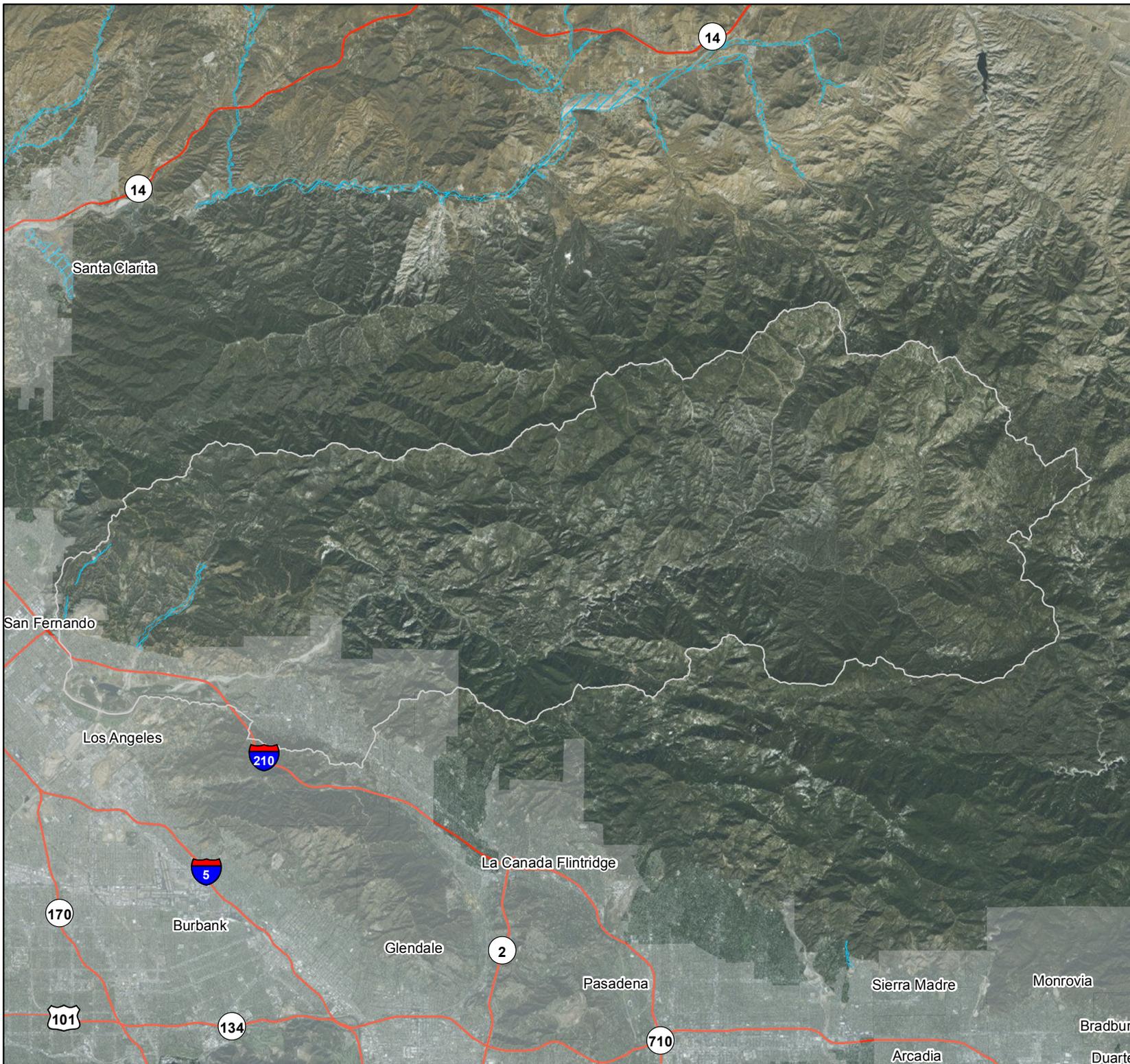
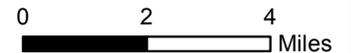
Big Tujunga Creek Watershed

Los Angeles County
Floodways, Capital
Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



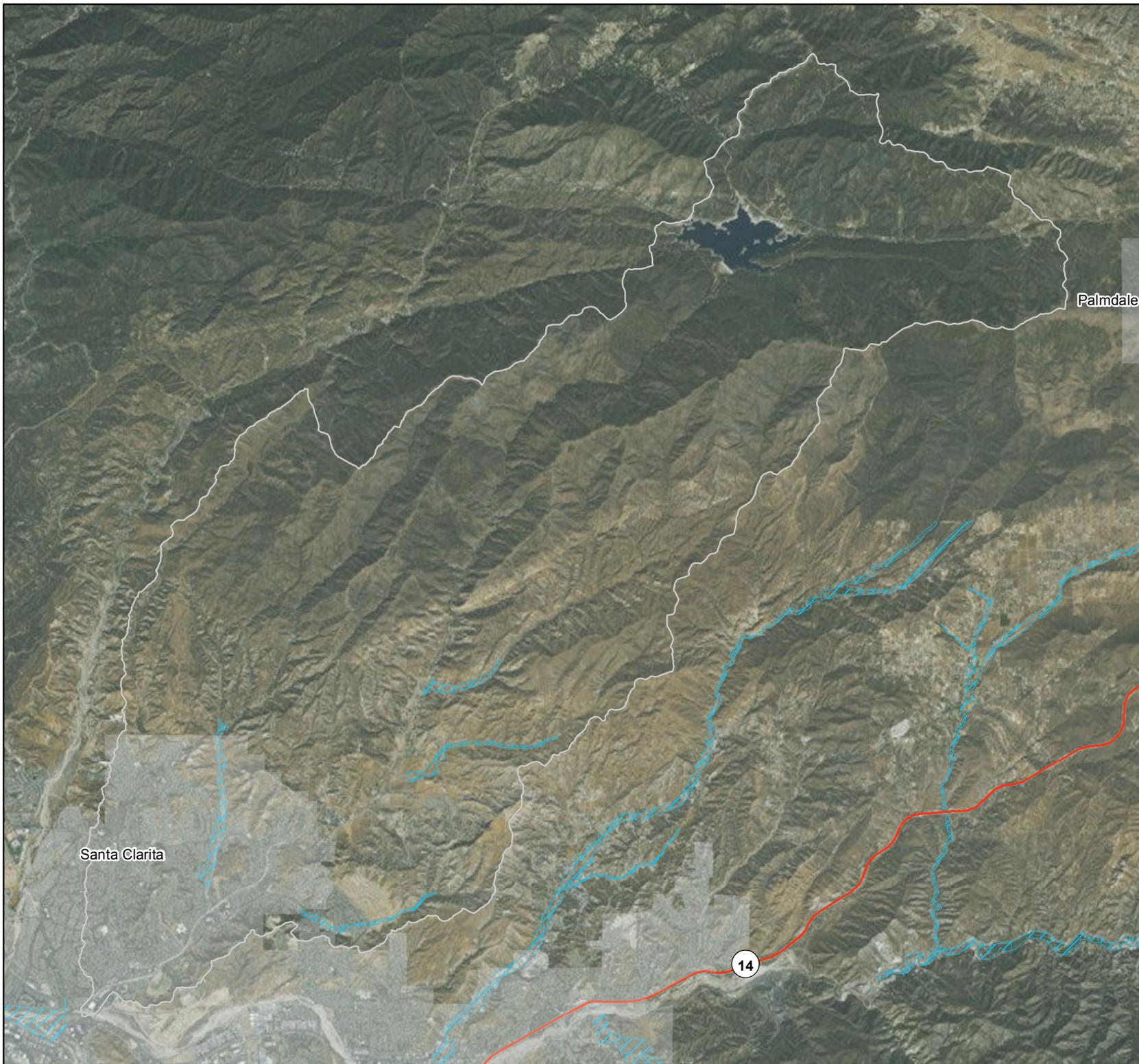
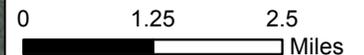
Bouquet Canyon Watershed

Los Angeles County
Floodways, Capital
Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



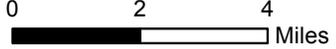
Big-Sycamore Canyon-Frontal Santa Monica Bay Watershed

Los Angeles County Floodways, Capital Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



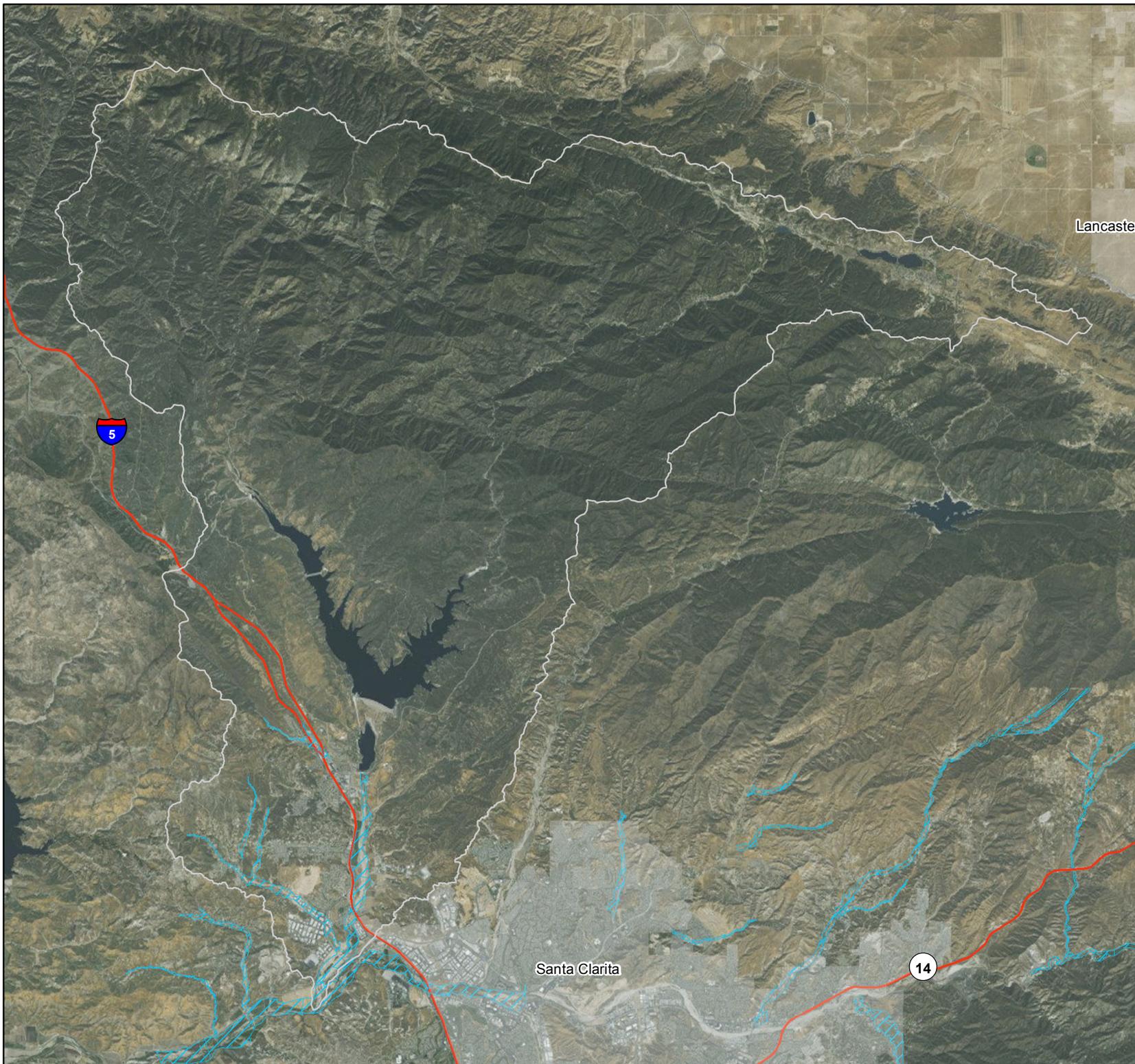
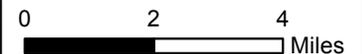
Castaic Creek Watershed

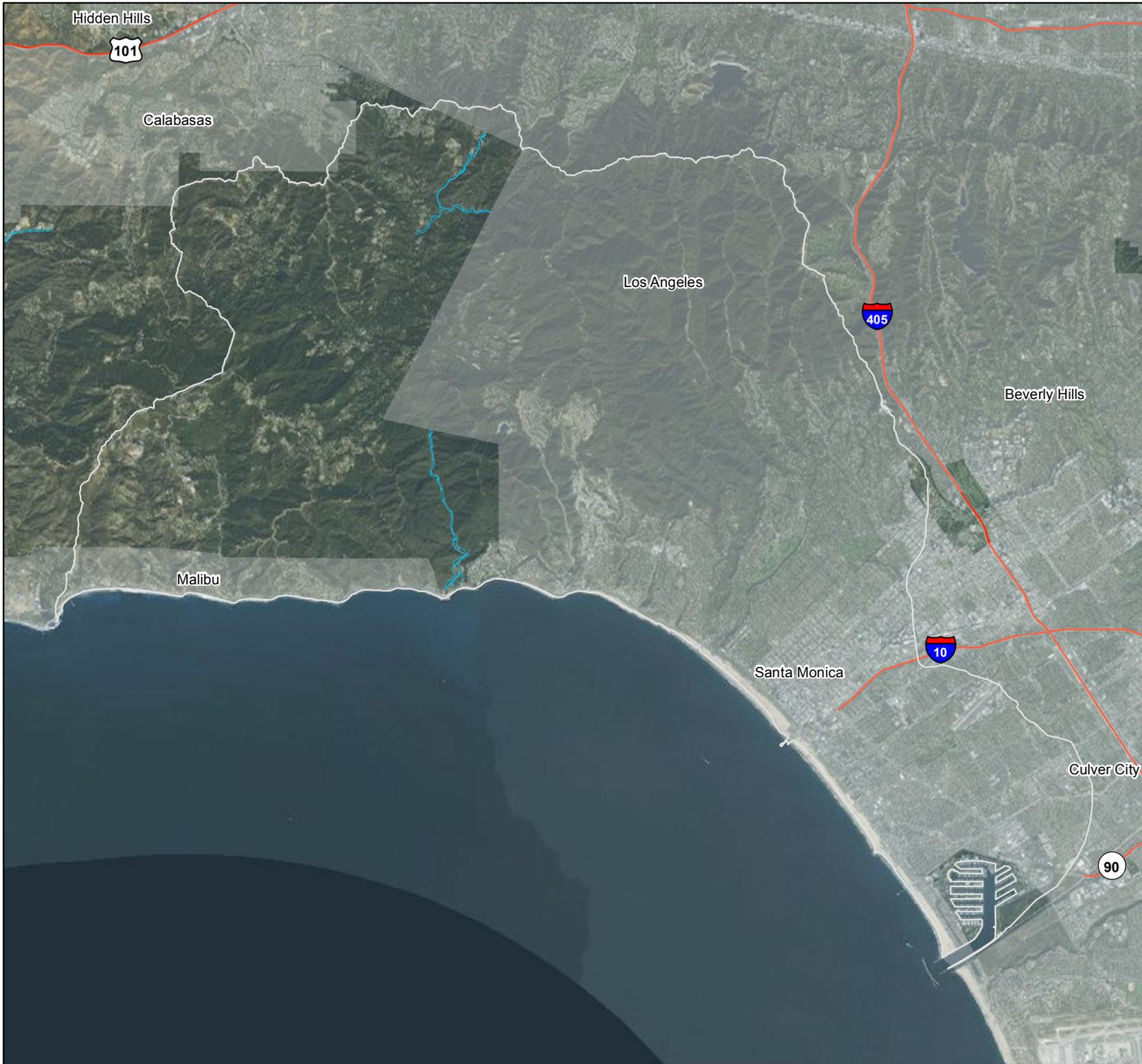
Los Angeles County
Floodways, Capital
Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15





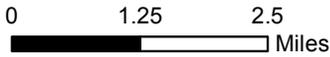
Garapito Creek-Frontal Santa Monica Bay Watershed

Los Angeles County
Floodways, Capital
Flood (50-year)

- Incorporated Cities
- Watershed Boundary
- Flood Hazard**
- County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



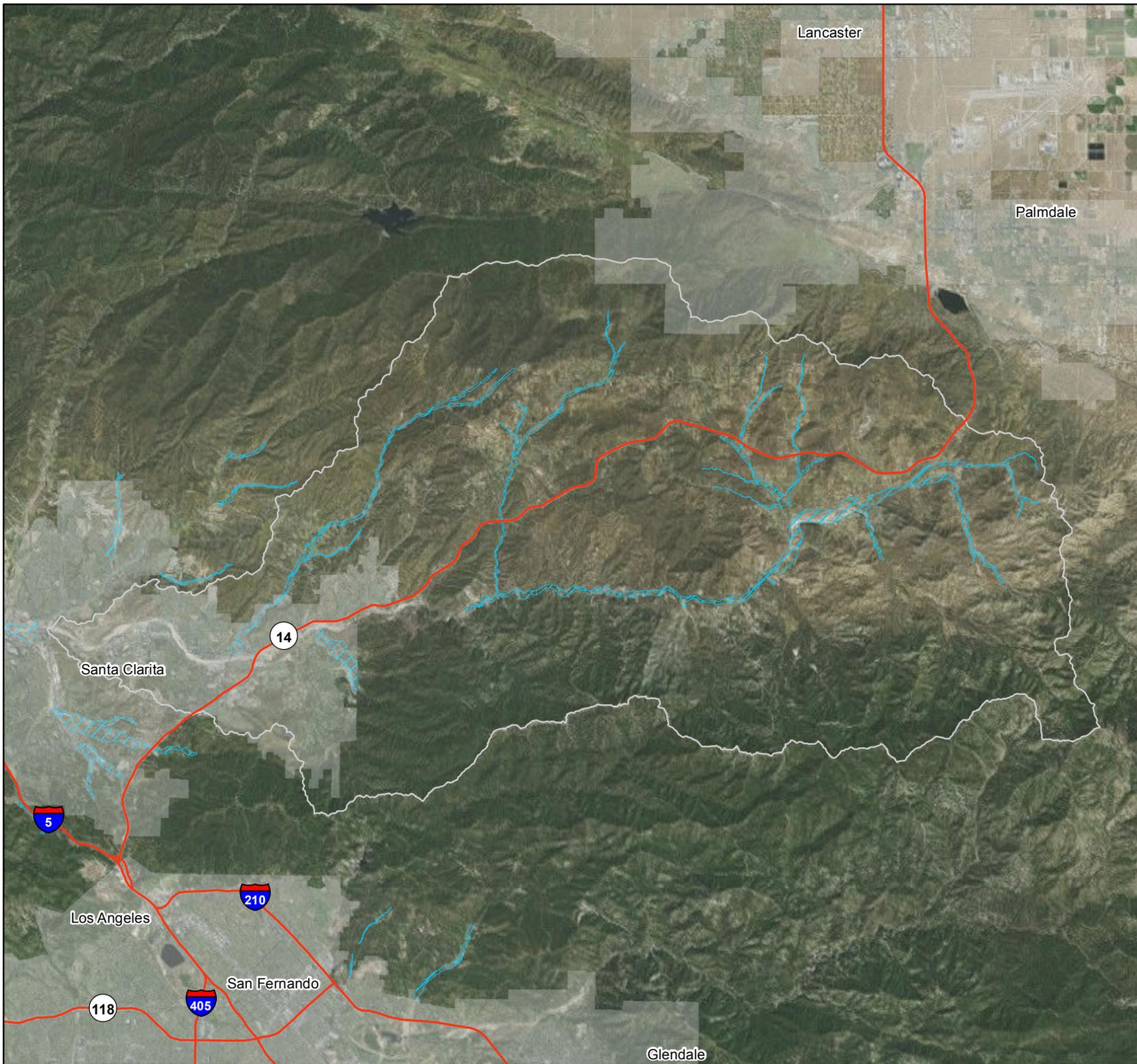
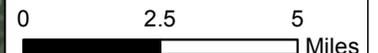
Headwaters Santa Clara River Watershed

Los Angeles County Floodways, Capital Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Malibu Creek Watershed

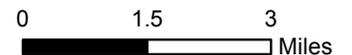
Los Angeles County Floodways, Capital Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr



Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Rio Hondo Watershed

Los Angeles County
Floodways, Capital
Flood (50-year)

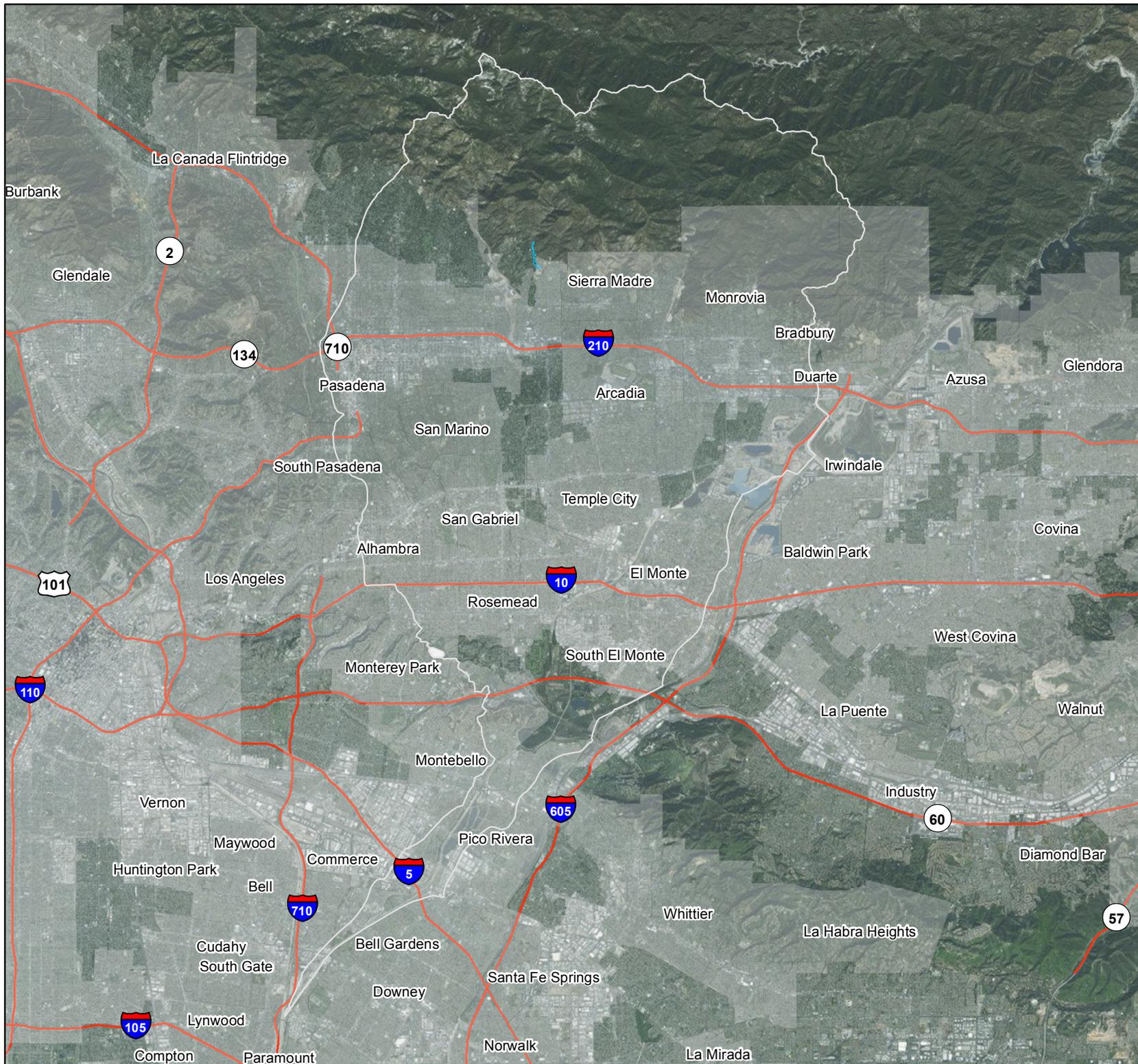
-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard
 -  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



0 2 4 Miles



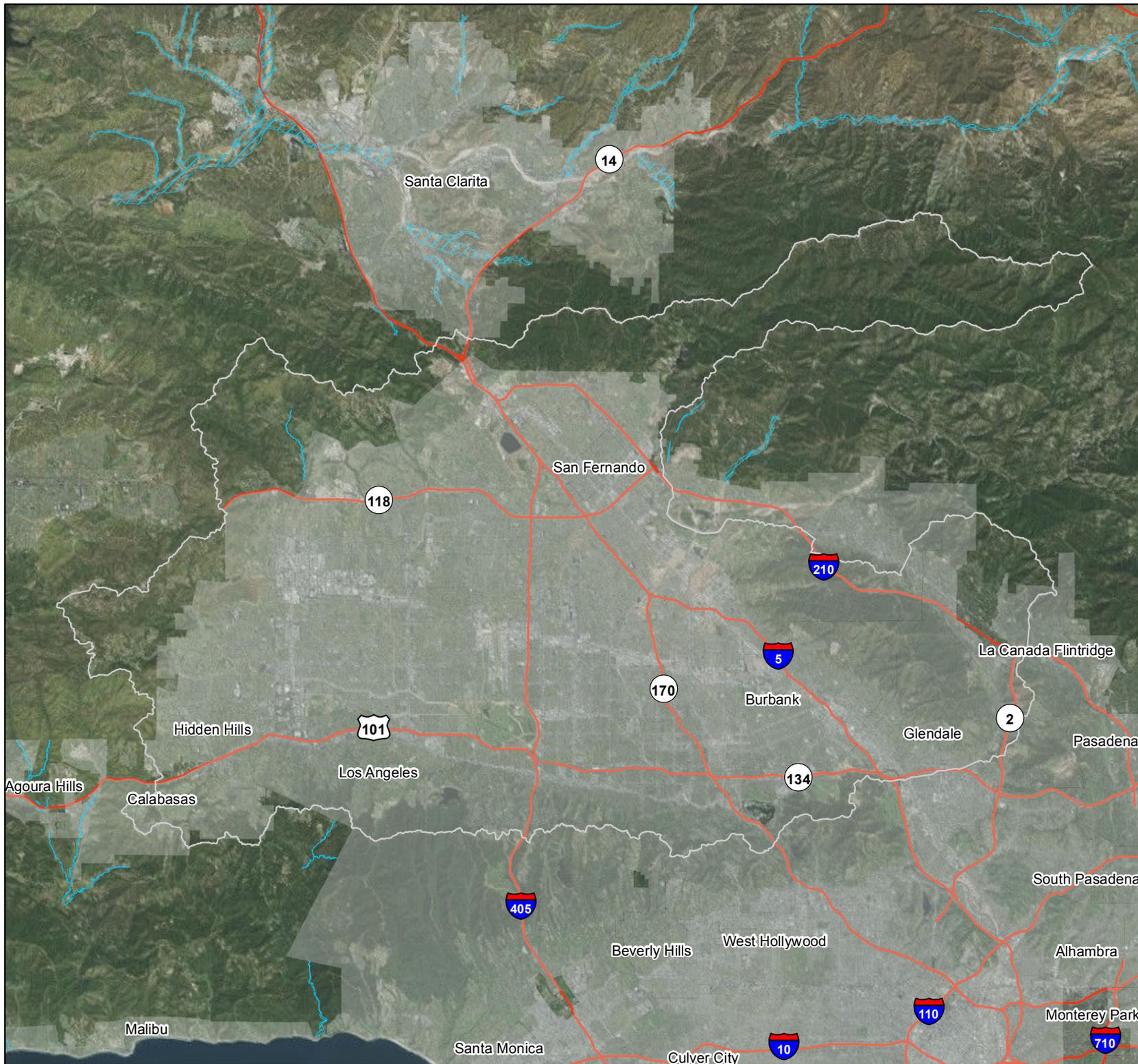
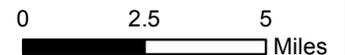
Upper Los Angeles River Watershed

Los Angeles County
Floodways, Capital
Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



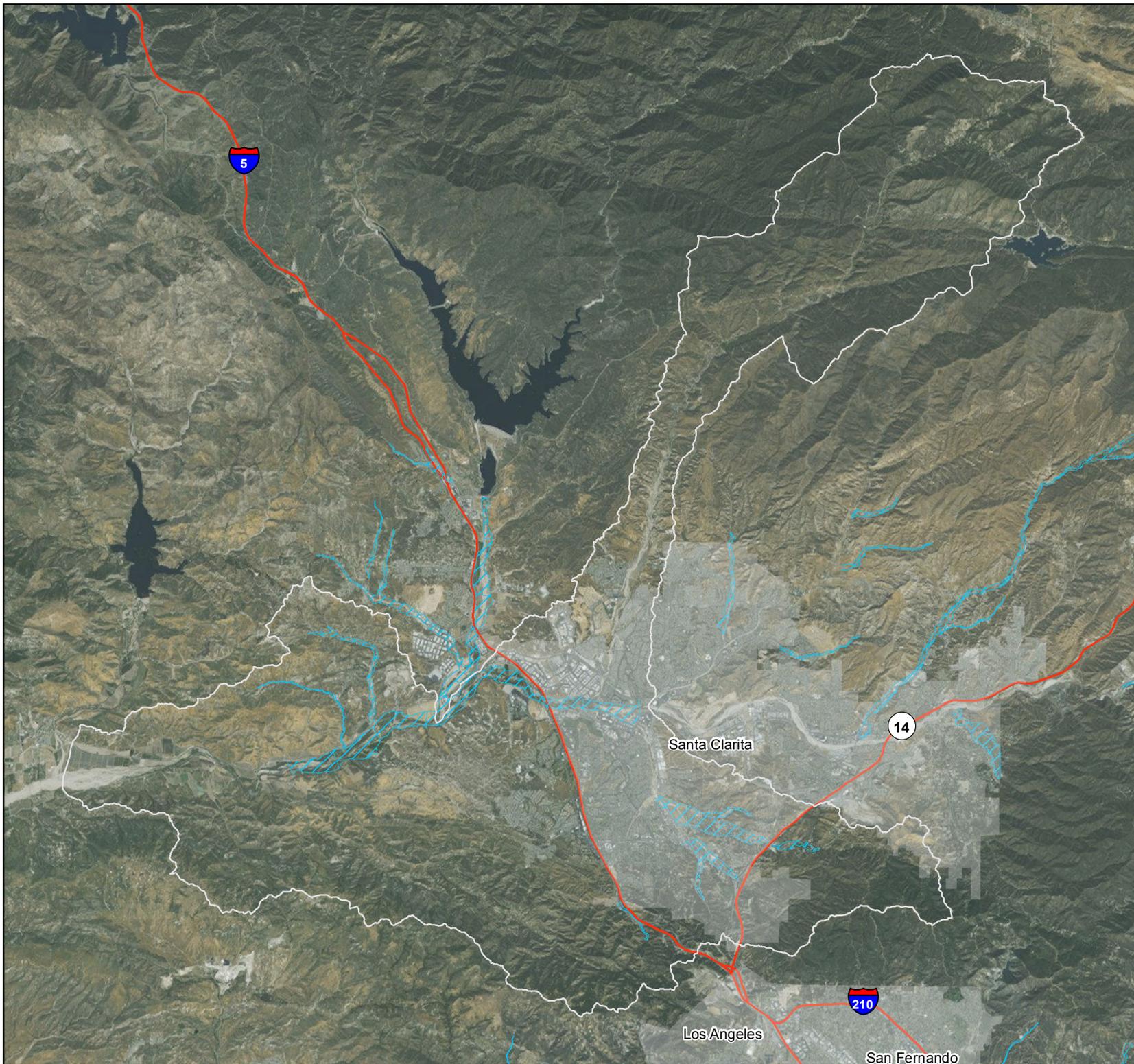
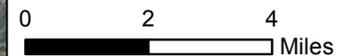
Upper Santa Clara River Watershed

Los Angeles County Floodways, Capital Flood (50-year)

-  Incorporated Cities
-  Watershed Boundary
- Flood Hazard**
-  County 50-yr

Base Map Data Sources:
Los Angeles County, ESRI

Map created: 5/27/15



Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX H.
EXAMPLE PROGRESS REPORT

APPENDIX H. EXAMPLE PROGRESS REPORT

Los Angeles County, California Comprehensive Floodplain Management Plan and Program for Public Information Annual Progress Report

Reporting Period: *(Insert reporting period)*

Background: Los Angeles County developed a floodplain management plan to reduce risk from flooding by identifying resources, information, and strategies for risk reduction. To prepare the plan, Los Angeles County organized resources, assessed risks from flooding, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from floods. The plan can be viewed on-line at:

<http://dpw.lacounty.gov/WMD/NFIP/FMP/>

During the floodplain management plan development, Los Angeles County also developed a program for public information to identify, prepare, implement, and monitor a range of flood-related public information activities that meet specific, local needs. The PPI framework is described in Chapter 14 of the floodplain management plan.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the *Los Angeles County Comprehensive Floodplain Management Plan* and on the implementation and evaluation of the outreach projects identified in the program for public information. The objective is to ensure that there is a continuing and responsive planning process that will keep the floodplain management plan and related outreach efforts dynamic and responsive to the needs and capabilities of Los Angeles County and stakeholders. This report discusses the following:

- Flood events that have occurred within the last year
- Changes in risk exposure within the planning area (unincorporated Los Angeles County)
- Mitigation success stories
- Changes in capabilities that could impact plan implementation
- Floodplain management plan implementation status
 - Review of the action plan
 - Recommendations for changes/enhancement
- Program for Public Information implementation and evaluation status
 - Review of the outreach projects
 - Review on progress toward desired outcomes
 - Recommendations for changes/enhancement.

Flood Events within the Planning Area: During the reporting period, there were [redacted] flood events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- _____
- _____
- _____
- _____
- _____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any flood event in the planning area that changed the probability of occurrence of flooding as presented in the floodplain management plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period, including notably successful public outreach efforts)*

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan or on public outreach efforts. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

FLOODPLAIN MANAGEMENT PLAN PROGRESS

Summary Overview of the Plan's Progress: The performance period for the floodplain management plan became effective on [redacted], 2016, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before [redacted], 2020. As of this reporting period, the performance period for this plan is considered to be [redacted]% complete. The floodplain management plan has targeted 35 flood hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- ___ out of ___ initiatives (___%) reported ongoing action toward completion.
- ___ out of ___ initiatives (___%) were reported as being complete.
- ___ out of ___ initiatives (___%) reported no action taken.

The Floodplain Management Plan Steering Committee: The floodplain management plan steering committee, made up of stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on [redacted], 201[redacted]. It was determined through the plan's development process that a steering committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

**TABLE 2.
ACTION PLAN MATRIX**

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O, ✓)
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	
Initiative # __ —			[description]	

PROGRAM FOR PUBLIC INFORMATION IMPLEMENTATION

Summary Overview of Implementation: The annual performance period for the program for public information is from September 1 to September 30 of each year. In the 20[] reporting period, [] ([] percent) of the [] identified outreach projects were implemented. Of the projects that were implemented [] ([] percent) have resulted in progress toward desired outcomes.

The Program for Public Information Committee: The Program for Public Information Committee, made up of stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on [], 201[]. It is expected that turnover will occur in Program for Public Information Committee membership from year to year. For this reporting period, the Committee membership is as indicated in Table 3.

TABLE 3. PROGRAM FOR PUBLIC INFORMATION COMMITTEE		
Name	Title	Jurisdiction/Agency

Review of the Outreach Projects: Table 4 reviews the identified outreach projects, reporting on the following items:

- 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.

Recommendations for Changes or Enhancements: Based on the review of this report by the program for public information Committee, the following changes will be incorporated during the next performance period:

- _____
- _____
- _____
- _____

**TABLE 4.
PROGRAM FOR PUBLIC INFORMATION COMMITTEE**

Message	Target Audiences	Desired Outcomes	Progress toward Outcomes	Projects	Assignment	Schedule	Stakeholder	Implemented (yes or why not?)
Topic 1: Know Your Flood Hazard								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				
Topic 2: Insure Your Property Against Your Flood Hazard								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				
Topic 3: Protect People from the Hazard								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				
Topic 4: Protect Your Property from the Hazard								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				

**TABLE 4.
PROGRAM FOR PUBLIC INFORMATION COMMITTEE**

Message	Target Audiences	Desired Outcomes	Progress toward Outcomes	Projects	Assignment	Schedule	Stakeholder	Implemented (yes or why not?)
Topic 5: Build Responsibly								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				
Topic 6: Protect Natural Floodplain Functions								
				Recommended changes:				
				Recommended changes:				
				Recommended changes:				
Topic 7: General Preparedness								
				Recommended changes:				
				Recommended changes:				

PUBLIC REVIEW NOTICE

The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the Los Angeles County Board of Supervisors and to local media outlets and the report is posted on the floodplain management plan website. Any questions or comments regarding the contents of this report should be directed to:

*Los Angeles County Department of Public Works
Watershed Management Division
(626) 458-7155*

Los Angeles County
Comprehensive Floodplain Management Plan

APPENDIX I.
PROGRAM FOR PUBLIC INFORMATION FRAMEWORK

APPENDIX I. PROGRAM FOR PUBLIC INFORMATION FRAMEWORK

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Topic 1: Know your flood hazard						
Know Your Flood Zone (www.dpw.lacounty.gov/wmd/floodzone/index.cfm)	Residents, property owners and businesses in the regulated floodplains Renters in flood-prone areas Critical Facility Operators in the regulated floodplains	Increase in hits to flood zone determination website	Outreach brochure "Are You Prepared for a Flood?"	DPW	Annually prior to rainy season	No
			Adopt a Creek	Mountains Restoration Trust	Ongoing	Yes
			Realtor's brochure or continuing education	Realtors	Ongoing with sale of real estate	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 Property owners implementing temporary or permanent flood mitigation projects Increased demand for sandbags during the storm season	Annual mailing to Repetitive Loss Area properties	DPW	Annually	No
Your Property May Be Subject To Flooding Or Flood Related Hazards	Gaps in the Maps identified properties Property owners near recently burned areas	Increase in inquiries to Public Works about flood hazards from gaps in the maps areas Increase in inquiries to Public Works about flood related hazards from recently burned areas	Homeowners Guide Online at: http://dpw.lacounty.gov/wmd/HomeOwners/index.cfm and distribute hard copy	DPW	As needed and after event	
			Gaps in the Maps newsletters article "Community Connections"	DPW	Annually	

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Topic 2: Insure your property against your flood hazard						
Take Advantage Of A Low Cost/ Preferred Risk Policy	Residents, property owners and businesses in 500 year floodplain Gaps in the Maps identified properties Residents, property owners and businesses in repetitive loss areas (if outside of regulated floodplain)	Increase in flood insurance policy holders outside of the 100 year floodplain	Fire hazard and sediment flow information			
			Information posted on the website	DPW	Available year round on website	No
			Newsletter article in Public Works' NewsWorks and County's Community Connections.	DPW	Annually	No
You Need Flood Insurance	Residents, property owners, and businesses in the 100 year floodplain Homeowners who do not have a mortgage	Increase in flood insurance policy holders in the 100 year floodplain	Mailings to properties in the flood zone and repetitive loss areas.	DPW	Annually	No
			Social media posting (Twitter)	DPW	During storm season	No
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	No
			Westside Rentals link	DPW	Annually	No
Topic 3: Protect people from the hazard						
Avoid Swift Water!	People/children who hike or bike through channels and streams People who are camping/residing in channels and streams	Decrease in swift water rescues 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
			Adopt a Creek	Mountains Restoration Trust	Year Round	Yes
			Homeless Count	Los Angeles Homeless Services Authority	Annually	Yes
			High water mark signage	DPW		No
Move To High Ground	Hikers and bikers People who are camping/residing near streams	Decrease in swift water rescues	Permanent signs posted in outdoor areas subject to flooding	DPW		No
Turn Around, Don't Drown	Drivers (sub-population may be in Antelope Valley and Santa Monica Mountains)	Decrease in swift water rescues Decrease in car-related flood injuries and fatalities	Temporary warning signs near frequently inundated crossings	DPW-Road Maintenance Division	Before Event.	No

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Know The Signs Of Flash Flooding	Antelope Valley Residents Hikers Populations who are camping/residing near streams in natural areas such as the Santa Monica and San Gabriel Mountains	Decrease in swift water rescues Decrease in accidents and injuries due to flash flooding	Information on website and link to YouTube Video	DPW	One time, available online	No
			Twitter reminder	DPW	Prior to and during rainy season	No
			Twitter reminder	Los Angeles County Parks and Recreation	Prior to and during rainy season	No
			Facebook message	Los Angeles County Parks and Recreation	Prior to and during rainy season	No
Know What Flood Warning Means	Residents, property owners and businesses in the regulated floodplains Property owners near recently burned areas	Decrease in accidents and injuries due to flooding	YouTube Video	DPW	Available year round online	No
			Develop a website with information on flood warning	DPW	Available year round online	No
			Twitter reminder	DPW	Prior to and during rainy season	No
			Twitter reminder	Los Angeles County Parks and Rec	Prior to and during rainy season	No
			Facebook message	Los Angeles County Parks and Rec	Prior to and during rainy season	No
Teach School Children About Flooding	School Districts CREEC	Decrease in accidents and injuries due to flooding to school children and their families	Crayfish removal patches	Adopt a Creek, Girl/Boy Scouts	Continually	Yes
			Children's information on FEMA website		Continually	No
			Develop information and messaging that can be shared with school children and parents.	DPW	Annually	No
			Develop and integrate information on flooding into educational materials	Heal the Bay	Year Round	Yes
			Integrate information on flooding into educational courses and materials	Santa Monica Mountains Resource Conservation District	Year Round	Yes

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Topic 4: Protect your property from the flood hazard						
Flood Affects More Than Homes	Equestrian centers, feed stores and associations Residents, property owners and businesses in the regulated floodplains		Develop a brochure/fact sheet – prevent all types of obstructions to flood flows Message to “Stop filling	DPW		No
			Develop displays/posters or informational piece at centers/stores	DPW		
Your Actions Impact Others	Residents, property owners and businesses in the regulated floodplains Equestrian centers, feed stores and associations Property owners that need to maintain creeks Residents and property owners along creeks where vegetation is sick or dying Renters in flood prone areas Lake Los Angeles property owners with creek Gaps in the Maps identified properties	Removal of obstructions (fences, corals, debris, berms, fill, etc.) in the flow paths	Mailing	DPW	As needed	No
			Twitter reminder	DPW	Prior to and during rainy season	No
			Twitter reminder	Los Angeles County Parks and Rec	Prior to and during rainy season	No
			YouTube Video	DPW	One time, available online	No
			Develop articles for inclusion in DPW NewsWorks. Community Connections.	DPW		No
Illegal Activities May Lead To Fines	Lake Los Angeles property owners with creek thru property Areas where there are significant instances of illegal dumping in conveyance systems	Removal of obstructions (fences, corals, debris, berms, fill, etc.) in the flow paths Fewer instances of illegal dumping	Distribute a mailing to property owners with known obstructions	DPW	As needed	No
			Dumping Website	DPW	Year Round	No
			Distribute a mailing to areas with instances of illegal dumping	DPW- Environmental Programs		No

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Need Advice For Protecting Your Property From Flood Hazards? Please Call Us Or Visit Website. http://dpw.lacounty.gov/wmd/HomeOwners/index.cfm and https://dpw.lacounty.gov/wrd/Fire/display.cfm?product=file/faq.htm	Residents, property owners and businesses in the regulated floodplains Residents, property owners and businesses in repetitive loss areas Environmental consultants/building contractors or others involved in the permitting process Gaps in the Maps identified properties Lake Los Angeles property owners with creeks thru property Property owners near recently burned areas Residents, property owners and businesses in the regulated floodplains Residents, property owners and businesses in repetitive loss areas Environmental consultants/building contractors or others involved in the permitting process Gaps in the Maps identified properties Lake Los Angeles property owners with creeks thru property Property owners near recently burned areas	Increase in requests for assistance/advice. 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
			YouTube Video	DPW	Available year round online	No

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 Homeowners applying for permits	Increase in protection of structures	Floodproofing brochure			No
			Social media (Twitter, Facebook, Flickr, Instagram, etc.) and NFIP website	DPW	Year Round	No
Just Because It Is Not Mapped Does Not Mean You Are Not At Risk	Gaps in the Maps identified properties		Develop a webpage that discusses the issue and related hazards	DPW		No
			Social media (twitter, facebook, flickr, Instagram, etc)	DPW		No
			Write an article for a newsletter targeting the Santa Monica Mountains			
Get A Permit Before You Build	Residents, property owners and businesses in the regulated floodplains Residents, property owners and businesses in repetitive loss areas Gaps in the Maps identified properties	Increase in number of properties protecting their structures	Develop a new webpage			No
			Social media (Twitter, Facebook, Flickr, Instagram, etc.)	DPW	Year Round	No
			Write an article in a newsletter	DPW	Annually	Yes

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Topic 6: Protect natural floodplain functions						
Share The Floodplains	<p>Hikers</p> <p>Beachgoers near the mouths of rivers/creeks</p> <p>Equestrian centers, feed stores and associations</p> <p>Countywide</p> <p>Populations who are camping/residing near streams in the mountains</p>		Adopt a Creek	Mountains Restoration Trust	Continually	Yes
			Fifth grade outdoor education, Cold Creek docents	Cold Creek Docents	Throughout year	Yes
			Waves, Wetland and Watersheds Curriculum (3-8 grade)	Heal the Bay	Available year round at healthebay.org	Yes
			The Next Wave, Quarterly Education Newsletter	DPW prepares article for Heal the Bay	Annually	Yes
			Source to Sea Watershed Education Program, Speaker Request Program for High School, Colleges, and Organizations	Friends of the L.A. River	Events throughout year and info available at folar.org	Yes
No Dumping www.dpw.lacounty.gov/epd/illdump	Areas where there are significant instances of illegal dumping in conveyance systems	Reduced illegal dumping	Drains to River signage/No Dumping signage	DPW	As needed	No
			No trespassing signage	DPW	As needed	No
Protect These Areas	<p>Hikers</p> <p>Beachgoers near the mouths of rivers/creeks</p> <p>Equestrian centers, feed stores and associations</p> <p>Countywide</p> <p>Populations who are camping/residing near streams in the mountains</p>		Trailhead flyers for kiosks	DPW	Annually	No
			Flyer	Resource conservation district		

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Floodplains Help Us!	Residents, property owners and businesses in the regulated floodplains Property owners that need to maintain channels or other conveyance systems Gaps in the Maps identified properties	Increased maintenance and clearance of obstructions in natural creeks.	Fifth grade outdoor education, Cole Creek docents	Cold Creek Docents	Throughout year	Yes
			Waves, Wetland and Watersheds Curriculum (3-8 grade)	Heal the Bay	Available year round at healthebay.org	Yes
			The Next Wave, Quarterly Education Newsletter	DPW prepares article for Heal the Bay	Annually	Yes
			Source to Sea Watershed Education Program, Speaker Request Program for High School, Colleges, and Organizations	Friends of the L.A. River	Events throughout year and info available at foliar.org	Yes
These Areas Are Habitat	Hikers Beachgoers near the mouths of rivers/creeks Equestrian centers, feed stores and associations Countywide Populations who are camping/residing near streams in the mountains		Fifth grade outdoor education, Cold Creek docents	Cold Creek Docents	Throughout year	Yes
			Waves, Wetland and Watersheds Curriculum (3-8 grade)	Heal the Bay	Available year round at healthebay.org	Yes
			The Next Wave, Quarterly Education Newsletter	DPW prepares article for Heal the Bay	Annually	Yes
			Source to Sea Watershed Education Program, Speaker Request Program for High School, Colleges, and Organizations	Friends of the L.A. River	Events throughout year and info available at foliar.org	Yes

Message	Target Audiences	Outcomes	Projects	Assignment	Schedule	Stakeholder (element STK)
Topic 7: General preparedness						
Sign Up For Alert LA www.lacounty.gov/emergency/alert-la/	Countywide Residents, property owners and businesses in the regulated floodplains School Districts	Increase number of residents that register their mobile number for Alert LA.	Social media posts (Twitter)	DPW	Quarterly	No
			Promote Alert LA on County Website.	DPW Sheriff's Dept	Available online year round	No
			Provide Alert LA County Brochure http://www.lacoa.org/pm_pub.html	CEO Office of Emergency Management	Available online year round	No
Develop A Family Disaster Plan http://www.lacoa.org/pm_pub.html http://www.lacoa.org/PDF/EmergencySurvivalGuide-LowRes.pdf	Countywide Residents, property owners and businesses in the regulated floodplains School Districts	Increase preparedness by residents	Distribute brochure	CEO Office of Emergency Management	Year round	No
			Social media (twitter, facebook, flickr, Instagram, etc)	DPW	Quarterly	No
			Write article in newsletter			
			Vendor booths at fairs	CEO Office of Emergency Management		No
Know Your Risk	Countywide Residents, property owners and businesses in the regulated floodplains School Districts	Increased visits to the Flood Zone Determination Website	Mailer	DPW	Annual mailing	No
			Social media (twitter, facebook, flickr, Instagram, etc)	DPW	Annually	No

Date of Meeting: April 15, 2015
Location: Los Angeles County Department of Public Works Headquarters
 (900 S. Fremont Ave. Alhambra, CA)
Subject: Program for Public Information (PPI) Meeting No. 1
Project Name: Los Angeles County Floodplain Management Plan Update
In Attendance: **PPI Committee:** George De La O, Edgar Cisneros, Angel Barnuevo,
 Tom Delmore and Debbie Sharpton
Planning Team: Eduardo Escobar and Kristen Gelino
Not Present: Kerjon Lee and Sara Townsend
Summary Prepared by: Kristen Gelino – 4/23/2015
Project No.: 103IS3293/T32834

Item	Action
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Welcome and Introductions

- Kristen Gelino thanked the committee members for their attendance and facilitated group introductions.
- Handouts provided included: Agenda, Session 1 Goals Sheet, Example of Other Public Information Efforts and Draft Los Angeles County Other Public Information Efforts.
- Before beginning the meeting agenda the committee discussed a few administrative tasks. It was decided that a call in number would be provided for future meetings due to the lengthy driving time for some members to reach Alhambra. Additionally, the committee requested that a calendar invite be sent out for future meetings.

It will provide a call number for future meetings and will send out calendar invitations.

PPI Overview

Kristen Gelino provided a brief overview of the PPI process. She provided a brief explanation of the relationship of the PPI process to the Community Rating System (CRS) and to the current effort to develop the County’s Comprehensive Floodplain Management Plan (FMP). Kristen indicated that the desired outcome of the PPI planning process is to develop a framework for the County’s flood-related public outreach projects and activities for the next year. She indicated that the framework would be included as a chapter in the FMP and

Item**Action**

that annual progress reports would be produced on the outreach activities identified by the committee. George De La O provided an explanation of the County's reasons for developing a PPI and indicated that there had been changes to the CRS program so the County wanted to ensure that they could maintain or improve the current class rating of seven given the new guidelines. Kristen indicated that the PPI was one of the new additions to CRS and so there are not a lot of already completed PPIs to use as examples. Kristen reviewed the seven steps of the PPI process and indicated that the planning team expected the process to be somewhat iterative. Kristen indicated the first step, establish a PPI committee, had already been accomplished. She reviewed the requirements for the committee and indicated that each member helped meet the CRS requirements and brought useful experience and skills to the table.

Session 1 Goals

Kristen indicated that today's meeting would be focused on step 2 assess the community's public information needs. She indicated that there were several components to step 2 including delineating target areas, determining target audiences and inventorying other public information efforts.

Goal #1 Determine Target Areas: Kristen described how CRS defines target areas: focus areas or priority areas of the community with concerns related to floodplains. She indicated that the risk assessment being developed as part of the FMP would be able to support this portion of the PPI planning process. She indicated that, at a minimum, target areas should be the FEMA designated floodplains, the County floodways and the repetitive loss areas. The committee then discussed whether any additional areas should be targeted. Kristen informed the committee that the CRS requires three products for target areas:

1. A map showing areas subject to different flooding conditions.
2. A description of each area.
3. The number of buildings in each area.

Kristen indicated that the planning team would be developing these items for inclusion in the plan. After discussion it was determined that the planning team would review the potential to include two additional types of target areas: gaps in the maps and wildfire risk areas. Gaps in

It will develop the required products for the target areas.

Item	Action
<p>the maps refer to areas where floodplains were not originally mapped, but where development may now be occurring. The committee was unsure if proceeding with wildfire risk areas would be appropriate, considering flood related risks occur after a burn has occurred. Kristen indicated that she would do some research and present more information to the group at the next meeting. Debbie Sharpton suggested that the National Park Service may have some data relevant for the wildfire risk area identification.</p>	<p>It will research the feasibility of including gaps in the maps and wildfire risk areas as target areas.</p>
<p>Goal #2 Determine Target Audience: Discussion then turned to determining target audiences. Kristen provided the definition of target audiences given by CRS: a group of people who need information on flood related topics. She clarified for the group that target audiences can be selected based off of the target areas or for other reasons. The committee then began a brainstorming session to identify potential target audiences:</p>	
<ul style="list-style-type: none"> - Drivers - School districts as a mechanism for providing information to parents and informing students through curriculum - Environmental consultants/building contractors or others involved in the permitting process, particularly in the Santa Monica Mountains - Residents, property owners and businesses in the regulated floodplains - Residents, property owners and businesses in repetitive loss areas - California Regional Environmental Education Community (CREEC) or other organizations that can disseminate information to teachers - Influencers, such as real estate agents - Cub Scouts - Countywide audience for a disaster preparedness message - Countywide audience for a climate change message - Hikers - Beachgoers near the mouths of rivers/creeks - Equestrian centers, feed stores and associations - Property owners that need to maintain channels or other conveyance systems - Residents and property owners along creeks where vegetation is sick or dying 	

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<ul style="list-style-type: none"> - Trails Council - Sierra Club - Homeowners who have paid off mortgages or that did not have a mortgage - Renters in flood prone areas - Hospitals, doctors' offices and other public health professionals that operate within the floodplain - Community members who might consider dumping items in conveyance systems 	

During the course of this discussion, several ideas about messaging and/or platforms for delivering messages were suggested by committee members:

- Frame messages in a consumer-friendly manner, emphasize why the consumer needs this information
- Need to identify how to make flood related messaging currently relevant, especially given the challenges of the drought
- May want to link safety and savings
- Consider what the definition of flood is for the target audience (e.g. flash flood, mudflow)
- The Antelope Valley has a particular kind of flood related issue where residents are cut off from several travel routes during flood conditions
- EMS signs could be placed at intersections as a way to get out flood messages
- Consider coordinating with hillside stabilization/coastal erosion messaging
- Need to keep in mind that there are people who respond to different mediums. Some are responsive to email and twitter, while others are on the opposite end of the spectrum
- The Board of Supervisors might have twitter or other social media accounts that could be utilized for messaging
- Cell phone Nixle alerts are a potential platform
- Communities with active Nextdoor networks may present an opportunity for outreach
- Information could be provided at trail heads.

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Goal #3 Inventory Other Public Information Efforts: Eduardo Escobar and George De La O indicated that they had started a list of other public outreach efforts, but it was not yet complete. Kristen requested that the committee assist with the continued development of the list. She indicated that committee members should brainstorm and email other public outreach campaigns that they are aware of that might provide an opportunity for collaboration.

PPI committee members should email other public information efforts to Kristen, so that they can be added to the list.

Discuss Next Meeting and Step 3 Formulate Messages

Kristen indicated that the next meeting would be focused on messaging. She indicated another doodle poll would be sent out to schedule the next meeting and handouts would be provided for the committee to review beforehand.

It will schedule the next PPI meeting and provide information for the committee's review.

Action Items for Next Meeting

The action items identified during the meeting were reviewed.

The meeting was adjourned at 3:00 PM

The next meeting will be held in May and will be determined based on the availability of the PPI Committee.

Date of Meeting: May 21, 2015
Location: Los Angeles County Department of Public Works Headquarters
(900 S. Fremont Ave. Alhambra, CA)
Subject: Program for Public Information (PPI) Meeting No. 2
Project Name: Los Angeles County Floodplain Management Plan Update
In Attendance: **PPI Committee:** George De La O, Edgar Cisneros, Angel Barnuevo,
Kerjon Lee and Debbie Sharpton
Planning Team: Eduardo Escobar and Kristen Gelino
Not Present: Sara Townsend
Summary Prepared by: Kristen Gelino – 5/25/2015
Project No.: 103IS3293/T32834

Item	Action
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Welcome and Introductions

- Kristen Gelino thanked the committee members for their attendance and facilitated group introductions.
- Handouts provided included: Agenda, PPI Meeting 1 Summary, Session 2 Goals Sheet, Draft Los Angeles County Other Public Information Efforts, Example Messages and Outcomes from CRS Handbook, and County-wide Target Area Maps (County Floodway, FEMA Floodway, Gaps in the Maps and Repetitive Loss Areas).
- Kristen reviewed the action items from the previous meeting:
 - A call-in number and outlook calendar invitation had been sent out for the meeting.
 - The planning team has developed draft county-wide maps of the target areas and has provided initial descriptions and building count estimates.
 - The planning team is recommending that wildfire risk areas be treated as a target audience rather than a target area.
 - No additional information on other public outreach efforts had been received. Kristen clarified that the list currently included only County-initiated outreach efforts and the committee would need to expand the list

Item	Action
<p>to include efforts by other organizations and agencies. George De La O and Debbie Sharpton indicated that they knew of additional efforts that should be included.</p> <ul style="list-style-type: none"> • Kristen then briefly reviewed the 7 steps of the PPI process. 	<p>PPI committee members will forward public outreach efforts undertaken by organizations and agencies other than the County.</p>

Session 2 Goals

Kristen introduced the PPI Session 2 Goals Sheet and indicated that this meeting would be focused on reviewing and refining Step 2 objectives and discussing Step 3 objectives.

Goal #1 Review of Step 2: Kristen briefly reviewed the target areas that had been identified by the committee at the previous meeting. A brief discussion ensued regarding the number of buildings identified as being located in the Gaps in the Maps target area. George De La O indicated that he was surprised by the number of structures that had been identified. He explained that the buffer that was used may be appropriate in some areas, but may overestimate the risk in other areas, specifically in the mountain areas with narrow canyons. The committee also briefly discussed the fact that many structures may be barns or sheds. Kristen indicated that the land use for each parcel had been identified and she would forward on the land use breakdown to George.

Kristen will forward the land use breakdown for the areas identified in the gaps in the maps analysis to George.

Kristen then reviewed the list of target audiences that had been identified at the previous meeting. It was suggested that the language used on one item be changed to “areas where there are significant instances of illegal dumping in conveyance systems.” Additionally, Eduardo Escobar indicated that some of the items identified as target audiences may be more aptly defined as mediums or modes to funnel information to the target audiences. Kristen agreed and indicated that the committee could keep two running lists: one for target audiences and one for additional community members that may help us reach those target audiences.

Kristen will revise the list of target audiences per the discussion.

Kristen indicated that the committee members should keep these target areas and audiences in mind during the messaging discussion. She also indicated that the committee should keep the other public information efforts handout nearby to refer to during the discussion.

Item**Action**

Kristen indicated that all of the steps in the PPI build on one another and it is expected that the process will be somewhat iterative.

Goal #2 Identify Messages: Kristen then introduced step 3 formulate messages. She indicated that messaging should be based on the six priority topics identified by CRS, but additional topics could be added if needed. The committee reviewed the six topics and George indicated he would like to add the topic of general preparedness. The seven priority topics will be:

1. Know your floodplain.
2. Insure your property for your flood hazard.
3. Protect people from the hazard.
4. Protect your property from the hazard.
5. Build responsibly.
6. Protect natural floodplain functions.
7. General preparedness.

Kristen indicated that the committee would develop messaging for each of these topic areas. The messages should be developed keeping target audiences and outcomes in mind. She clarified that CRS is concerned with outcomes, not outputs, so that messages should be framed in a way that identifies a measureable metric, such as an increase in the number of flood insurance policies. The issue of prioritization was raised by a committee member. The planning team clarified that there certainly are some higher priorities than others within these messaging topics and audiences. This higher priority items are likely to be the ones that will result in identified outreach programs for this PPI. Kristen indicated that any ideas for outreach or audiences that do not make it onto this year's list can still be compiled and can be added during the next fiscal year.

The committee then discussed messaging for the priority topics. Messages were crafted with target audiences and outcomes in mind (Note: those messages added in italics were additional messaging options for consideration that were added by the planning team).

1. Know your floodplain.
 - a. Know your flood zone
 - b. You are in a repetitive flood area
 - c. Your property may be subject to flooding
 - d. *Your property is subject to flooding*

Item	Action
<ol style="list-style-type: none"> 2. Insure your property for your flood hazard. <ol style="list-style-type: none"> a. Take advantage of a low cost/preferred risk policy (depending on zone d or x) b. You need flood insurance c. <i>Renters can buy flood insurance</i> 3. Protect people from the hazard <ol style="list-style-type: none"> a. Stay out of the channel b. The channels are dangerous c. Turn around, don't drown d. Move to high ground e. Know the signs of flash flooding f. <i>Know what flood warning means</i> g. <i>Teach school children about flooding</i> 4. Protect your property from the hazard. <ol style="list-style-type: none"> a. Flood affects more than homes b. Your actions impact others c. Need advice? Please call us d. You will be fined. e. It is illegal to... 5. Build responsibly. <ol style="list-style-type: none"> a. A little investment now, could save you money later b. Just because it is not mapped does not mean you are not at risk c. <i>Get a permit before you build</i> 6. Protect natural floodplain functions <ol style="list-style-type: none"> a. Share the floodplains b. No dumping c. Protect these areas d. Floodplains help us (attenuate flows) e. Use it, but protect it f. Pretend the floodplain is your backyard g. These areas are habitat 7. General preparedness. <ol style="list-style-type: none"> a. Sign up for Alert LA b. <i>Develop a family disaster plan</i> 	<p>Kristen will develop a draft messaging matrix and distribute to the committee for comment. The committee will review and provide feedback.</p>

Kristen indicated that these topics, messages, audiences and draft outcomes would be developed into a messaging matrix. This matrix

Item	Action
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would be sent to the committee for their review and comment. For this matrix, specific outreach projects would be identified.

Discuss Next Meeting and Step 4 and Step 7

The PPI committee established a date for the next meeting. Kristen indicated that it would be focused on identifying outreach projects and on establishing an implementation and reporting protocol.

Kristen will send out an outlook invitation for the June 10 meeting.

Action Items for Next Meeting

The action items identified during the meeting were reviewed.

The meeting was adjourned at 12:00 PM

The next meeting will be held:

Wednesday, June 10, 2015

9:00 am to 11:00 am

PDD Conference Room, 11th Floor

900 S. Fremont Ave., Alhambra

Conference Line: 866-692-5721 Code: 564-2302

Date of Meeting: June 10, 2015
Location: Los Angeles County Department of Public Works Headquarters
(900 S. Fremont Ave. Alhambra, CA)
Subject: Program for Public Information (PPI) Meeting No. 3
Project Name: Los Angeles County Floodplain Management Plan Update
In Attendance: **PPI Committee:** George De La O, Angel Barnuevo, Kerjon Lee and
Debbie Sharpton
Planning Team: Eduardo Escobar, Kristen Gelino, and Sara
Townsend
Not Present: Edgar Cisneros
Summary Prepared by: Sara Townsend and Kristen Gelino – 6/12/2015
Project No.: 103IS3293/T32834

Item	Action
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Welcome and Introductions

- Kristen Gelino thanked the committee members for their attendance, both in person and on the phone. Phone attendees included Angel Barnuevo and Debbie Sharpton.
- Handouts provided included: Agenda, Session 3 Goals Sheet, Draft Los Angeles County Other Public Information Efforts, Example Messages and Outcomes from CRS Handbook, Draft Messaging Matrix.
- Kristen reviewed the action items from the previous meeting:
 - The Messaging Matrix had been compiled and sent out to the committee via email for feedback.
 - Some additional information on other possible public outreach efforts has been received.
- Kristen then briefly reviewed the remaining steps of the PPI process that would be discussed and indicated that, unless members elected to, this would be the last planning meeting for developing the PPI. Next meetings would be scheduled based on need for monitoring, evaluation, and annual review.

PPI Committee Actions

County Actions

Tt Actions

Session 3 Goals

Kristen introduced the PPI Session 3 Goals Sheet and indicated that this meeting would be focused on discussing Steps 4 and 7, with a brief explanation of Step 6. Step 5 will not be included as part of this PPI process. She then reviewed the messages that had been identified in the Messaging Matrix during the previous two PPI sessions.

PPI committee members will continue to forward public outreach efforts undertaken by organizations and agencies other than the County. It will refine those efforts into a final list to be included as part of the Messaging Matrix.

Goal #1 Step 4, Identify Outreach Projects to Convey Messages

Kristen explained that this session is intended to utilize the newly constructed Messaging Matrix in conjunction with the Other Public Outreach Efforts information to fill in the projects that can be undertaken to convey the messages identified. Projects identified can be already ongoing or new projects, and only those included in the plan are eligible to receive the additional CRS credit under the PPI.

Projects that were identified during the session need to be refined and detailed, with notes on who will do the project and when. The County will work to finalize this information.

There are three kinds of projects; informational materials (brochures available at LADPW facilities), general outreach (info disseminated to general audiences), and targeted outreach (materials delivered to 90% of a specific target audience).

The Messages in the matrix must either clearly state what the audience should do, or may have a message that includes a phone number or website that can guide the audience to additional information. It will ensure each message is adequately prepared. County will assist in identifying links and confirm information.

The PPI committee then began to fill in the outreach projects that would be appropriate for each message. The updated Messaging Matrix will be redistributed to committee members next week for review, suggestions, and edits.

During the course of review and discussion several ideas for outreach projects and audiences not previously identified were discussed:

- Debbie Sharpton indicated that the Mountains Restoration Trust conducts crayfish trapping as part of the Adopt a Creek program, and that messages could be distributed through this program, which occurs regularly throughout the year.
- Credit for the existing website was discussed. It should be clarified that a total of ten topics can receive credit when included on the website. However, if other websites carry messages identified in the matrix, they may be eligible for additional point credit.

The County will identify other opportunities to receive points via websites with appropriate messages.

Item	Action
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- CERT programs provide ongoing workshops and training to the public. The possibility of incorporating PPI messages into their training is an important opportunity to investigate.
- Critical facilities within the floodplain may already have mailings that are distributed to them, possibly by the EOC; need to investigate opportunities to include floodplain messages into those mailings.

It will follow up internally to see if the planning team has any examples of messaging distributed to critical facility owners or operators in the floodplain.

PPI Committee will review attached Messaging Matrix and provide comments.

Goal #2 Step 6, Prepare the PPI Document

Kristen explained that the PPI document will be a chapter in the updated 2015 FMP, and that it will be prepared as part of the larger document by Tt. When the plan is adopted, the PPI will also be adopted. Kristen indicated that the draft FMP will be sent to the committee for review and comment before the public review and adoption phase.

Goal #3 Step 7, Implement, Monitor, and Evaluate the Program

Kristen indicated that the next steps following completion of the PPI will be its implementation, monitoring, and evaluation.

- Implementation will be done according to assignments in the Messaging Matrix.
- Monitoring of the success of these messages and impacts on their outcomes will be assessed by the County.
- Evaluation of the program is the responsibility of the entire PPI committee and must happen on an annual basis.

Ongoing PPI Participation, Responsibilities and Scheduling

George De La O indicated that the County would like to review the PPI on a schedule in conjunction with the larger FMP review. The rainy season (September) will kick off the beginning of the PPI year and review will be done and submitted on October 1, at the same time as the FMP review.

The committee made the decision to wait and see how the final form of the Messaging Matrix and then decide if additional meetings would be needed. At this time, it is expected that the Messaging Matrix will be adequately reviewed by the committee via email, and that the committee

Committee members will keep their status and contact info available to the County committee coordinators.

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will reconvene at the time that the annual report/evaluation process is begun. This will likely be in summer 2016. Coordination to begin the evaluation process will be initiated by the County committee members.

The County will identify a new committee member to participate in future meetings.

Participation in the committee is voluntary and members may have the need to rotate out of the group. New members may be identified and participate at any time, as long as the required composition is maintained between governmental and non-governmental participants. At this time, one additional participant will be needed for future committee meetings.



Los Angeles County

Repetitive Loss Area Analysis

FINAL DRAFT

July 2016



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Los Angeles County REPETITIVE LOSS AREA ANALYSIS

DRAFT

JULY 2016

Prepared for:



Los Angeles County Department of Public Works
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Los Angeles County
Repetitive Loss Area Analysis

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Part 1 —
Planning Process and Project Background

CHAPTER 1. INTRODUCTION

1.1 REPETITIVE LOSS PROPERTIES AND THE COMMUNITY RATING SYSTEM

A repetitive loss property is defined by the Federal Emergency Management Agency (FEMA) as a property for which two or more National Flood Insurance Program (NFIP) losses of at least \$1,000 each have been paid within any 10-year rolling period since 1978 (FEMA, 2013). From 1978 through 2011, about a quarter of all claims paid under the NFIP nationwide were for repetitive loss properties, even though such properties make up fewer than 2 percent of all NFIP insurance policies (NFIP/CRS, 2011).

Federal programs such as the Community Rating System (CRS) encourage communities to identify and mitigate the causes of repetitive losses. The first step is to map repetitive loss areas, which are contiguous areas that include one or more properties on FEMA's list of repetitive loss properties and all nearby properties with exposure to the same or similar flooding conditions. FEMA considers listed repetitive loss properties to be indicative of an overall repetitive loss problem that may affect other nearby properties. Designation of repetitive loss areas around listed repetitive loss properties allows an evaluation of actual or potential flooding problems at properties that may not have flood insurance or may have had only a single previous claim. This ensures that all properties with the same exposure to a flood risk are addressed equally.

The CRS, which provides for reduced flood insurance premiums in communities that carry out various flood mitigation activities, requires the following from participating communities with 10 or more repetitive loss properties (Category C communities):

- Prepare a map of repetitive loss areas.
- Review and describe each area's repetitive loss problem.
- Prepare a list of the addresses of all properties in the repetitive loss areas with insurable buildings, which are defined to include the following (FEMA, 2013):
 - A structure that is affixed to a permanent site and has two or more outside rigid walls and a fully secured roof
 - A manufactured home (also known as a mobile home) built on a permanent chassis, transported to its site in one or more sections, and affixed to a permanent foundation
 - A travel trailer without wheels, built on a chassis and affixed to a permanent foundation, that is regulated under the community's floodplain management and building ordinances or laws.
- Undertake an annual outreach project to those addresses.
- Prepare a floodplain management plan or area analysis for the repetitive loss areas.

1.2 LOS ANGELES COUNTY REPETITIVE LOSS AREA ANALYSIS

Los Angeles County had 54 FEMA-designated repetitive loss properties in its unincorporated areas as of FEMA's last report on January 31, 2011. These properties have been mapped into 22 repetitive loss areas, and an analysis has been conducted for each area. FEMA prescribes the following five-step process for conducting an area analysis:

- Step 1—Advise all the property owners in the repetitive flood loss area that the analysis will be conducted.
- Step 2—Contact agencies or organizations that may have plans that could affect the cause or impacts of the flooding.
- Step 3—Collect data on the analysis area and each building in it to determine the causes of the repetitive damage.
- Step 4—Review alternative mitigation approaches and determine whether any property protection measures or drainage improvements are feasible.
- Step 5—Document the findings in a report.

This report documents the fulfillment of the CRS requirements for Category C communities, following the five-step area-analysis process. As required under Step 5, it provides the following information:

- A summary of the process followed (Chapters 2 and 3)
- Problem statements with maps for each area (Chapters 7 – 28)
- A table of basic information about each building in the area (Chapters 7 – 28)
- A description of alternative approaches considered to address the problem (Chapter 6)
- A set of recommended action items to address the problem (Chapters 7 – 29).

Individual properties and structures are counted and described in this document, but specific address information is withheld under the federal Privacy Act of 1974. A separate document on file with Los Angeles County for internal use only correlates the property ID numbers presented here with specific address information.

1.3 NUMBERING AND NOMENCLATURE

In designating federally recognized repetitive loss properties, FEMA assigns a seven-digit repetitive loss number (RL #) to each property, using a nationally defined numbering system. For the Los Angeles County Repetitive Loss Area Analysis, the 54 repetitive loss properties within the unincorporated county were renumbered 1 through 55 (the number 51 was omitted in a numbering revision). These numbers are referred to as RL Map numbers in this report.

Based on geographic distribution, repetitive loss areas were defined that include one or more repetitive loss properties. Areas were designated with a place name indicating the general location of the area. Table 1-1 summarizes the numbering and naming used in this analysis.

**TABLE 1-1.
NAMING AND NUMBERING OF LOS ANGELES COUNTY REPETITIVE LOSS PROPERTIES
AND AREAS**

Repetitive Loss Area Name	Los Angeles County RL Map Number	FEMA RL #
Agua Dulce	37	#0091339
Altadena A	35	#0056933
Altadena B	36	#0091348
Calabasas A	26	#0072498
Calabasas B	41	#0136718
Cold Creek	27	#0071255
	45	#0148768
Del Sur	55	#0138781
Lower Topanga Canyon	19	#0014900
	20	#0017941
	21	#0017942
	22	#0028440
	23	#0017940
Malibou Lake	1	#0046576
	2	#0047197
	3	#0001165
	4	#0039962
	5	#0028487
	6	#0040087
	7	#0012820
	8	#0049496
	10	#0028444
	11	#0071413
	12	#0073653
	13	#0072406
	14	#0071417
	15	#0035727
16	#0052974	
17	#0093872	
18	#0057971	
25	#0091232	
46	#0137792	
Malibu	28	#0070079
Quartz Hill A	38	#0057385
Quartz Hill B	39	#0091087
	40	#0131222
Roosevelt	42	#0137354
Rowland Heights	44	#0138651
Topanga Canyon A	30	#0028394
Topanga Canyon B	34	#0012818
Topanga Canyon C	48	#0111971

**TABLE 1-1.
NAMING AND NUMBERING OF LOS ANGELES COUNTY REPETITIVE LOSS PROPERTIES
AND AREAS**

Repetitive Loss Area Name	Los Angeles County RL Map Number	FEMA RL #
Topanga Canyon D	49	#0137970
Topanga Canyon E	50	#0138321
Triunfo Canyon A	24	#0095737
Triunfo Canyon B	43	#0137793
Upper Topanga Canyon	29	#0074656
	31	#0074334
	32	#0074553
	33	#0076269
	47	#0074498
Mitigated	9	#0014896
	52	#0017933
	53	#0028337
	54	#0049465

CHAPTER 2.

REPETITIVE LOSS AREA ANALYSIS METHODOLOGY

2.1 BASIC REQUIREMENTS

There are two key sets of requirements to be met for a repetitive loss area analysis (RLAA):

- **Repetitive loss area mapping** requirements contained in Section 503 of the CRS Coordinator’s Manual and in the supplemental publication, *Mapping Repetitive Loss Areas*. (The supplemental publication was being updated at the time this RLAA was being developed and therefore was not available to provide direction to this process.)
- **Building data collection** requirements contained in Section 512.b of the CRS Coordinator’s Manual:
 - Visit each building in the repetitive loss area and collect basic data.
 - Collect data during the site visit that is sufficient to make a preliminary determination of the cause of the repetitive flooding and of mitigation measures that would be appropriate to address the problem. This usually includes a review of drainage patterns around the building, the condition of the structure, and the condition and type of foundation.
 - The person conducting the visit should not have to enter the property—adequate information should be collected from observations from the street.
 - Floor elevations or historical flood levels are not required, but can be helpful if available.
 - The date of each building’s insurance claim can help identify the cause of flooding (e.g., rainfall or overbank flooding). The amount of the claim can help determine the amount of damage. Every year, each repetitive loss community is provided with a list of its historical insurance claims. This includes single-claim properties. Non-repetitive-loss communities that elect to do an RLAA may request these data from the CRS program.
 - This step may be done using the “limited data view” of the National Flood Mitigation Data Collection Tool.

More information on building data can be found in *Selecting Appropriate Mitigation Measures for Floodprone Structures* (FEMA-551).

2.2 REVERSE DAMAGE FUNCTION METHODOLOGY (INITIAL IDENTIFICATION)

2.2.1 Rationale for Alternative Approach

For the Los Angeles County RLAA, building data collection requirements were met using an alternative to the approach outlined in the CRS Coordinator’s Manual. The RLAA planning team selected the alternative approach—a “reverse damage function” methodology—for initial identification of repetitive loss areas for the following reasons:

- Like many CRS communities, Los Angeles County had not received a formal update of its repetitive loss data from the Insurance Services Office (ISO) since 2011. The County requested updated data from the State of California Department of Water Resources and from FEMA Region IX. Neither agency provided data matching or approximately matching the last set of data provided by ISO in 2011. It was decided to use the 2011 ISO data since it was the most complete and was the last official CRS dataset available to the County.

- Los Angeles County had prepared two detailed floodplain management plans for repetitive loss areas in 2007 that were updated in 2009. Both of these plans were the County’s CRS plan of record, meeting the County’s Category C repetitive loss requirements. The repetitive loss properties addressed by these plans were identical to those listed by ISO in 2011. These plans included site visits of each property in the identified repetitive loss areas. It was determined that this data could be carried over to this RLAA by being reviewed and enhanced using the selected alternative approach.
- A Level 2, user-defined flood model using Hazus-MH, version 2.1 was constructed in 2015 to support the development of the *Los Angeles County Comprehensive Floodplain Management Plan*. The model was possible due to the quality of Los Angeles County Assessor data available to the planning team. The County Assessor data provided key building attributes to model flood risk, such as date of construction, foundation type, occupancy class, square footage and permit history. The detailed model data allowed the use of the selected alternative approach.

2.2.2 Description of Selected Approach

The selected reverse damage function approach used available data and capabilities to prepare the RLAA. The alternative approach achieves the same objectives as the approach prescribed in the 2013 CRS Coordinator’s Manual (Section 512b), while providing the County a better protocol for maintaining data in the future to identify properties in a defined repetitive loss area and determine the cause of repetitive flooding.

The reverse damage function approach is a quantitative process based on modeling principles rather than the qualitative process outlined in the 2013 CRS Coordinator’s Manual. It uses an existing model to apply the principles of the “depth-damage function,” which is the cornerstone of risk assessment in FEMA’s Hazus-MH and Benefit-Cost Analysis programs. Both of these programs estimate damage using curves that show the percentage of asset value that will be damaged as a function of the depth of floodwaters. These depth-damage curves are well-established as a basis for estimating losses caused by flooding.

The reverse damage function methodology uses known values of damage from a flood event, based on filed claims, to estimate what the floodwater depth was for that event. The following protocol was followed:

- Each repetitive loss property from the ISO 2011 data set was mapped in GIS to look for possible groupings based on proximity. The GIS mapping was based on the LiDAR-generated digital elevation model used to prepare the *2015 Los Angeles County Comprehensive Floodplain Management Plan*. This digital elevation model has a 5-foot resolution.
- The average loss for each repetitive-loss (RL) property was determined by taking the average of all claims for that property.
- Replacement cost for each structure was calculated by applying the size and construction class for each RL property to the construction-cost-per-square-foot tables in *2015 BNi Home Builder’s Costbook* (Building News International, 2015).
- The percent damage “X” was calculated as:
 - $X = Z \div Y$
 - where:
 - X is the percent damage (to be determined)
 - Y is the replacement cost of the structure (based on assessor information)
 - Z is the estimated loss (based on the flood insurance claim)

- Once the percent damage was determined, the corresponding flood depth was determined by looking at the U.S. Army Corps of Engineers 2003 *Generic Depth-Damage Relationships for Residential Structures* (see Appendix A). These are the same damage functions contained in FEMA's Hazus-MH and BCAR platforms. They represent projected flood depths above the top of the finished floor.
- The determined flood depth was applied to the repetitive loss structure. Using the foundation type from assessor's data, the depth was added to the top of the finished floor. For a structure with a slab foundation, the top of the finished floor was set at 8 inches above adjacent grade. For a structure with a crawlspace foundation, the finished floor was set at 24 inches above adjacent grade. These parameters are based on standard building practices. None of the RL properties were shown to have basements, according to the assessor's data.
- Once the depth was applied to the finished floor, it was extended across the digital elevation model until it ran to zero depth (high ground) and a boundary was delineated. These boundaries were projected north, south, east and west for each property. In areas with multiple RL properties, the property with the highest depth above finished floor was used for this exercise.
- The boundary for each repetitive loss area was intersected with an ortho-photo and parcel boundary map. Each parcel with a structure within the delineated boundary was determined to be a property potentially subjected to repetitive flooding and was added to a repetitive loss list for Los Angeles County.
- Once all repetitive loss areas were delineated, they were checked against the repetitive loss areas identified in the 2009 plans.
- The historical claims data base provided to the County by ISO in 2011 for repetitive loss requirements of the CRS program was used to identify properties that had filed single flood insurance claims in each delineated area.
- Property condition assessments were made using the Google Street View application.

Utilizing this methodology, 22 repetitive loss areas were delineated. Maps and descriptions of the causes of flooding for each area can be found in Chapters 7 to 28.

The final step was to determine the cause of flooding, giving consideration to the following findings from the initial identification:

- 24 of 50 properties (48 percent) are located in a FEMA-designated 100-year flood zone.
- 2 of 50 properties (4 percent) are located in a FEMA-designated 500-year flood zone.
- The average number of claims per property was 3.
- The average claim paid, adjusted to 2015 dollars, was \$17,109. The highest average claim per property was \$52,557 and the lowest was \$6,203.
- The average replacement cost for the RL properties was \$514,690.
- The average percent-damage (the average claim divided by the replacement cost) was 4.2 percent.
- This correlated to an average flood depth of less than 1 foot above adjacent grade.

The planning team concluded that the majority of the repetitive losses are associated with localized urban drainage flood problems, even for properties within a FEMA-designated flood zone. There is no record of costly loss events that would indicate the maximum flood risk reflected in FEMA mapping. These findings were validated by the conclusions of the 2009 plans.

2.3 SECONDARY IDENTIFICATION

Once the initial identification of the repetitive loss areas was completed using the reverse-damage-function methodology, the planning team performed a secondary review of each repetitive loss area based on three questions about each area:

- Is there really a repetitive loss problem in this area, based on local knowledge?
- Does the list of properties make sense based on what we know about the area?
- Does the county have any additional qualifying data on the area to justify adding or removing properties?

Adjustments were made after applying these questions to each repetitive loss area. The initial identification for the RLAA indicated 164 properties in repetitive-loss areas, with 186 insurable structures. Based on the secondary identification, the list was adjusted to 192 properties with 208 insurable structures. This became the final repetitive loss area mailing list for the unincorporated areas of Los Angeles County.

2.4 PROPERTY CONDITION ASSESSMENT

A subjective assessment for each property in the repetitive loss areas was assigned by the planning team using assessor's data and visual confirmation based on Google Street View where possible. Three categories of property conditions were defined:

- **Good** (optional minor repair)—Only cosmetic repairs are needed.
- **Fair** (needs minor repair)—The following characteristics are observed:
 - Minor shrinkage cracks due to thermal expansion and contraction
 - Signs of rust on iron or steel members
 - Signs of corrosion of rebar
- **Poor** (needs significant repair)—The following types of damage are observed:
 - Bowed brick veneer wall or parapet walls
 - Leaning of wall
 - Wall cracking due to excessive settlement
 - Building settlement
 - Large cracking around sills, eaves, chimneys, parapets, and iron or steel lintels
 - Differential settlement of chimney
 - Fungal and insect attack of wood
 - Exposed rebar in concrete walls due to corrosion
 - Fire damage.

2.5 FOUNDATION TYPE

In Los Angeles County, there are generally two types of foundations (see Figure 2-1):

- A crawlspace, or raised foundation, is built above the ground, with just enough room to crawl underneath. There are stem walls on the perimeters, pierced in-between, with a girder system and floor joists on top of that. The foundation is high enough to leave at least 2 feet below to crawl into for access to the home's mechanical systems.
- Slab foundation is usually concrete poured directly onto the ground. This type of foundation uses concrete rather than wood to help support the weight of the home.

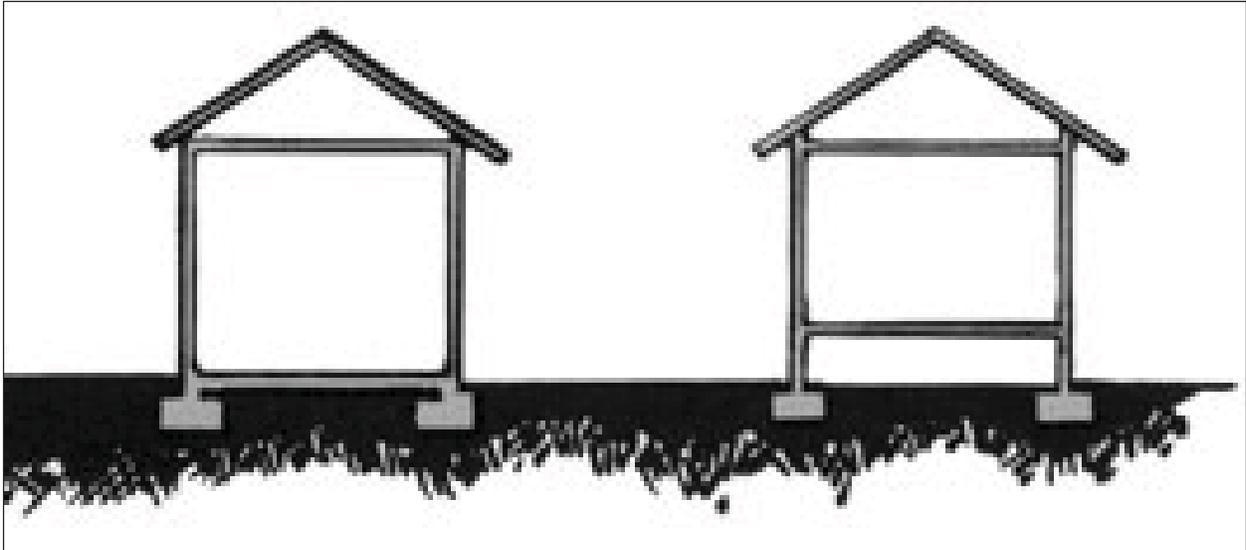


Figure 2-1. Foundation Types—Slab (left) and Crawlspace (right)

CHAPTER 3. REPETITIVE LOSS AREAS OUTREACH

3.1 CRS OUTREACH REQUIREMENTS FOR RLAA

RLAA Step 1 (2013 CRS Coordinator’s Manual Section 512.b) requires notification that an analysis is being conducted to all properties in the repetitive loss areas, with a request for input on the hazard and recommended actions. The notice (or any public document) must not identify which properties are on FEMA’s repetitive loss list. There are no restrictions on publicizing what properties are in repetitive loss areas that have more than one property and there are no restrictions on publishing aggregate data, such as how many properties received claims or the average value of those claims. Planning staff may share insurance claim information with the owner of a property but may not make it available to anyone else.

- The notice can be sent to owners OR residents, at the community’s discretion, as long as a representative of each property is notified.
- The notice cannot be done via a newspaper or newsletter notice or article.
- The notice must advise the recipients when and how copies of the draft report can be obtained and ask for their comments on the draft.

Several methods were deployed to engage repetitive loss area property owners during the course of this RLAA process. This chapter highlights those efforts.

RLAA Step 2 requires contact with agencies or organizations that may have plans or studies that could affect the cause or impacts of the flooding. The analysis report must identify contacted agencies and organizations.

3.2 COUNTYWIDE FLOODPLAIN MANAGEMENT PLANNING EFFORT

This Repetitive Loss Area Analysis is considered by Los Angeles County Department of Public Works to be the companion document to the 2016 Los Angeles County Comprehensive Floodplain Management Plan. The two plans were created in concert, with oversight by the same planning team. The development of this RLAA benefited from the planning process conducted to develop the floodplain management plan. The outreach effort used to develop the floodplain management plan included properties in the repetitive loss areas and provided a tangible benefit to the RLAA effort. This section provides an overview of the outreach conducted for the floodplain management plan.

3.2.1 Contact with Agencies and Organizations

The following agencies were invited to participate in the planning process 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 email throughout the RLAA development process. In addition, the RLAA was submitted for review to the Los Angeles County Access and Functional Needs Committee, in order to ensure compliance with the federal Americans with Disabilities Act.

3.2.2 Strategy

The strategy for involving the public in developing the RLAA 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 the RLAA. 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 departments 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).

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 3-1). 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.

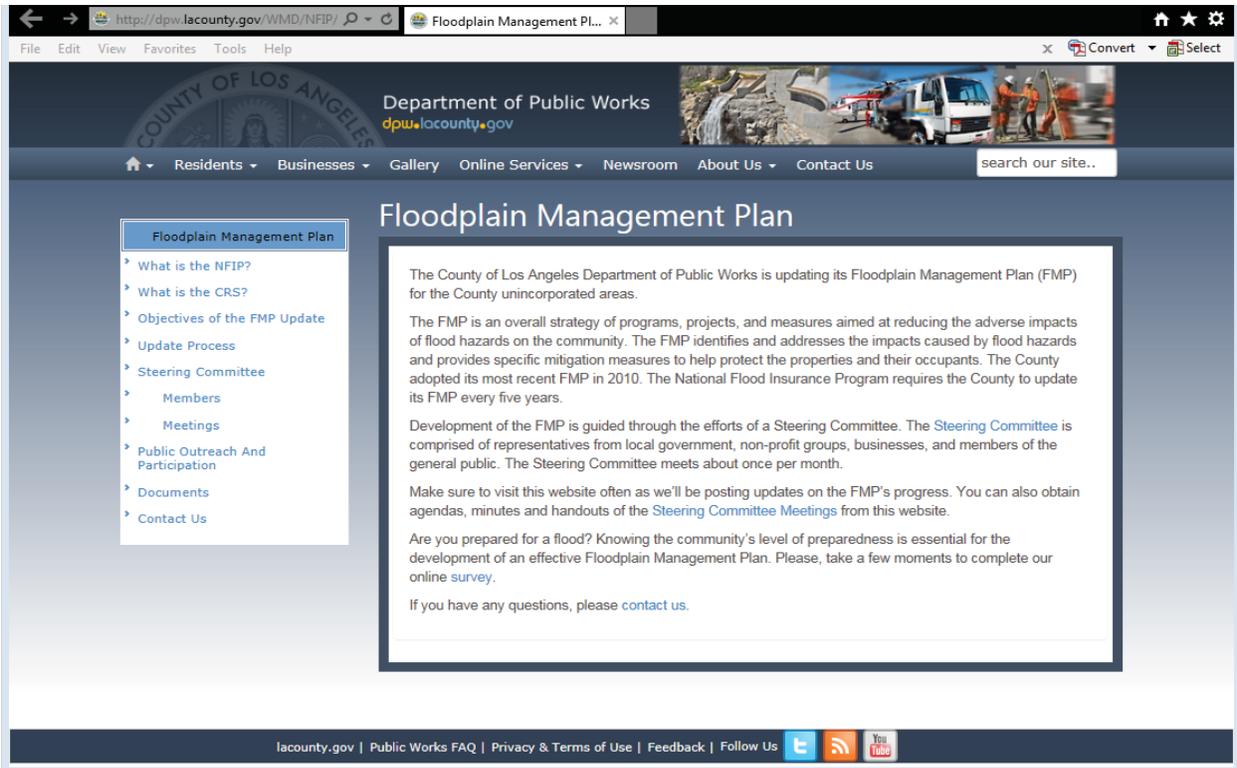


Figure 3-1. Sample Page from Floodplain Management Plan Web Site

Survey

A survey (see Figure 3-2) 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 repetitive loss area action items.

The screenshot shows a web-based survey interface. At the top, it says 'Los Angeles County Survey: Flood Preparedness'. Below that is a yellow header for '1. Survey Introduction'. The main content area is white and contains the following text:

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

Figure 3-2. Sample Page from Survey Distributed to the Public

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 3-3).

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 B.



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

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 3-1.

TABLE 3-1. FLOODPLAIN MANAGEMENT PLAN OPEN HOUSE PUBLIC MEETINGS	
When	Where
December 3, 2014, 4:00 pm to 7:00 pm	Agoura: Malibou Lake Mountain Club 29033 Lake Vista Drive, Agoura, CA 91301
January 10, 2015, 2:00 pm to 5:00 pm	Altadena: Altadena Community Library 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 18601 Soledad Canyon Road, Santa Clarita, CA 91351
February 21, 2015, 12:00 pm to 3:00 pm	Lancaster: Lancaster Public Library 601 West Lancaster Boulevard, Lancaster, CA 93534
April 2, 2015, 5:00 pm to 7:00 pm	Lynwood: Lynwood Library 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 3-4)
- Flyers were developed and distributed throughout the communities (see Figure 3-5).
- Postcards were mailed to properties located in floodplains near the meeting locations (see Figure 3-6). Over the course of the planning process, 2,472 postcards were distributed.



Figure 3-4. Press Release Announcing Public Meetings for the Floodplain Management Plan

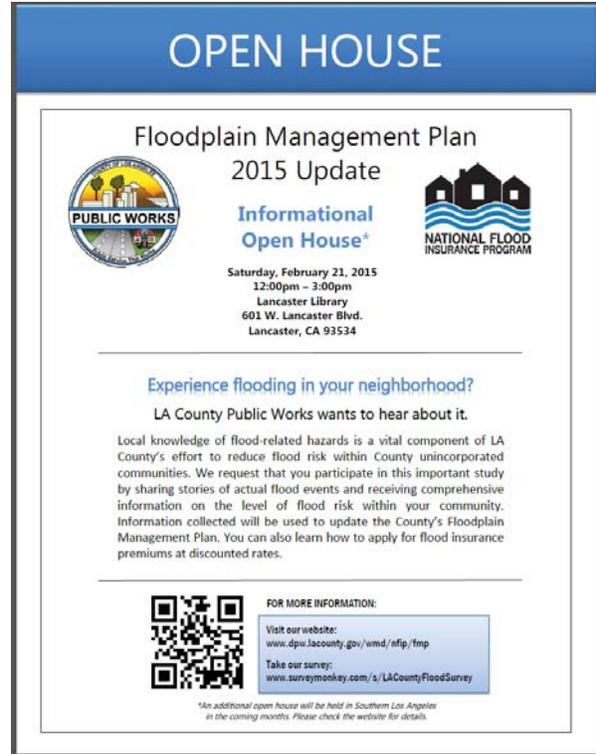


Figure 3-5. Flyer Announcing Public Meeting for the Floodplain Management Plan

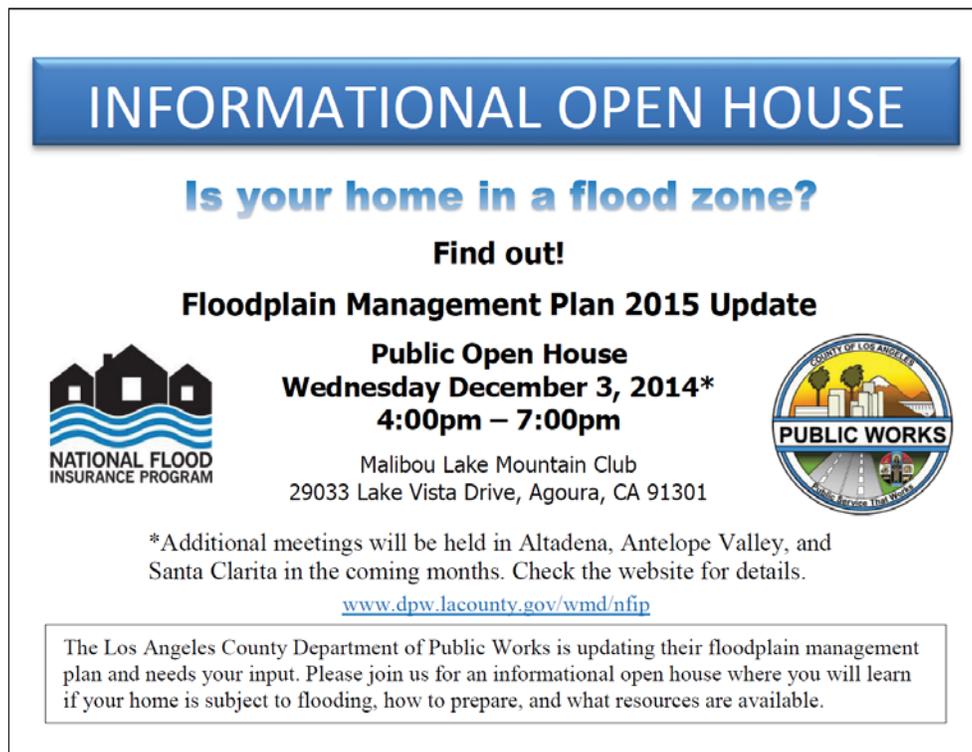


Figure 3-6. Postcard Announcing Public Meeting for the Floodplain Management Plan

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 3-7). 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 3-8 through Figure 3-11.



Figure 3-7. Example Printout from Hazus Workstation



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



Figure 3-9. Display of Flood Hazard Mapping, Altadena Meeting, January 10, 2015

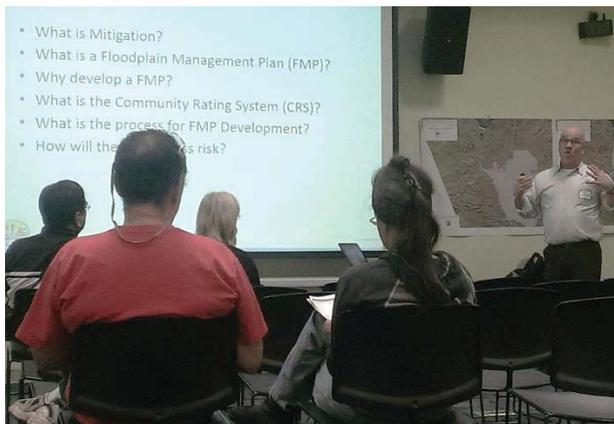


Figure 3-10. Informational Presentation, Santa Clarita Meeting, January 24, 2015



Figure 3-11. 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 3-2 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 3-2. FLOODPLAIN MANAGEMENT PLAN PRESENTATIONS TO TOWN COUNCILS	
When	Where
March 18, 2015, 6:00 pm	Lancaster—Antelope Acres Town Council Meeting: Westside Community Church 47707 90th Street West, Lancaster, CA 93536
March 24, 2015, 7:00 pm	Palmdale— Lake Los Angeles Town Council Meeting: Stephen Sorensen Park Gymnasium 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 42110 N. 6th Street West, Lancaster, CA 93534

3.2.3 Public Involvement Results

Survey Outreach

The survey for was completed by 136 respondents. Detailed results are provided in Appendix B. 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.
 - Retrofitting infrastructure (improving culverts, bridges, and local drainage)
 - Capital projects (dams, levees, floodwalls, and drainage improvements)
 - Providing better flood risk information to the public
 - Strengthening codes and regulations to higher regulatory standards
 - Acquiring vulnerable properties and maintaining them as open space
 - Assisting vulnerable property owners with securing mitigation funding
 - 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 3-3. 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 Zone AH area east of I-605 between Rivera Road and Slauson Avenue expressed concern about required flood insurance costs.

Date	Location	Number of Attendees	Number of Surveys 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
Town Council Presentations			
March 18, 2015	Antelope Acres Town Council Meeting, Westside Community Church	11	0
March 24, 2015	Lake Los Angeles Town Council Meeting, Stephen Sorensen Park Gymnasium	30	0
March 25, 2015	Association of Rural Town Councils Meeting, Fire Station 129	19	0
Total		108	10

- 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 Zone AO area 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.

3.3 REPETITIVE LOSS AREA SPECIFIC OUTREACH

Upon the completion of a draft of this report, Los Angeles County Department of Public Works disseminated a letter to residents in each repetitive loss area informing them of this report, where and how they would be able to review it, and where and how they might submit comments regarding it. The communication document is shown in Figure 3-12.

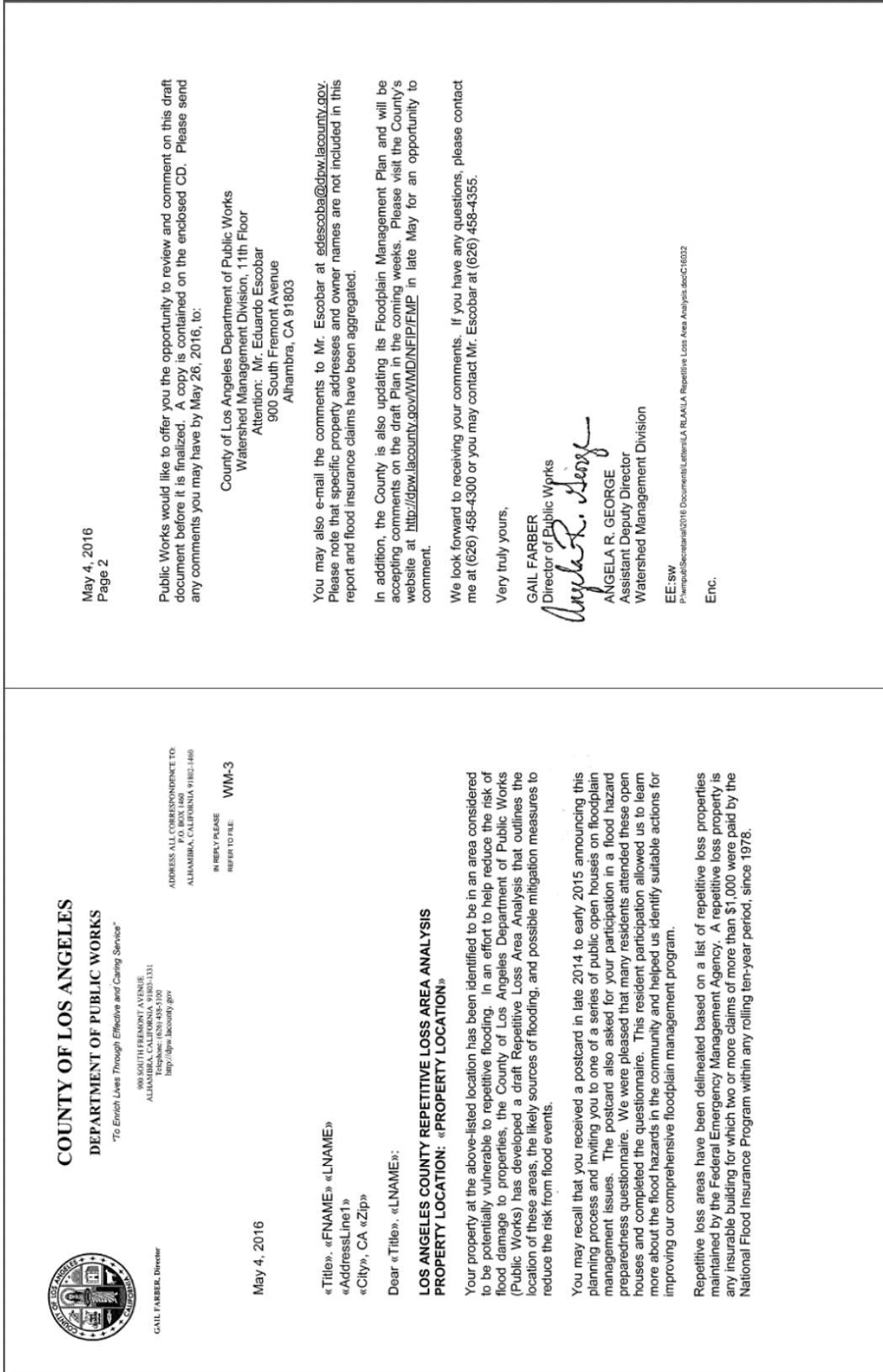


Figure 3-12. Repetitive Loss Area Target Mailing

CHAPTER 4.

RELEVANT PROGRAMS AND REGULATIONS

This chapter provides a comprehensive review of existing laws, ordinances and plans at the federal, state and local level that can support or impact action items identified in this RLAA. 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 the RLAA 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.

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).

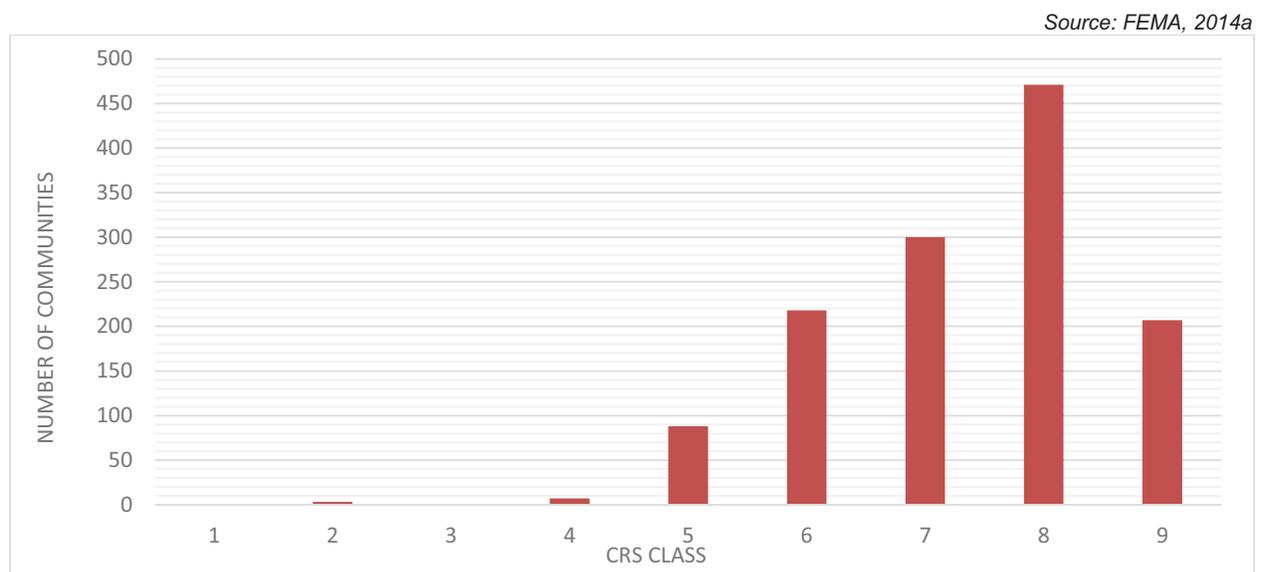


Figure 4-1. CRS Communities by Class Nationwide as of May 2014

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.

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.

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 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.

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.

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. City 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.

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, subject to specified exemptions. CEQA makes environmental protection a mandatory part of every California state and local agency's decision making process. It establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. For any project with potentially significant environmental impacts that is not within the scope of a specified exemption, agencies must prepare a mitigated negative declaration or an environmental impact report to analyze and discuss the environmental impacts and mitigation measures.

This RLAA does not require the preparation of a mitigated negative declaration or an environmental impact report. 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 RLAA 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 adoption, approval, publication, and implementation of California 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.

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.

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. It includes four key actions:

- 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 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, or sooner.

Each plan identifies activities 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 will rely heavily on three important 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 implement designs for 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 supplies, beautify neighborhoods, and cool communities by increasing the amount of vegetation.
- **Low Impact Development**—Low impact development uses site design and best management practices to 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 vision and direction for the sustainable management of water resources in the Greater Los Angeles County Region for the next 20 years through collaborative planning. The Plan identifies a comprehensive set of 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 either 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 the development and implementation of projects that reduce reliance on imported water, provide improved water quality and protect natural resources, including 52 projects that were awarded over \$100 million of 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. 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 encompasses 2,752 square miles, six major watersheds and 85 cities. Its 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 than 80,000 catch basins. Efforts to rehabilitate flood control facilities also consider other 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 a comprehensive 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 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 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 within 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:

- 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; and;
- 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 the future. Many of the projects are structural, but highlights also include natural resource preservation, 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 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 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 Compton Creek. The project is designed to increase recreational opportunities and local aesthetics through improvements, such as a bike trail, equestrian trail, and landscaping. The Los Angeles County Drainage Area 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).

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 Area 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 repetitive loss area action items. A qualifying explanation of the each of the categories is as follows:

- **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 fiscal capability of Los Angeles County. This table identifies what financial resources (other than grants) are available to the county to support the implementation of repetitive loss area action items.

Table 4-3 summarizes the County’s participation in flood-related national programs. These programs rank and evaluate the County’s capabilities to implement flood hazard reduction programs such as building code enforcement and flood warning and response activities.

Table 4-4 summarizes the administrative and technical capability of Los Angeles County. This table inventories the staff/personnel resources available to Los Angeles County to help with flood hazard mitigation planning and the implementation of specific mitigation 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 <i>Comment:</i> County of Los Angeles County Code, Title 26 – Building Code	Yes	No	No	Yes
Zoning Code <i>Comment:</i> County of Los Angeles County Code, Title 22 – Planning and Zoning	Yes	No	No	Yes
Subdivisions <i>Comment:</i> County of Los Angeles County Code, Title 21 – Subdivision Code	Yes	No	No	No
Post-Disaster Recovery <i>Comment:</i> 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	Yes	No	No	No
Flood Damage Prevention Ordinance <i>Comment:</i> County of Los Angeles County Code: Title 26, Chapter 1, Section 110 – Prohibited Uses of Building Sites Title 11, Division 3, Chapter 11.60 – Floodways and Water Surface Elevations Title 21, Chapter 21.44.320 – Land subject to flood hazard, inundation, or geological hazard Title 21, Chapter 21.44.330 – Flood-hazard area, floodway or natural watercourse designation Title 20, Division 5, Chapter 20.94 – Channels Title 22, Division 1, Chapter 22.52, Part 5 – Flood Control	Yes	No	No	No
Low-Impact Development Standards <i>Comment:</i> County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.84 Low Impact Development Standards	Yes	No	No	Yes
Real Estate Disclosure <i>Comment:</i> State of California Natural Hazards Disclosure Act, effective June 1, 1998 (California Civil Code Section 1103.2)	No	No	No	Yes
Growth Management <i>Comment:</i> 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.	No	No	Yes	Yes
Site Plan Review <i>Comment:</i> County of Los Angeles County Code, Title 26 – Building Code, Chapter 1 – Administration, Inspections.	Yes	No	No	No
Special Purpose (flood management, critical areas) <i>Comment:</i> County of Los Angeles County Code, Title 11 – Health and Safety, Division 2 – General Hazards, Chapter 11.52 – Water Hazards. County of Los Angeles County Code, Title 11 – Health and Safety, Division 3 – Miscellaneous Regulations, Chapter 11.60 – Floodways and Water Surface Elevations. County of Los Angeles County Code, Title 12 – Environmental Protection, Chapter 12.80 – Stormwater and Runoff Pollution Control Angeles County Code, Title 12 – Environmental Protection, Chapter 12.20 – Depositing Petroleum Products on Beaches or into Pacific Ocean County of Los Angeles County Code, Title 20 – Utilities, Division 5 – Flood Control District Property and Facilities County of Los Angeles County Code, Flood Control District Code, Chapter 21 – Stormwater and Runoff Pollution Control 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 <i>Comment:</i> 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	Yes	No	No	Yes
Capital Improvement Plan <i>Comment:</i> 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.	Yes	No	No	No
Economic Development Plan <i>Comment:</i> Los Angeles County Strategic Plan for Economic Development, 2016 2035 General Plan, Chapter 14 – Economic Development Element. Available online	Yes	No	No	No
Floodplain or Basin Plan <i>Comment:</i> Los Angeles County Floodplain Management Plan, 2010. Available online.	Yes	No	No	No
Stormwater Plan <i>Comment:</i> Low Impact Development Standards Manual, February 2014	Yes	No	Yes	Yes
Watershed Management Plan <i>Comment:</i> 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	Yes	No	Yes	No
Habitat Conservation Plan <i>Comment:</i> 2035 General Plan, Chapter 9 – Conservation and Natural Resources Element, Significant Ecological Areas. Available online	No	No	No	No
Shoreline Management Plan <i>Comment:</i> 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) <ul style="list-style-type: none"> • 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	Yes	No	No	Yes
Emergency Response Plan <i>Comment:</i> Los Angeles County Operational Area Emergency Response Plan (ERP), 2012. Available online	Yes	No	No	Yes
Post-Disaster Recovery Plan <i>Comment:</i> Recovery Annex to the ERP ERP, Section 2.7: Recovery Considerations also reviews County Recovery Procedures	Yes	No	No	No
Sediment Management Plan <i>Comment:</i> Sediment Management Strategic Plan, 2012-2032. Available online	Yes	No	No	No

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 <i>Comment:</i> 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.	Yes	No	No	Yes
Water Resource Management Plan <i>Comment:</i> 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	Yes	No	Yes	Yes
Best Management Practices <i>Comment:</i> 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. 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 4-3. 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 4-4.
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 (DPW) Land Development Division; Los Angeles County Department of Regional Planning
Engineers or professionals trained in building or infrastructure construction practices	Yes	Los Angeles County DPW Geotechnical and Materials Engineering Division; Los Angeles County DPW Building and Safety Division
Planners or engineers with an understanding of flooding hazards	Yes	Los Angeles County DPW Geotechnical and Materials Engineering Division; Los Angeles County DPW Water Resources Division and associated subdivisions
Staff with training in benefit/cost analysis	Yes	Los Angeles County DPW multiple divisions, including the Watershed Management Division
Floodplain manager	Yes	Los Angeles County DPW Watershed Management Division
Surveyors	Yes	Los Angeles County DPW Survey/Mapping and Property Management (Land Records) Division
Personnel skilled or trained in GIS applications	Yes	Los Angeles County DPW Survey/Mapping and Property Management (Land Records) Division; Los Angeles County DPW GIS Managers
Scientists familiar with flooding hazards in local area	Yes	Los Angeles County DPW Water Resources Division and associated subdivisions
Emergency manager	Yes	Los Angeles County DPW Disaster Services Group; Los Angeles County Office of Emergency Management
Grant writers	Yes	Los Angeles County DPW Watershed Management Division, Water Resources Division, and Programs Development Division ; Los Angeles County Office of Emergency Management

CHAPTER 5. MITIGATED REPETITIVE LOSS PROPERTIES

5.1 REPETITIVE LOSS LIST CORRECTION

As part of their application and cycle verification obligations, CRS-participating communities must review their lists of repetitive-loss properties for accuracy, for correct addresses, to determine whether the properties are actually in the community's corporate limits, and to determine whether the insured buildings have been removed, retrofitted or otherwise protected from the cause of the repetitive flooding. The result of this review is recorded on a Repetitive Loss Update Worksheet (AW-501; see Figure 5-1). A community with repetitive losses must sign the Repetitive Loss List Community Certification, CC-RL, certifying that each address has been checked. If there are updates, the submittal must include corrected Repetitive Loss Update Worksheets (AW-501) with any required supporting documentation. The community must note the following situations in which the form should be updated:

1. The property is not located in the community's jurisdiction. The property may be outside the community's corporate limits, it may be in another city, or it may have been annexed by another community. If it can be determined in which community the property belongs, the property will be reassigned to the correct community. If a property is not in the community, it will not be reassigned unless the community in which the property does belong can be definitely identified.
2. There was an error in the repetitive loss data base, such as a duplicate listing or an incorrect address.
3. The property has subsequently been protected from the types of events that caused the losses. Buildings that have been acquired, relocated, retrofitted, or otherwise protected from the types of frequent floods that caused the past damage are not counted in determining the community's CRS requirements.
4. The property is protected from damage by the base flood shown on the current Flood Insurance Rate Map (FIRM). For example, the community may demonstrate that the building is elevated or flood-proofed above the base flood elevation but was flooded by a higher level. If the property is outside the Special Flood Hazard Area, the community may show that all of the repetitive losses were caused by events with recurrence intervals of over 100 years (e.g., two 200-year storms).

5.2 MITIGATED REPETITIVE LOSS PROPERTIES

For corrections made under situations 3 or 4 above, all future AW-501s issued for the community will be segregated into two categories; mitigated and unmitigated.

Los Angeles County is using the ISO repetitive loss list and AW-501s dated January 31, 2011 as the basis for this Repetitive Loss Area Analysis. This is the last officially sanctioned CRS repetitive loss data set issued to Los Angeles County. According to the AW-501s issued, Los Angeles County has 55 repetitive loss properties, of which four are recognized as "mitigated." The mitigated properties are shown in Table 5-1. No area analysis will be conducted for these properties.

**TABLE 5-1.
MITIGATED REPETITIVE LOSS PROPERTIES**

Repetitive Loss Number	Date Corrected
0014896	April 25, 1995
0017933	May 10, 1995
0028337	June 11, 1996
0049465	May 10, 1995

CHAPTER 6.

MITIGATION ALTERNATIVES CONSIDERED

Although this report presents separate analyses for each identified repetitive loss area in unincorporated Los Angeles County, the list of potential measures to address repetitive flooding problems was the same for each area. This chapter summarizes the alternatives that were identified for consideration. These alternatives can be implemented by the County, the homeowner, or other entities. The selection of suitable alternatives for each at-risk property in the repetitive loss areas is described in the chapters presenting individual repetitive loss area analyses.

Many types of flood hazard mitigation exist, and there is not one mitigation measure that fits every case or even most cases. Successful mitigation often requires multiple strategies. The CRS Coordinator's Manual (FEMA FIA-15, 2013) breaks the primary types of mitigation down as follows:

- **Preventive** activities keep flood problems from getting worse. The use and development of flood-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices
- **Property protection** activities are usually undertaken by property owners on a building-by-building or parcel basis.
- **Natural resource protection** activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations.
- **Emergency services** are measures taken during an emergency to minimize its impact. These measures are usually the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.
- **Structural projects** keep floodwaters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff.
- **Public information** activities advise property owners, potential property owners, and visitors about hazards and ways to protect people and property from them, as well as the natural and beneficial functions of local floodplains. They are usually implemented by a public information office.

6.1 PREVENTIVE

Los Angeles County regulates residential and commercial development through its building code, planning and zoning requirements, stormwater management regulations and floodplain management ordinances. Any project located in a floodplain, regardless of its size, requires a permit from Los Angeles County, unless the project can be characterized as routine maintenance.

6.2 PROPERTY PROTECTION

These measures are generally performed by property owners or their agents. FEMA has published numerous manuals that help a property owner determine which property protection measures are appropriate for particular situations:

- FEMA 259, Engineering Principles and Practices of Retrofitting Floodprone Residential Structures
- FEMA 312, Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding
- FEMA 551, Selecting Appropriate Mitigation Measures for Floodprone Structures
- FEMA 348, Protecting Building Utilities from Flood Damage
- FEMA 511, Reducing Damage from Localized Flooding
- FEMA 102, Floodproofing Non-Residential Structures
- FEMA 84, Answers to Questions about the NFIP
- FEMA 54, Elevated Residential Structures Book
- FEMA 268, Protecting Floodplain Resources: A Guidebook for Communities
- FEMA 347, Above the Flood: Elevating Your Floodprone House
- FEMA 85, Protecting Manufactured Homes from Floods and Other Hazards

The manuals listed above are available for review at FEMA's website. For a complete guide to retrofitting homes for flood protection, see FEMA P-312, *Homeowner's Guide to Retrofitting 3rd Edition* (2014). The primary methods of property protection in Los Angeles County are:

- Demolition/relocation.
- Elevation (structure or damage prone components such as furnace or AC unit)
- Dry flood-proof (so water cannot get in).
- Wet flood-proof portions of the building (so water will not cause damage).
- Direct drainage away from the building.
- Drainage maintenance.
- Sewer Improvements.

6.2.1 Acquisition

One of the most effective approaches to preventing further flood damage to a building is acquisition and relocation or clearing of the structure. The property would then serve as open space or recreation area. Property owners retain the right to select this as a mitigation method. They may sell their property to a government agency or an agency dedicated to the preservation and management of local open space. The property owner can also relocate the building to another property. Alternatively, the building can be moved to another area of the same property, if that area is outside the flood hazard. The property owner can also take advantage of federal funding for such mitigation.

For the Los Angeles County RLAA, it has been determined that acquisition would not be a cost-effective alternative for structures with probable flood depths of 2 feet or less. "Cost-effective" means that the benefits of the action would equal or exceed the costs to implement the action. For this RLAA, a benefit is considered to be an avoided loss. The high value of property in Los Angeles County makes it unlikely that acquisition projects can be cost-effective.

6.2.2 Home Elevation

Sometimes dry or wet flood-proofing are not enough and greater measures must be taken. For example, if the floodwaters are too high for dry flood-proofing and the inhabited area is too low for wet flood-proofing, it may be necessary to raise the structure. Whenever the floor of a home is below the 100-year flood elevation, physically elevating the structure is often recommended as it is one of the most effective means to prevent flood damage. Financial assistance may be available for floodproofing. Los Angeles County requires all substantially improved residential buildings to have their lowest floor elevated 1 foot above the 100-year elevation. No basements are allowed in the flood hazard.

6.2.3 Dry Flood-Proofing

Dry flood-proofing consists of completely sealing around the exterior of the building so that water cannot enter the building (see Figure 6-1). Dry flood-proofing is not a good option for areas where floodwater is deep or flows quickly. The hydrostatic pressure and/or hydrodynamic force can structurally damage the building by causing the walls to collapse or causing the entire structure to float. However, in areas that have minimal velocity and low depth, dry flood-proofing can be a good option.

Source: FEMA P-312, June 30, 2014

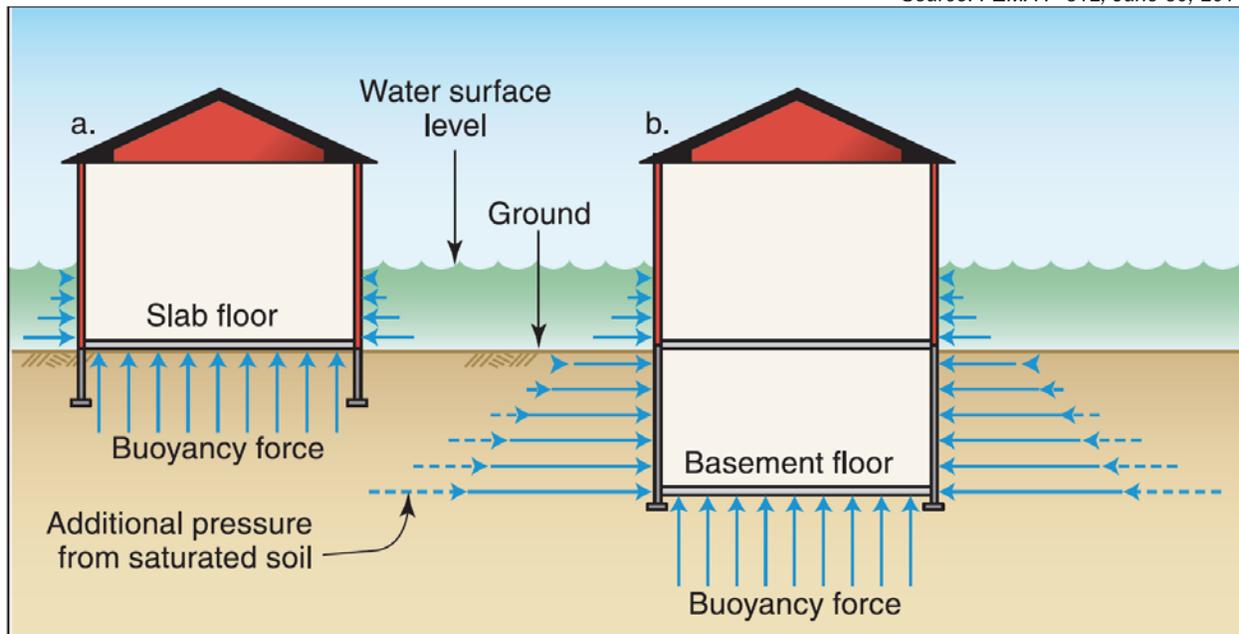


Figure 6-1. Dry Flood-Proofing Example

Many flood hazards can be mitigated with various forms of dry flood-proofing. Properties that do not have adequate protection of their low opening (window or basement door) can effectively raise the low opening height with a window well or a flood gate. The ultimate height of the low opening depends on several factors, such as: the level of flood protection desired, the appearance, and cost. The flood protection elevation could be set 1-foot higher than the existing low opening elevation, or it could be set to match the elevation of the lowest opening into a home that cannot be raised. This might be the elevation of the threshold of a door, for example.

The NFIP only allows dry flood-proofing for residential retrofits that are not classified as a substantial improvement. A substantial improvement is any reconstruction, rehabilitation, addition, or other

improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the “start of construction” of the improvement.

6.2.4 Wet Flood-Proofing

Wet flood-proofing consists of modifying uninhabited portions of a home, such as a crawlspace, garage, or unfinished basement with flood-damage resistant materials, to allow floodwaters to enter the structure without causing damage (see Figure 6-2). Wet flood-proofing requires portions of the building to be cleared of valuable items and mechanical utilities. A key component of wet flood-proofing is providing openings large enough for the water to flow through the structure such that the elevation of the water in the structure is equal to the elevation of the water outside of the structure. This equilibrium of floodwater prevents hydrostatic pressure from damaging structural walls.

6.2.5 Direct Drainage Away from the Building

In some cases, there are things that the property owner can do on-site such as directing shallow floodwater away from a flood-prone structure. Shallow flooding can often be kept away from a structure if some simple improvements are made to the yard. Sometimes structures are built at the bottom of a hill or in a natural drainage way or storage area, so that water naturally flows toward them.

One solution is to regrade the yard. If water flows toward the building; a new swale or wall can direct the flow to the street or a drainage way. Filling and grading next to the building can also direct shallow flooding away. Although water may remain in the yard temporarily, it is kept away from the structure. When these types of drainage modifications are made, care must be taken not to adversely affect the drainage patterns of adjacent properties. Over time, the swales along the lot lines or in the back yard may get filled in. Property owners build fences, garages, sheds, swimming pools, and other obstructions up to the lot line. These drainage problems can be fixed by removing the obstructions and restoring the swales so they will carry water away from the building.

6.2.6 Drainage Maintenance

Dumping into the drainage system is a Los Angeles County Code violation. Debris can accumulate and restrict the flow of stormwater, increasing the potential of localized flooding. To report flood problems or illegal dumping to the drainage system, call 800-675-HELP (4357).

6.2.7 Sewer Improvements

Heavy rains can saturate the soil and infiltrate the sanitary sewer system through leaky joints or cracks in the pipes. The inflow of stormwater floods the sanitary sewer system causing water to back-up into the home through lower level plumbing fixtures. This occurrence can be prevented by installing a sewer backflow preventer (see Figure 6-3). A backflow preventer will allow the sanitary sewer water to flow freely from the home to the sewer, but restrict the reverse flow. Backflow preventers do require maintenance and can fail if debris in the sewer prevents the valve seating properly. An overhead sewer system pumps wastewater from basement level plumbing fixtures up to an elevation near the ground level, where it can drain by gravity into the sewer service line. This higher sewer makes it unlikely that water will back-up into the building.

Source: FEMA P-312, June 30, 2014

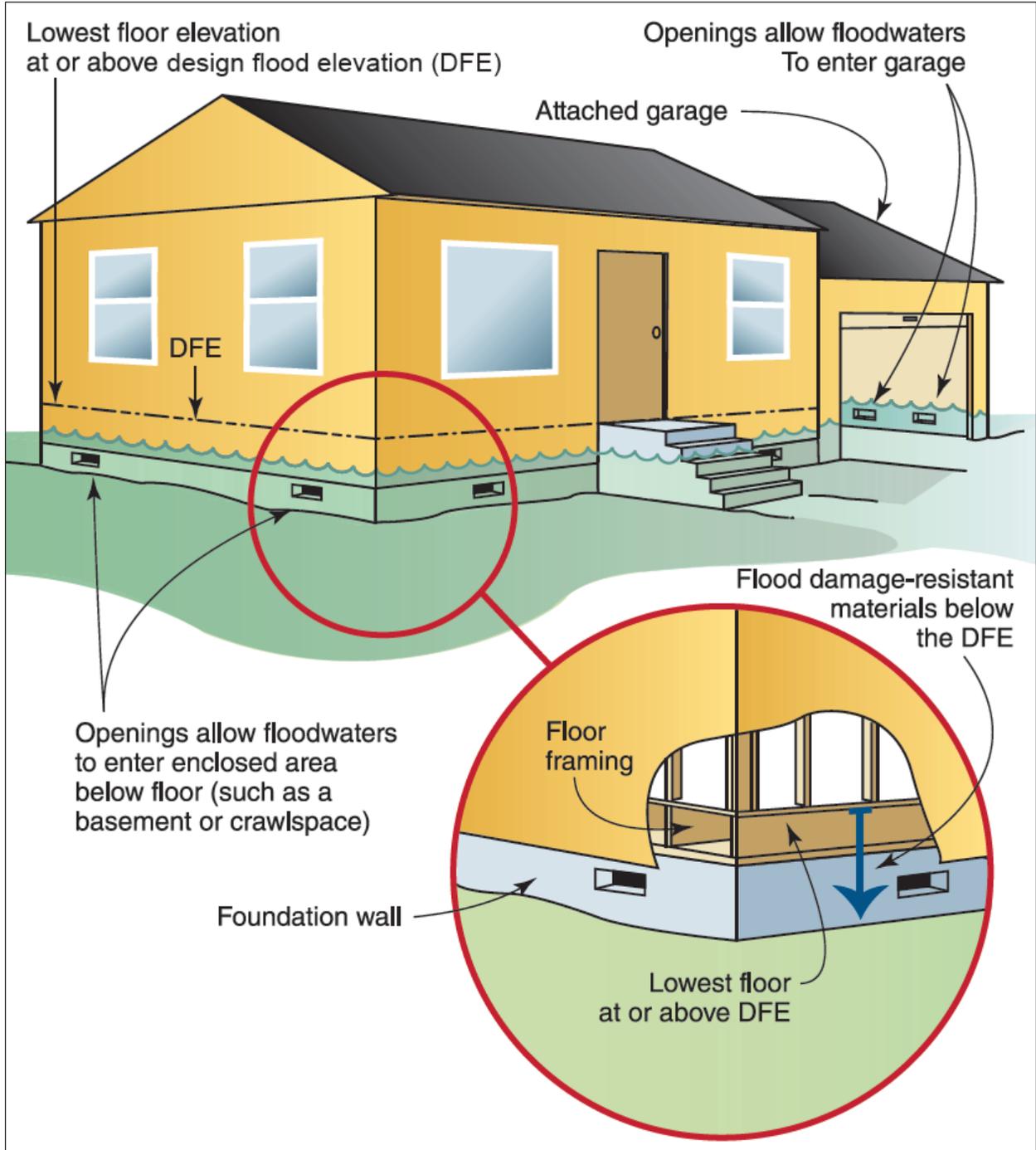


Figure 6-2. Wet Flood-Proofing Example

Source: FEMA P-312, June 30, 2014

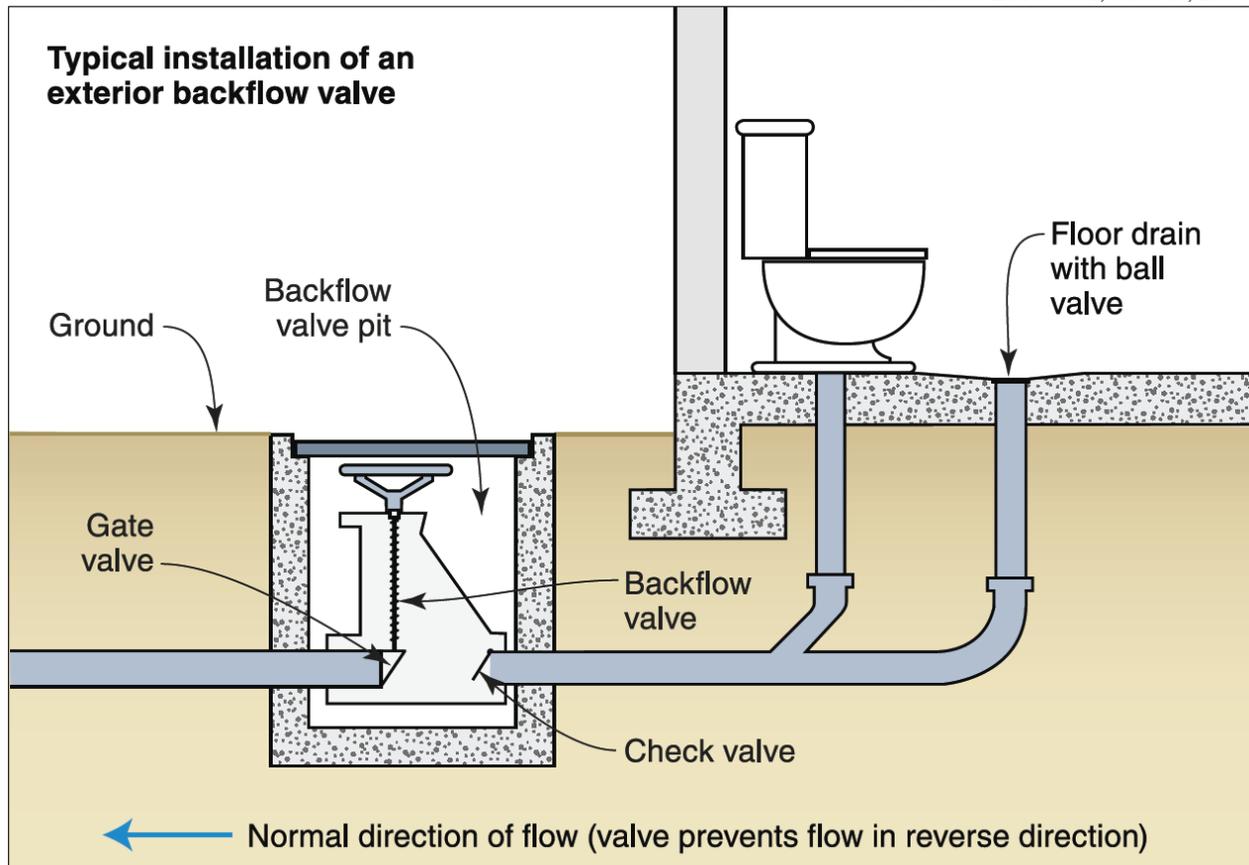


Figure 6-3. Sewer Backflow Valve Installation Example

6.2.8 Temporary Barriers

Several types of temporary barriers are available to address typical flooding problems. They work to direct drainage away from structures with the same principles as permanent barriers such as floodwalls or levees, but can be removed, stored, and reused in subsequent flood events.

6.3 NATURAL RESOURCE PROTECTION

Care should be taken to maintain the streams, wetlands and other natural resources within a floodplain or repetitive loss area. Removing debris from streams and channels prevents obstructions. Preserving and restoring natural areas provides flood protection, preserves water quality and provides natural habitat.

6.4 EMERGENCY SERVICES

Advance identification of an impending storm is only the first part of an effective Flood Warning and Response Plan. To truly realize the benefit of an early flood warning system, the warning must be disseminated quickly to floodplain occupants, repetitive loss areas and critical facilities. Appropriate response activities must then be implemented, such as: road closures, directing evacuations, sandbagging, and moving building contents above flood levels. Finally, a community should take measures to protect public health and safety and facilitate recovery. These measures may include: cleaning up debris and garbage, clearing streets, and ensuring that that citizens have shelter, food, and safe drinking water.

6.5 STRUCTURAL PROJECTS

Structural projects keep floodwaters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff. The Los Angeles County Department of Public Works develops and implements capital projects. 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.

6.6 PUBLIC INFORMATION

One of the most important, and often overlooked, aspects of mitigation is public awareness. Awareness starts with recognition of the flood risk. FIRM panels, which designate areas of a community according to various levels of flood risk, can be viewed at www.FEMA.gov. Also, real estate transactions require disclosure of known flood hazards. The next level of awareness is related to hazard mitigation measures. Often homeowners can greatly reduce their risks with mitigation efforts if they are aware of the risks.. For that reason, as part of this analysis, every resident in the repetitive loss area has been contacted and informed of the opportunity to review this Report. In addition, the Los Angeles County Department of Public Works sends out an annual outreach letter to every resident in each repetitive loss area.

Los Angeles County has defined a program for public information (PPI) as part of its 2015 Comprehensive Floodplain Management Plan. This PPI includes a strategy for providing important information about property protection to property owners in the repetitive loss areas identified under this RLAA.

Part 2 —
Analysis of Individual Repetitive Loss Areas

CHAPTER 7. AGUA DULCE REPETITIVE LOSS AREA

7.1 PROBLEM STATEMENT

Figure 7-1 shows the Agua Dulce Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This repetitive loss area is in the San Gabriel Mountains, east of Santa Clarita. The targeted repetitive loss property for this area is located within the floodplain of Mint Canyon. The property is in Zone A, which has significant risk from a 100-year flood. The culvert under Sierra Highway at approximately 250 feet upstream from the repetitive loss property is subject to becoming obstructed by debris from upstream. When runoff exceeds the capacity of the culvert, street flooding occurs and the subject property is subject to inundation. In addition, the property owner claimed the upstream neighbor improperly altered the natural creek and encroached on the floodplain and caused flow breakout from the channel. Mint Canyon borders the repetitive loss property, eroding and flooding its backyard. The property owner placed the log retaining walls around the street side property entrance. The County also built a berm on top of the channel bank near the culvert under the Sierra Highway in an effort to contain the water inside the channel.

7.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 7-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 7-1. REPETITIVE LOSS PROPERTIES IN AGUA DULCE REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0091339	37	2/93, 2/98	\$13,903	No	
<i>Identified Flood Cause:</i> Property is located in the floodplain. Repetitive flooding possibly caused by street flooding when storm flows exceed the capacity of an upstream culvert. No reported losses since 1998.					

Agua Dulce Repetitive Loss Area

Figure 7-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

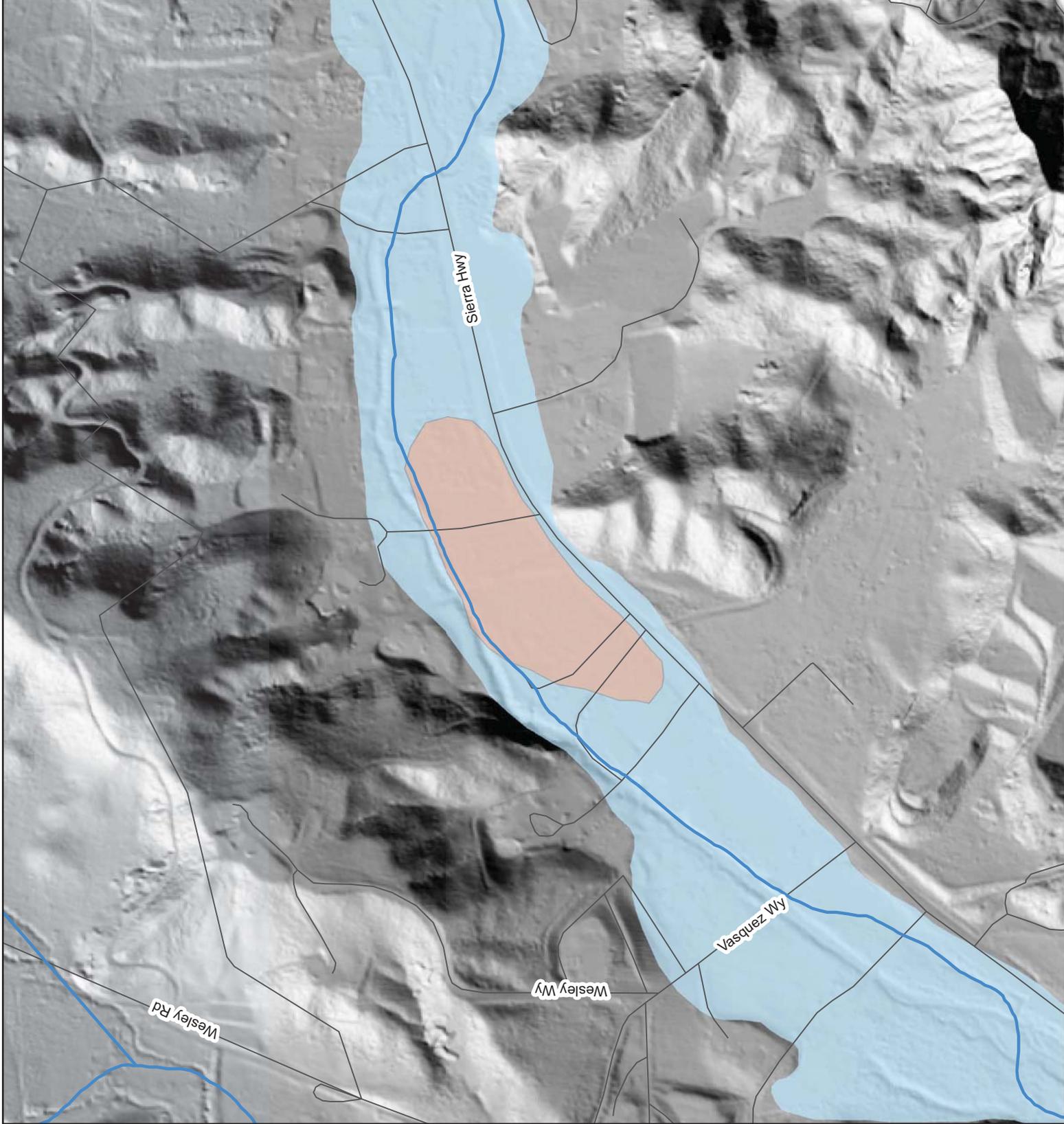
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.05 0.1 Miles



7.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #37 property is the only property included in this repetitive loss area. It has two insurable buildings. Table 7-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 7-2. ALL PROPERTIES IN AGUA DULCE REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
AD1	2	Slab, Crawlspace	Good	Enlarge culvert Drainage system maintenance Acquisition Elevation Public education
Total	2			

CHAPTER 8. ALTADENA A REPETITIVE LOSS AREA

8.1 PROBLEM STATEMENT

Figure 8-1 shows the Altadena A Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is located in the San Gabriel Mountains, east of Burbank near Altadena. The target repetitive loss property for this area is located at the bottom of the hill and possibly impacted by the storm runoffs from surrounding hills. There is a 2-foot-wide and 1-foot-deep dry earthen ditch running west of but outside of the property. The property is located at higher grounds compared to the bank elevations of the ditch. Repetitive flood history for this area appears to be isolated to the single RL property and can be associated with post-wildfire conditions.

8.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 8-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 8-1. REPETITIVE LOSS PROPERTIES IN ALTADENA A REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0056933	35	2/91, 2/92	\$2,725	No
<i>Identified Flood Cause:</i> Hillside drainage problem.				

8.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #35 property is the only property included in this repetitive loss area. It has one insurable building. Table 8-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 8-2. ALL PROPERTIES IN ALTADENA A REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ALT-A1	1	Crawlspace	Good; Hillside problem, possibly with grading/drainage and retaining wall at the toe	Construct terrace drain and plant slope to reduce erosion Public education
Total	1			

Altadena A Repetitive Loss Area

Figure 8-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

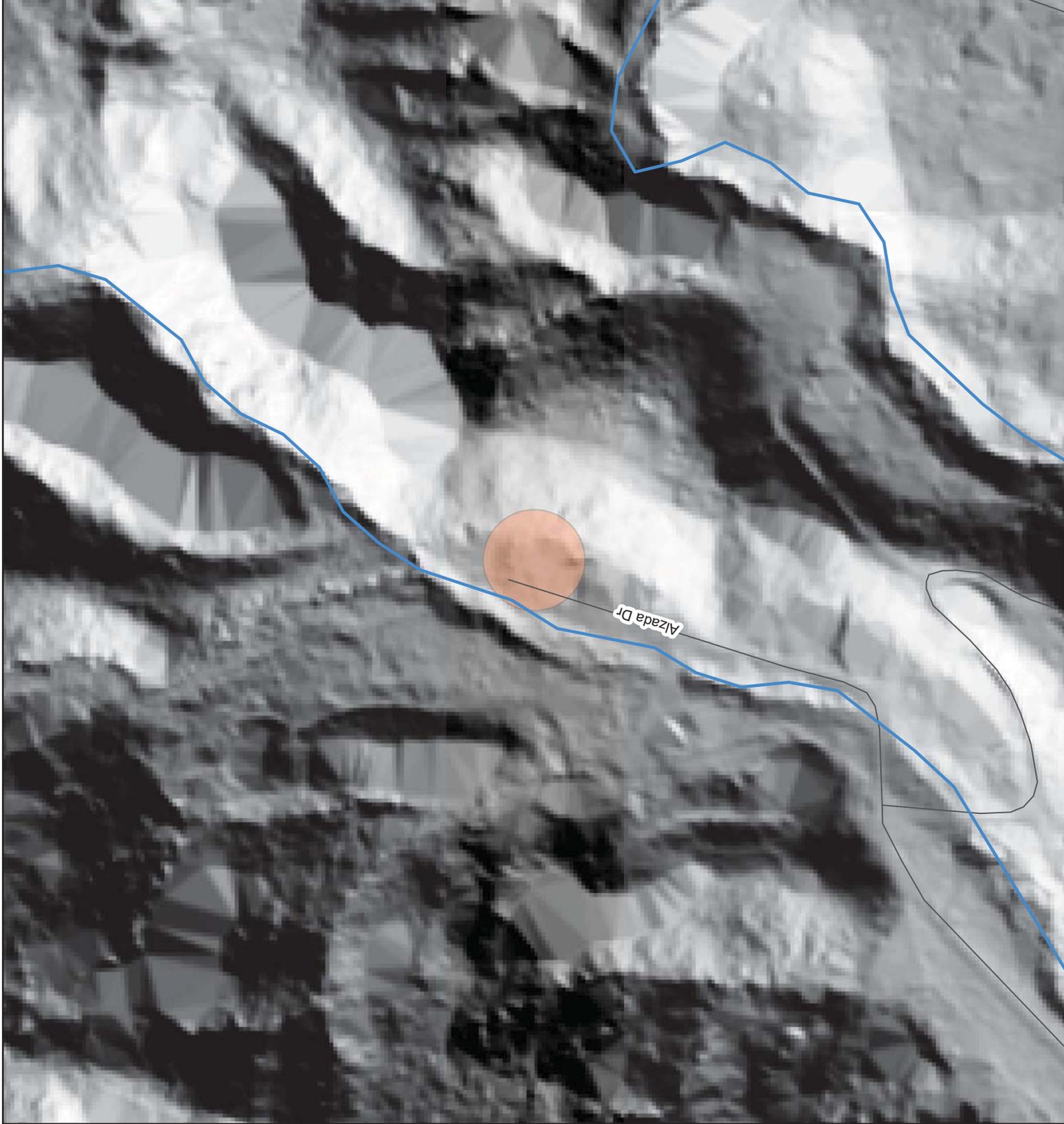
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.0225 0.045 Miles



CHAPTER 9. ALTADENA B REPETITIVE LOSS AREA

9.1 PROBLEM STATEMENT

Figure 9-1 shows the Altadena B Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in the San Gabriel Mountains, east of Burbank near Altadena. The target repetitive loss property for this area is located adjacent to a private, unmapped channel within a private residential community. Repetitive flood history for this area appears to be isolated to the single RL property and can be associated with post-wildfire conditions.

9.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 9-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 9-1. REPETITIVE LOSS PROPERTIES IN ALTADENA B REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0091348	36	3/95, 2/98	\$4,321	Yes*	
<p>Identified Flood Cause: Property is located near the privately constructed channel within the private hillside residential community. According to property owner who resides in the community, the channel has a concrete bottom but is not engineered. After the brush fire in 1993, the hillside storm runoff in the channel destroyed the private studio in the floodplain and eroded the bank protections, which were restored and improved later. In a separate incident, the basement was flooded due to a backyard drainage deficiency, which was improved with a 6-inch berm.</p>					
<p>*Note: an AW-501 has been submitted for this property, but correction was not yet approved as of this RLAA. Area will be removed from RLAA once correction is processed by FEMA.</p>					

Altadena B Repetitive Loss Area

Figure 9-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

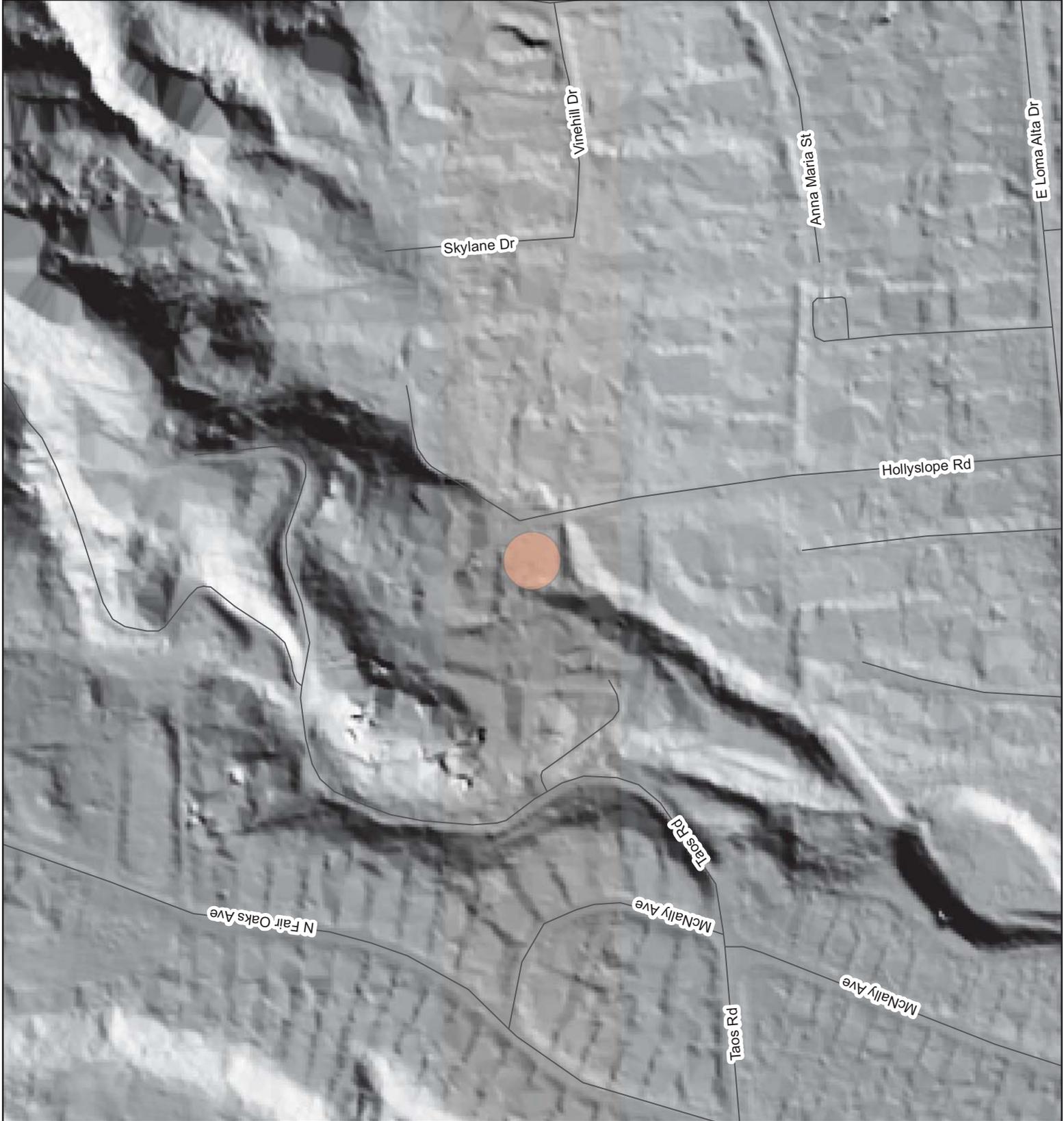
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



9.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #36 property is the only property included in this repetitive loss area. It has one insurable building. Table 9-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 9-2. ALL PROPERTIES IN ALTADENA B REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ALT-B1	1	Crawlspace	Good	Private channel maintenance Establish post-fire protocols Public education
Total	1			

CHAPTER 10. CALABASAS A REPETITIVE LOSS AREA

10.1 PROBLEM STATEMENT

Figure 10-1 shows the Calabasas A Repetitive Loss Area. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. This area is a camping ground owned by the University of Pepperdine and located at the bottom of a hillside area. The steep hill at the west corner, or the highest point of the property, was prone to mudflow from the hill whenever it rains. The flow then runs along the private road across the camping ground between the camp housing facilities to the natural creek located at the east property boundary. Currently, the owner placed sandbags in some locations to temporarily protect the housing facilities near the bottom of the hill. The owner claimed that the sandbags were strategically placed to protect the housing facilities, and if the pattern of hillside runoff changes as it did in 1996 after the brush fire, his property would again be at the risk. The subject property is not located in or near a FEMA mapped floodplain. This repetitive flooding problem appears to be isolated to the subject property.

10.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 10-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 10-1. REPETITIVE LOSS PROPERTIES IN CALABASAS A REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0072498	26	2/92, 1/95, 1/95, 2/98	\$6,436	No	
<i>Identified Flood Cause:</i> Mudflow from the hillside at the east end of the property and along the private road within the property.					

Calabasas A Repetitive Loss Area

Figure 10-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

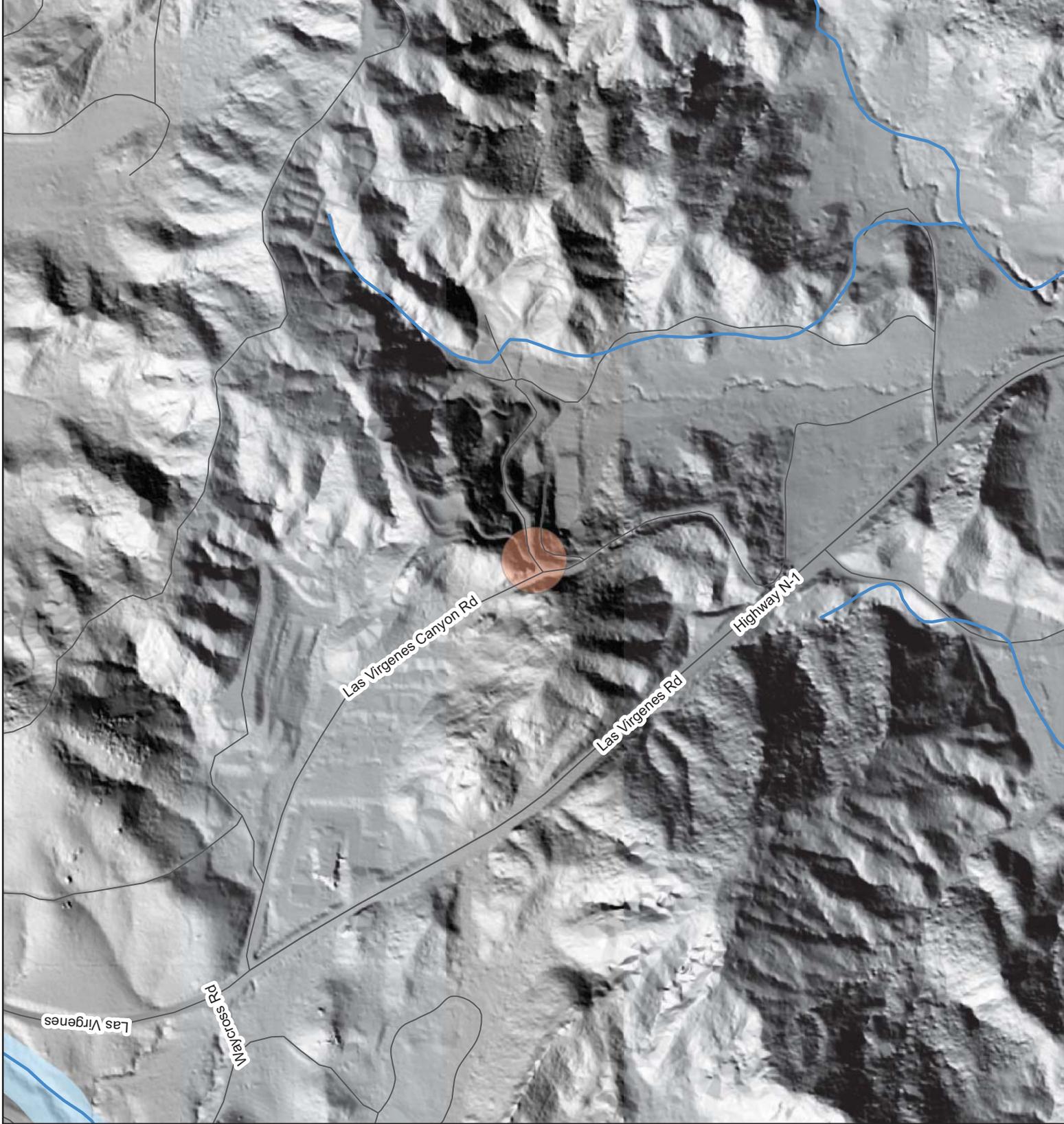
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.05 0.1 Miles



10.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #26 property is the only property included in this repetitive loss area. It has one insurable building. Table 10-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 10-2. ALL PROPERTIES IN CALABASAS A REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
CA-A1	1	Slab	Good	Drainage improvement Drainage system maintenance Public education
Total	1			

CHAPTER 11. CALABASAS B REPETITIVE LOSS AREA

11.1 PROBLEM STATEMENT

Figure 11-1 shows the Calabasas B Repetitive Loss Area. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. The flooding on RL Map 41 appears to be associated with urban drainage issues associated with runoff from streets as well as grading issues from property to property. The RL property for this area is located at the low point of the street and flows entering the front yard can be trapped and cause damage to the house, including foundation cracks.

11.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 11-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 11-1. REPETITIVE LOSS PROPERTIES IN CALABASAS B REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0136718	41	2/98, 12/04	\$4,105	No
<p>Identified Flood Cause: The subject property is located adjacent to a higher neighboring property and receives runoff that can seep into the house. A former problem is that runoff from the roof enters planters in front of the house. The owner has installed pipes and drains in the planters to evacuate the water from the planters. Street level is higher than the subject property, potentially creating a condition where runoff could enter from the street. However, the owner indicated that an existing storm drain adequately captures flows from the street.</p>				

Calabasas B Repetitive Loss Area

Figure 11-1

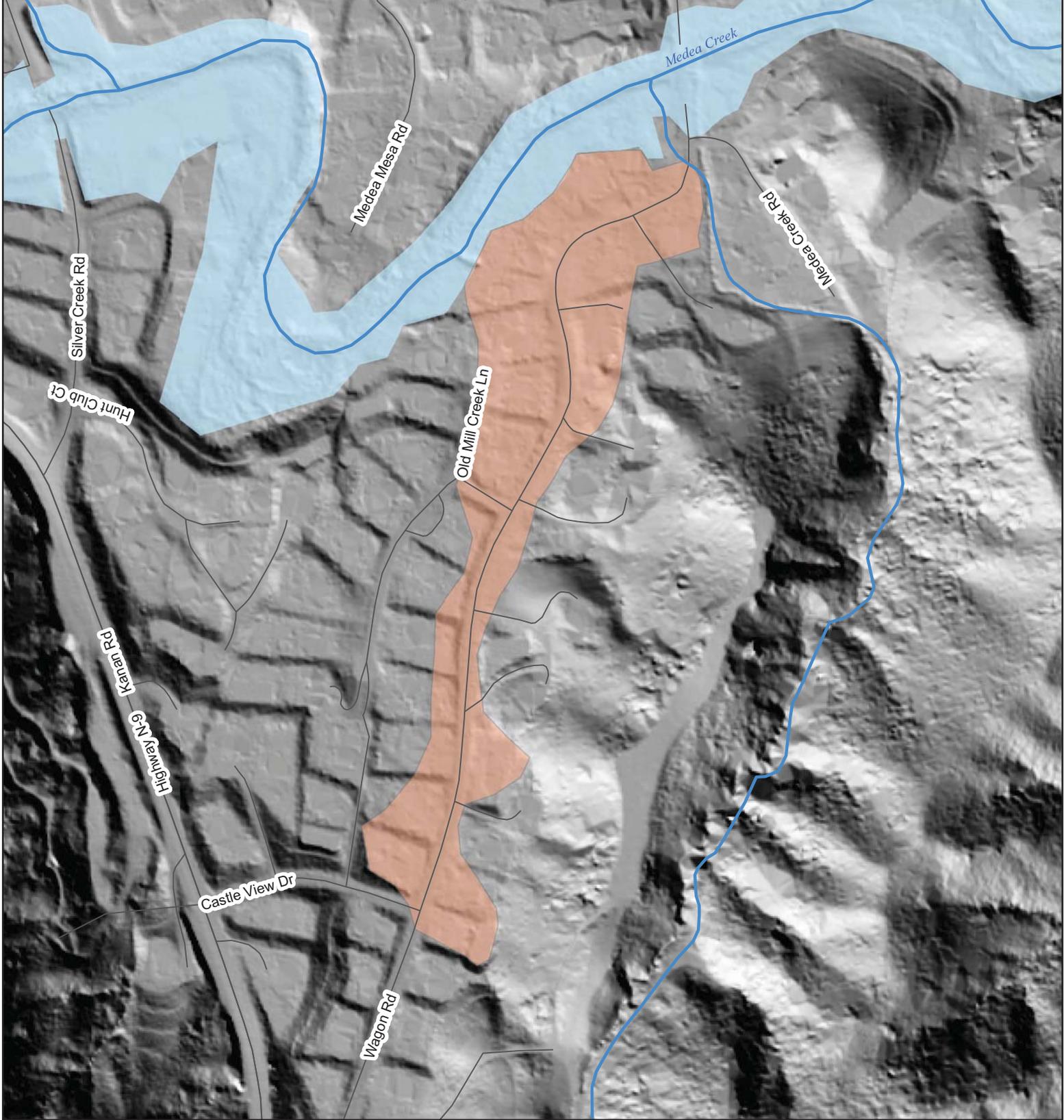
-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



11.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Sixteen properties with 16 insurable buildings have been identified in this repetitive loss area. Table 11-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 11-2. ALL PROPERTIES IN CALABASAS B REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
CA-B1	1	Crawlspace	Good	Construct a berm to prevent off-site flows from entering the property. Provide grading and drainage to avoid water impoundment near the structure. Convert planter to pavement near the problem area. Continue to inspect the foundation for cracks and repair.
CA-B2	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B3	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B4	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B5	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B6	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B7	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B8	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B9	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B10	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B11	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B12	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B13	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B14	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B15	1	Crawlspace	Good	Drainage system maintenance Public education
CA-B16	1	Crawlspace	Good	Drainage system maintenance Public education
Total	16			

CHAPTER 12. COLD CREEK REPETITIVE LOSS AREA

12.1 PROBLEM STATEMENT

Figure 12-1 shows the Cold Creek Repetitive Loss Area, which includes RL Map 27 and RL Map 45. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. While none of the repetitive loss properties are located within a FEMA mapped floodplain, the delineated repetitive loss areas do parallel an approximate Zone A area mapped along Cold Creek. There is significant topographic relief in both of these areas. The cause of repetitive flooding in both these areas is associated with the blockage or obstruction of contributory drainages to Cold Creek off the hillside areas. Drainage ways and flow paths can become blocked by debris (downed trees and shrubs, leaves, sediment, and trash) collected by overland flows. When the drainages are blocked, stormwater flows overland to the streets, where there are few if any drainage conveyances. The target properties in the Cold Creek Repetitive Loss Area are topographically subject to flooding when these situations occur due to their locations below roadways.

12.2 IDENTIFIED REPETITIVE LOSS PROPERTIES

Table 12-1 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

TABLE 12-1. REPETITIVE LOSS PROPERTIES IN COLD CREEK REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
#0071255	27	02/92, 01/93	\$23,983	No	
<i>Identified Flood Cause:</i> Is located at the high grounds and flooded by the excessive storm runoff from surrounding hills. It was also determined from the FEMA FIRM in Figure 12-1 that the property was not in the floodplain of Cold Canyon, adjacent to the property. No flooding activity since 1992.					
#0148768	45	12/04, 2/05	\$8,062	No	
<i>Identified Flood Cause:</i> Property is lower than the adjacent street, where flows concentrate during a rainstorm. The property is adjacent to the Cold Creek (Zone X (shaded) in FIRM); however, the owner claimed that no issues were caused by creek flows. The owner claimed that he has provided sufficient catch basins to handle the flows. Without proper diversion and control of runoff from the streets, future flood damage may occur.					

Cold Creek Repetitive Loss Area

Figure 12-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

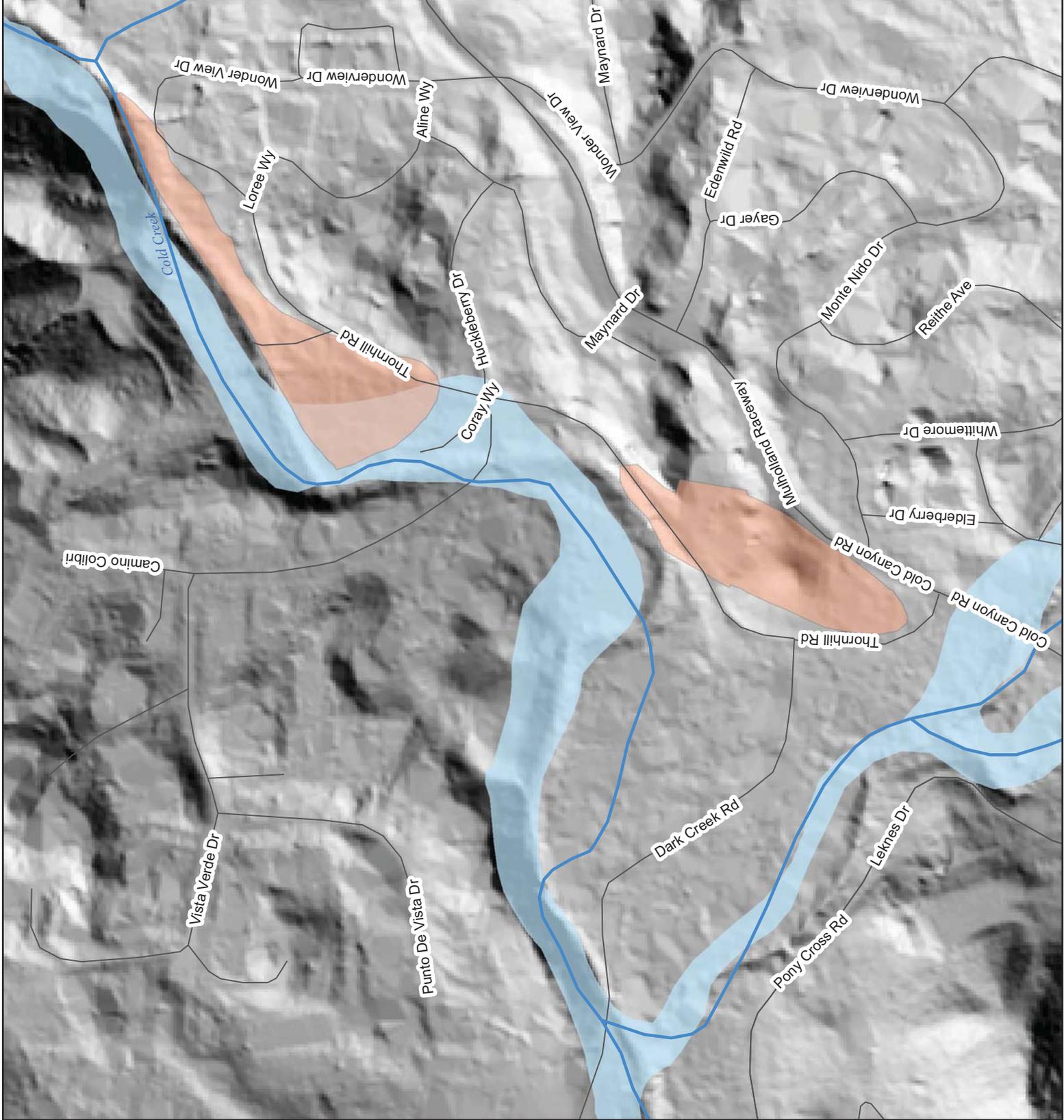
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



12.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Nine properties with nine insurable buildings have been identified in this repetitive loss area. Table 12-2 and Table 12-3 provide general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 12-2. ALL PROPERTIES IN COLD CREEK REPETITIVE LOSS AREA AROUND RL MAP 27				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
CO1	1	Slab/ Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
CO2	1	Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
Total	2			

TABLE 12-3. ALL PROPERTIES IN COLD CREEK REPETITIVE LOSS AREA AROUND RL MAP 45				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
CO3	1	Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
CO4	1	Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
CO5	1	Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
CO6	1	Slab	Good	Public education Local drainage improvements Drainage maintenance
CO7	1	Slab	Good	Public education Local drainage improvements Drainage maintenance
CO8	1	Crawlspace	Good	Public education Local drainage improvements Drainage maintenance
CO9	1	Slab	Good	Public education Local drainage improvements Drainage maintenance
Total	7			

CHAPTER 13. DEL SUR REPETITIVE LOSS AREA

13.1 PROBLEM STATEMENT

Figure 13-1 shows the Del Sur Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. RL Map 55 is within a FEMA-designated 100-year floodplain, and the dates of loss for the claims on the property coincide with presidentially declared flood events. No other loss history suggests any flooding of this area other than from the riverine overbank flooding reflected in the FEMA flood maps. The properties identified for this area analysis were selected due to their proximity to the stream.

13.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 13-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 13-1. REPETITIVE LOSS PROPERTIES IN DEL SUR REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
#0138781	55	1/05, 2/05	\$14,034	No
<p><i>Identified Flood Cause: This property is located within a FEMA designated 100-year floodplain and the dates of loss for the 2 claims coincide with significant flood events within LA county that received presidential disaster declarations (DR-1577 and DR-1585). The cause of flooding for this area is commensurate with the flood risk reflected on the FEMA Flood Insurance Rate Map for this area</i></p>				

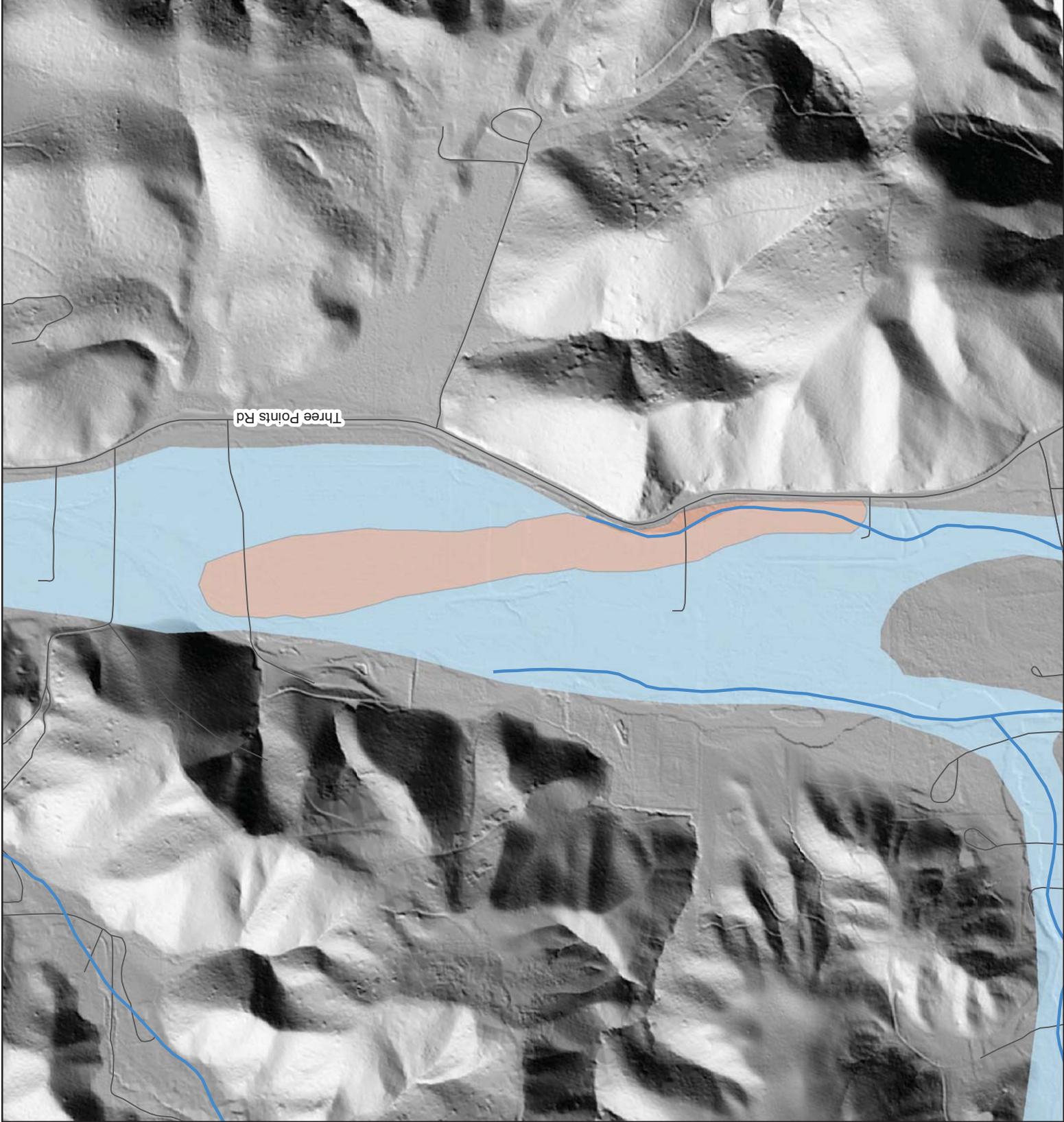
Del Sur Repetitive Loss Area

Figure 13-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



13.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Three properties with three insurable buildings have been identified in this repetitive loss area. Table 13-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 13-2. ALL PROPERTIES IN DEL SUR REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
DS1	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
DS2	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
DS3	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
Total	3			

CHAPTER 14. LOWER TOPANGA CANYON REPETITIVE LOSS AREA

14.1 PROBLEM STATEMENT

The Lower Topanga Canyon Repetitive Loss Area includes RL Map 19, 20, 21, 22 and 23. These areas are in the Topanga Canyon area of Los Angeles County, about 26 miles northwest of the City of Los Angeles. All of the areas located along the lower reach of the Topanga Canyon channel (sometimes referred to as the Rodeo Grounds area) were frequently inundated by the Topanga Canyon flood flows. These properties are practically located within the lower reach of Topanga Canyon with ground elevation similar to the channel invert (i.e. lowest elevation of the channel). This information was derived from analysis of the topographic data as described in Chapter 2. Rodeo Grounds Road is higher than the invert; however, the berm is not sufficient to confine the floodwater and the Rodeo Grounds low-lying areas have been subject to severe flood damage. Previous insurance claims were filed by the property residents who leased the properties from Los Angeles Athletic Club Company, Inc.

14.2 IDENTIFIED REPETITIVE LOSS PROPERTIES

Table 14-1 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

TABLE 14-1. REPETITIVE LOSS PROPERTIES IN LOWER TOPANGA CANYON REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0014900	19	3/78, 2/80	\$9,171	Yes
<i>Identified Flood Cause:</i> Property in the channel and in Flood Zone AE of Lower Topanga Canyon				
0017941	20	1/78, 2/80, 1/83	\$9,446	Yes
<i>Identified Flood Cause:</i> Property in the channel and in Flood Zone AE of Lower Topanga Canyon				
0017942	21	1/78, 1/80, 2/80, 1/83, 2/92, 1/95	\$10,063	Yes
<i>Identified Flood Cause:</i> Property in the channel and in Flood Zone AE of Lower Topanga Canyon				
0028440	22	1/78, 3/78	\$8,805	Yes
<i>Identified Flood Cause:</i> Property in the channel and in Flood Zone AE of Lower Topanga Canyon				
0017940	23	1/78, 3/78, 2/80	\$3,999	Yes
<i>Identified Flood Cause:</i> Property in the channel and in Flood Zone AE of Lower Topanga Canyon				

14.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The identified five RL map properties are the only properties in this repetitive loss area. The secondary analysis for this area determined that there are no longer structures on any of the properties. The County will need to submit new AW-501s for this area. Until these correction can be made, this area will remain in this RLAA, however no additional properties are identified.

CHAPTER 15.

MALIBOU LAKE REPETITIVE LOSS AREA

15.1 PROBLEM STATEMENT

Figure 15-1 shows the Malibou Lake repetitive loss area. This area includes 20 identified repetitive loss properties, 4 of which have been mitigated and 16 of which are unmitigated. Malibou Lake is, a privately owned and operated reservoir located in the western area of Los Angeles County near the Ventura County/Los Angeles County line. The contributing watershed starts in Ventura Hidden Valley in Ventura County, approximately 10 miles northwest of Malibou Lake. Stormwater runoff enters the ungated Lake Sherwood and flows through Potrero Valley Creek, Westlake Lake, Triunfo Canyon Creek, and empties into Malibou Lake. Westlake Lake is 4.7 miles northwest of Malibou Lake and is in both Ventura and Los Angeles County. Malibou Lake also receives runoff from Medea Creek, a major tributary north of the lake. The total drainage area at the spillway of Malibou Lake is 64 square miles.

The lake has a surface area of approximately 20 acres at spillway elevation. The contributory watershed covers portion of Ventura County and Los Angeles County and crosses three city boundaries; Thousand Oaks, Agoura Hills, and Westlake Village.

Most of the repetitive loss properties in this area are damaged by rising water of Malibou Lake during flood events. Malibou Lake lies at the confluence of Triunfo Canyon and Medea Creek. The terrain in this area is steep and rocky, causing rainwater to concentrate at the lake quickly. In addition, upstream urbanization has a higher discharge at the lake for a given rainstorm event due to the increase in impervious surfaces. The existing lake has an estimated surface area of 20 acres and a storage volume of 250 acre-feet at the spillway elevation. The storage below the spillway is ineffective for peak flow attenuation during normal times since the water elevation is maintained at the spillway elevation at all times. During flood events, the lake is partially filled with sediments, reducing its recreational functions.

Those repetitive loss properties not located around the lake (RL Maps 2, 1, 8, 25 and 46) were damaged by other localized events. RL Map 2 is on high ground and was flooded by runoff for surrounding hillsides. RL Map 18 was damaged by floodwater from Medea Creek. This could be attributed to backwater from Malibou Lake. RL Map 19 does reside in the Medea Creek floodplain. RL Map 25 was flooded by overflows from a storm drain ditch east of the property. RL Map 46 was damaged from storm flows entering the property from the street, which is at a higher elevation than the house.

15.2 IDENTIFIED REPETITIVE LOSS PROPERTIES

Table 15-1 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

TABLE 15-1. REPETITIVE LOSS PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
#0046576	1	2/80, 3/83, 2/92, 2/93, 1/95, 3/95, 2/98	\$6,716	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0047197	2	2/80, 3/83, 2/92	\$5,538	No
Identified Flood Cause: Hillside, backyard drainage problem.				
#0001165	3	2/98, 1/01, 3/01, 2/03, 2/04, 1/05, 2/05, 1/08, 1/10	\$11,674	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0039962	4	2/80, 2/92, 3/95, 2/98	\$2,859	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0028487	5	3/78, 2/80	\$9,398	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0040087	6	2/80, 3/83	\$15,836	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0012820	7	2/92, 2/93, 1/95, 2/98, 3/01, 12/04, 1/05	\$57,493	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0049496	8	3/83, 2/92, 1/95, 2/98	\$9,792	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events				
#0028444	10	3/78, 2/80, 1/83, 3/83, 1/95, 3/95, 2/98	\$15,858	Yes
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events. Structure has been elevated, confirmed by site visit. Property no longer subject to repetitive flooding				
#0071413	11	2/92, 1/95, 3/95	\$16,264	Yes
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events. The home was elevated above the Los Angeles County capital flood elevation (736.18 feet) in 2002.				
#0073653	12	2/92, 1/95	\$65,231	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events.				
#0072406	13	2/93, 1/95	\$4,391	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events.				
#0071417	14	2/92, 1/95, 2/98, 2/01	\$3,660	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events.				
#0035727	15	2/80, 1/83, 3/83, 2/92, 1/95, 2/98	\$25,272	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events.				

TABLE 15-1. REPETITIVE LOSS PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
#0052974	16	2/80, 1/83, 3/83, 2/92, 1/95, 3/95, 2/98, 1/05	\$12,979	Yes
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events. 10-years since last claim. Property appears to have been mitigated based on comparison of photos from 2009 plan and photos taken during site visit in 2015. Crawlspace foundation with finished floor approximately 36 inches above adjacent grade. Property no-longer considered subject to repetitive flooding.				
#0093872	17	1/95, 2/98	\$5,895	No
Identified Flood Cause: Inundated by rising waters of Malibou Lake during repetitive storm events. Over 15 years since last flood claim. Crawlspace foundation with finished floor approximately 42 inches above adjacent grade.				
#0057971	18	3/83, 2/92, 1/95	\$9,150	No
Identified Flood Cause: Flood water from Medea Creek or backwater from Malibou Lake, or a combination of both. No flood claims since 1995.				
#0091232	25	2/98, 2/98, 1/05	\$14,607	No
Identified Flood Cause: Capacity of storm drain culvert located near the property is undersized which causes overflows to the street and adjoining properties.				
#0137792	46	3/01, 1/05	\$1,557	No
Identified Flood Cause: Property sits below street elevation. Stormwater flow from street can impact the home.				

15.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Fifty-six properties with 71 insurable buildings have been identified in this repetitive loss area. Table 15-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML1	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML2	2	Slab	Good	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML3	1	Crawlspace	Good	Elevation Flood-proofing Floodwall Public education
ML4	0	N/A	N/A	All structures removed
ML5	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
ML6	2	Slab	Good	Elevation, Floodwall Flood-proofing Public education
ML7	1	Slab	Good	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public education
ML8	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public education
ML9	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public education

**TABLE 15-2.
ALL PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML10	1	Slab	Good	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML11	1	Piers	Good; Structure appears to be elevated to post and pier foundation with no enclosures; elevation unknown	Public Education
ML12	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML13	1	Crawlspace	Good	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML14	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education
ML15	1	Crawlspace	Fair	Elevation Acquisition Public education
ML16	1	Crawlspace	Good	Confine upstream inflow Upsize the pipe opening Improve storm drain Add a truss-rack at the inlet Public education
ML17	1	Crawlspace	Good	Elevation Acquisition Public education
ML18	1	Crawlspace	Fair	Install perimeter diversion ditches, walls, and berms to prevent street runoff entering the property Raise and pave planting areas with ditches to drain, Build a cutoff wall to keep storm runoff from street flows away from the structure. Provide a ditch crossing the driveway to divert flows away from the structure Build cutoff wall to prevent seepage Public education
ML19	1	Slab	Good	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Public education

**TABLE 15-2.
ALL PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML20	1	Slab	Good	Maintain drainage flow away from property Public education
ML21	1	Slab	Fair	Maintain drainage flow away from property Public education
ML22	1	Crawlspace	Good; Substantial remodel, located on hillside above lake—detached garage at road level	Flood-proofing of the garage Public education
ML23	2	Slab	Good; Boat house on lake and basement garage most susceptible	Flood-proofing Public education
ML24	2	Slab	Good; Boat house on lake and basement garage most susceptible	Flood-proofing Public education
ML25	2	Slab	Good; Boat house on lake and basement garage most susceptible	Flood-proofing Public education
ML26	2	Slab	Good; Two structures on property—main house and a boat house	Public education for whole property Flood-proofing for the boat house For the main house: Flood-proofing Abandon lowest floor Elevation Acquisition
ML27	2	Slab	Good; Two structures on property—main house and a boat house; lower level of main house is a garage susceptible to flood levels	Flood-proofing Public education
ML28	2	Slab	Good; Boat house on lake most susceptible	Flood-proofing Public Education
ML29	2	Slab	Good; Boat house on lake most susceptible	Flood-proofing Public Education
ML30	2	Slab	Good; Boat house on lake most susceptible	Flood-proofing Public Education

**TABLE 15-2.
ALL PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML31	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Flood-proofing Floodwall Public education
ML32	1	Crawlspace	Good	Elevation, acquisition Flood-proofing Public education
ML33	1	Crawlspace	Fair	Flood-proofing Floodwall Public education
ML34	1	Slab	Good	Floodwall Flood-proofing Public Education
ML35	2	Slab	Good; The source of the flooding is not the lake (due to the elevation of the structure), but the possibility of street flooding	Temporary barriers to protect doors, divert water around home, decrease water coming in from street/driveway Public education
ML36	1	Slab	Good; Two structures on property—main structure is in flood zone; second structure is outside flood zone and not subject to repetitive flooding	Mitigation measures for main structure: Acquisition Flood-proofing Floodwall Public education
ML37	1	Slab	Fair	Flood-proof basement garage Floodwall Public education
ML38	1	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public Education
ML39	2	Slab	Fair	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public education
ML40	2	Crawlspace	Fair	Elevation Acquisition Floodwall Public Education

**TABLE 15-2.
ALL PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML41	2	Crawlspace	Fair	Elevation Acquisition Floodwall Public Education
ML42	1	Crawlspace	Good	Elevation Acquisition Floodwall Public education
ML43	1	Slab	Good	Flood-proof basement garage Floodwall Public education
ML44	1	Crawlspace	Fair	Flood-proofing, Temporary barriers (sandbags and such other items) Public education
ML45	1	Slab	Good; New construction, properly elevated for the flood zone	Public Education
ML46	1	Slab	Good; Structure appears to be properly elevated; eligible for an AW-501	Public Education
ML47	1	Crawlspace	Good	Flood-proofing Public education
ML48	1	Slab	Good	Elevation Acquisition Floodwall Flood-proofing Public education
ML49	1	Crawlspace	Fair	Floodwall Flood-proofing Public Education
ML50	1	Crawlspace	Good	Flood-proofing Public education
ML51	2	Slab	Fair; Two structures on property, only one subject to flooding	Abandon lowest floor or convert to parking and storage Elevate lowest floor to above base flood elevation Acquisition Flood-proofing Public education
ML52	1	Crawlspace	Good; Structure appears to have been elevated	Public education
ML53	1	Slab	Newer construction; little risk	Public education

**TABLE 15-2.
ALL PROPERTIES IN MALIBOU LAKE REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ML54	1	Crawlspace	Good; New construction, properly elevated	Public education
ML55	2	Slab	Fair	Elevation Acquisition Floodwall Flood-proofing Public education
ML56	1	Slab	Good	Elevation Acquisition Floodwall Flood-proofing Public education
Total	71			

CHAPTER 16. MALIBU REPETITIVE LOSS AREA

16.1 PROBLEM STATEMENT

Figure 16-1 shows the Malibu Repetitive Loss Area. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. The property is located at the lowest point of the street. The first floor of the house was built lower than the street level, and street runoff can enter the house through the driveway. An owner of this property built a 6-inch berm in front of the driveway to divert the water. This, however, may not have relieved the flood problem associated with major floods. The other properties in this area have similar circumstances, with the first floor of the house built below the street within a similar elevation contour. There is no mapped FEMA flood zone within this area.

16.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 16-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 16-1. REPETITIVE LOSS PROPERTIES IN MALIBU REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0070079	28	2/92, 1/95, 3/98, 3/00	\$5,524	No
<i>Identified Flood Cause:</i> House is located at the low point of the street.				

Malibu Repetitive Loss Area

Figure 16-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



16.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Seven properties with seven insurable buildings have been identified in this repetitive loss area. Table 16-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 16-2. ALL PROPERTIES IN MALIBU REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
MAL1	1	Crawlspace	Fair	Diversion Berm Street grading Public education
MAL2	1	Crawlspace	Good	Diversion Berm Street grading Public education
MAL3	1	Slab	Good	Diversion Berm Street grading Public education
MAL4	1	Slab	Good	Diversion Berm Street grading Public education
MAL5	1	Slab	Good	Diversion Berm Street grading Public education
MAL6	1	Slab	Good	Diversion Berm Street grading Public education
MAL7	1	Slab	Good	Diversion Berm Street grading Public education
Total	7			

CHAPTER 17. QUARTZ HILL A REPETITIVE LOSS AREA

17.1 PROBLEM STATEMENT

Figure 17-1 shows the Quartz Hill A Repetitive Loss Area. This area is located in the Quartz Hill region of Los Angeles County. Quartz Hill, a 390-square-mile, high desert community, is located in the westernmost part of the Mojave Desert north of the San Gabriel Mountains. It is approximately 80 miles northwest of Palmdale and 55 miles southwest of Lancaster. Flood studies of the Quartz Hill area show that the identified RL property is located within Flood Hazard Zone X, an area of minimal flooding. The repetitive flooding this area is the overflow runoff from the detention basin, which has now been relocated, southeast of the identified RL property. This property is also possibly subject to the sheet-flow along the “Antelope Valley Drainage Corridor No. 9.” According to the RL property owner, the property was flooded when the retention basin, located a couple of blocks to the south, could not hold the storm water, and the gate was forced to open. The overland runoff entered his property across empty lots, causing flooding at the property. The basin has been replaced by a golf course and relocated one half mile to the northwest, further downstream from the property, which eliminated further flooding problems. This is substantiated by the fact that there has been no subsequent flood damage to the property since the relocation of the retention basin. This is considered to be an isolated event, and no other properties were determined to be impacted. The County has submitted an AW-501 for this property. This property will be shown as “mitigated,” and the area will be removed from obligation for annual repetitive loss mailing under the County’s CRS program.

17.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 17-1 lists the FEMA-designated repetitive loss property within this repetitive loss area; which is being listed as “mitigated.” No other properties are identified for this area.

TABLE 17-1. REPETITIVE LOSS PROPERTIES IN QUARTZ HILL A REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0057385	38	1/92, 1/92, 2/92, 12/92	\$15,228	Yes*
<i>Identified Flood Cause:</i> Overflow from detention basin, which has been relocated. Property no longer subject to repetitive flooding.				
<i>*Note:</i> An AW-501 has been submitted for this property, but correction was not yet approved as of this RLAA. Area will be removed from RLAA once correction is processed by FEMA.				

17.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #38 property is the only property included in this repetitive loss area. It has one insurable building with a slab foundation that is in good condition. This property has been mitigated, so no new mitigation measures are recommended.

Quartz Hill A Repetitive Loss Area

Figure 17-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

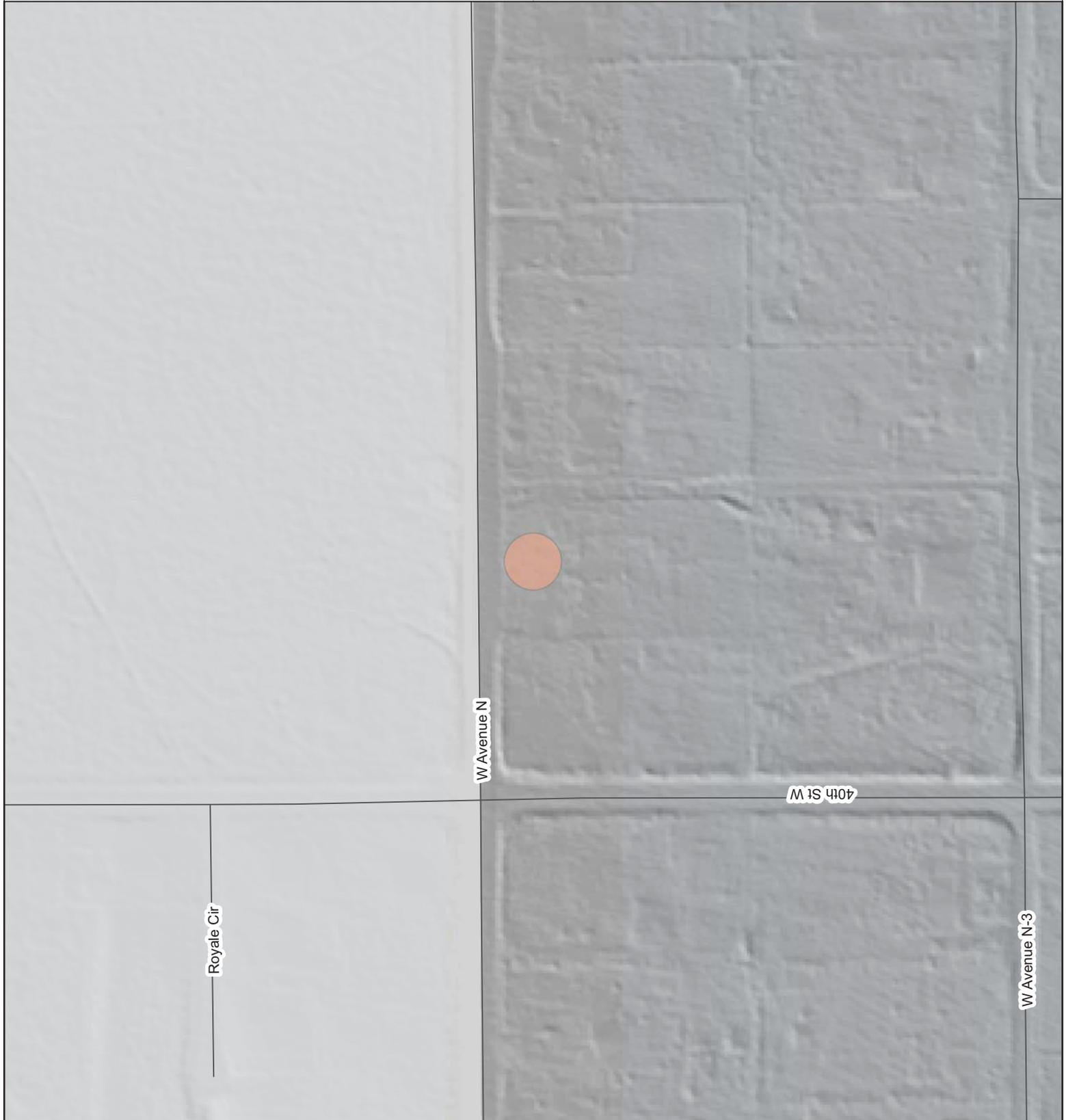
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



CHAPTER 18. QUARTZ HILL B REPETITIVE LOSS AREA

18.1 PROBLEM STATEMENT

Figure 18-1 shows the Quartz Hill B Repetitive Loss Area, which includes RL Map 39 and RL Map 40. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is located in the Quartz Hill region of Los Angeles County. Quartz Hill, a 390-square-mile, high desert community, is located in the westernmost part of the Mojave Desert north of the San Gabriel Mountains. It is approximately 80 miles northwest of Palmdale and 55 miles southwest of Lancaster.

None of the properties in this area are located within a FEMA-identified Special Flood Hazard Area. The flooding source for RL Map 39 is the street runoff that breaks out from Antelope Valley Drainage Corridor No. 7 (identified in the *Antelope Valley Comprehensive Plan of Flood Control and Water Conservation*; Los Angeles County, 1991) along 50th and 52nd streets. The other properties within this area are at ground elevations similar to that of the identified repetitive loss property and have lowest floors with similar elevations as well. RL Map 40 is located within an alluvial fan which contributes flows to the property via surrounding streets. This property is located at the low point of the street where flows can concentrate and enter the property. The other properties identified within this area have a topographic relationship with the identified repetitive loss property.

18.2 IDENTIFIED REPETITIVE LOSS PROPERTIES

Table 18-1 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

TABLE 18-1. REPETITIVE LOSS PROPERTIES IN QUARTZ HILL B REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0091087	39	2/92, 12/97	\$2,783	No	
<i>Identified Flood Cause:</i> Property is located in Antelope Drainage Corridor. The sheet flow from Antelope Valley Drainage Corridor No.7 flooded the property, displacing retaining walls. The property currently has a private earthen ditch and small berms along it to route the water through the property boundaries.					
0131222	40	2/04, 10/04, 12/04, 1/05, 2/05	\$6,186	No	
<i>Identified Flood Cause:</i> The subject property is located within Flood Hazard Zone X (shaded) and is located in Antelope Drainage corridor. The property is subject to significant flooding. The corridor flows may be conveyed to this property through streets and low lying areas and trapped at the property (which is lower than the streets). The first floor elevation is also lower than the streets and has been damaged frequently by historical floods. The owner has constructed berms at the entry gate and prepared a pump pit. Without a comprehensive and reliable berm and on-site pump system, this property may continue to experience flood damage and submit future claims. In addition, the interior household flows are being discharged to the side yard, but should be disposed via a sanitary sewer or County-approved drywell.					

Quartz Hill B Repetitive Loss Area

Figure 18-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



18.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Twenty-five properties with 26 insurable buildings have been identified in this repetitive loss area. Table 18-2 and Table 18-3 provide general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 18-2. ALL PROPERTIES IN QUARTZ HILL B REPETITIVE LOSS AREA AROUND RL MAP 39				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
QH-B1	1	Slab	Good	Improve private ditch Construct an area-wide storm drain and flood retention system Public education
QH-B2	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B3	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B4	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B5	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B6	2	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B7	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B8	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B9	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B10	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B11	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B12	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
QH-B13	1	Slab	Good	Construct an area-wide storm drain and flood retention system Public education
Total	14			

**TABLE 18-3.
ALL PROPERTIES IN QUARTZ HILL B REPETITIVE LOSS AREA AROUND RL MAP 40**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
QH-B14	1	Slab	Fair	Stabilize the entry with rock or concrete blocks under the dirt. Install a permanent automatic control pump so that it activates if water reaches a predetermined level of 1 or 2 inches. Complete and raise the 1' high side wall Install a dry well with dimensions of 2' or 3' diameter, 10' or 15' depth to receive discharge. Connect the washer and bath flow to the dry well.
QH-B15	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B16	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B17	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B18	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B19	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B20	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B21	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B22	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B23	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B24	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
QH-B25	1	Slab	Fair	Construct an area-wide storm drain and flood retention system Public education
Total	12			

CHAPTER 19. ROOSEVELT REPETITIVE LOSS AREA

19.1 PROBLEM STATEMENT

Figure 19-1 shows the Roosevelt Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is within the floodplain of Little Red Rock Wash, in Lancaster. Lancaster is located approximately 70 miles north of the City of Los Angeles in Southern California’s Antelope Valley. It is separated from the Los Angeles Basin by the San Gabriel Mountain Range to the south and from Bakersfield and the San Joaquin Valley by the Tehachapi Mountain Range to the north. Lancaster’s elevation is 2,500 feet above sea level on a high, flat valley surrounded by mountain ranges. The subject property lies below adjacent grade and receives runoff from the higher adjacent grade during rain events.

19.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 19-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 19-1. REPETITIVE LOSS PROPERTIES IN ROOSEVELT REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0137354	42	1/05, 2/05	\$17,148	No	
Identified Flood Cause: Property is located in Flood Hazard Zone A and in the floodplain of Little Red Rock Wash. The existing lot is lower than the adjacent grade and may receive runoff from adjacent properties during rain events.					

Roosevelt Repetitive Loss Area

Figure 19-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

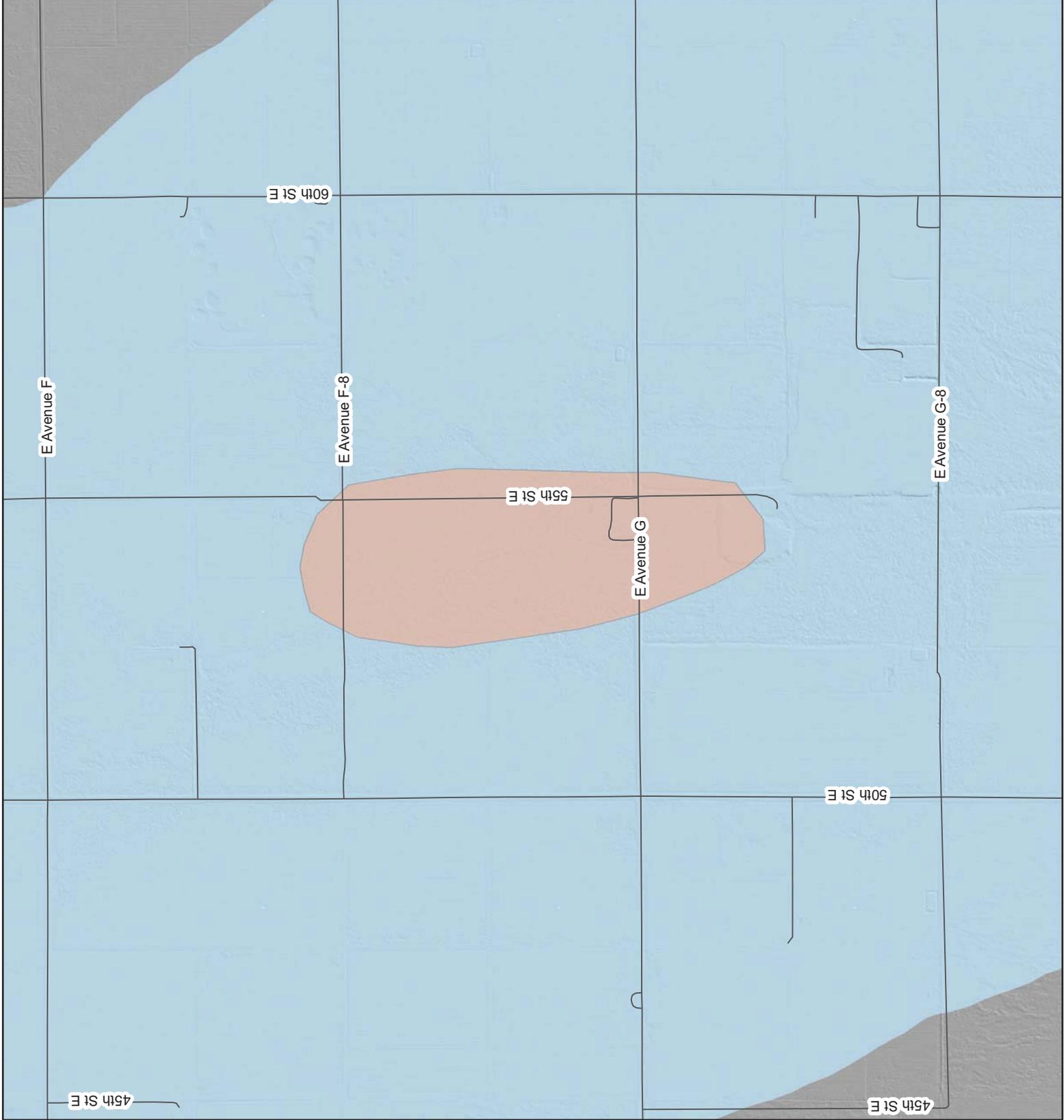
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.15 0.3 Miles



19.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Three properties with three insurable buildings have been identified in this repetitive loss area. Table 19-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 19-2. ALL PROPERTIES IN ROOSEVELT REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ROO1	1	Slab	Good	Establish drainage flow paths around structure Elevation Drainage system maintenance Public education
ROO2	1	Slab	Good	Establish drainage flow paths around structure Elevation Drainage system maintenance Public education
ROO3	1	Slab	Good	Establish drainage flow paths around structure Elevation Drainage system maintenance Public education
Total	3			

CHAPTER 20. ROWLAND HEIGHTS REPETITIVE LOSS AREA

20.1 PROBLEM STATEMENT

Figure 20-1 shows the Rowland Heights Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in Rowland Heights—about 9 square miles of unincorporated Los Angeles County near the boundaries of where the Los Angeles County, Orange County and San Bernardino County meet. The elevation is 540 feet above sea level. It is loosely bounded by the Puente Hills to the south and San Jose Hills to the north-northeast. The area is approximately 10 miles north of Anaheim and 34 miles east-southeast of Los Angeles. Flood studies of the Rowland Heights area show that RL Map 44 is located within Flood Hazard Zone X, an area of minimal flooding. RL Map 44 is a single dwelling within a hillside development generally situated high above the floodplain. It was observed that the possible flooding source is the storm and irrigation runoff from the adjoining property. The neighboring property to the east is much higher than the subject property. The property may receive significant excess runoff from the elevated neighboring property, especially during large storms. There is also a possibility of slope erosion due to the high and steep nature of the slope. The flooding problem seems to have been partially fixed with a small toe wall. However, a more comprehensive wall and drain system will be required to prevent future claims. This repetitive flooding problem is considered to be localized and isolated to the identified repetitive loss property. The fact that no subsequent claims have been filed in the last 10 years suggests that the problem has been rectified. No additional properties are identified for this area.

20.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 20-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 20-1. REPETITIVE LOSS PROPERTIES IN ROWLAND HEIGHTS REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0138651	44	3/01, 2/05	\$9,734	No
<p>Identified Flood Cause: RL Map 44 is significantly lower in elevation than the neighboring property. Without insurance records, it seems that flows from the neighboring property to the side yard can be sufficient to cause damage. Additionally, the slope may be eroded and contribute debris. Street flows may tend to collect in front of the property before moving down the steep street. The finished floor elevation, however, seems to be high enough to prevent damage by street flow.</p>				

Rowland Heights Repetitive Loss Area

Figure 20-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



20.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #44 property is the only property included in this repetitive loss area. It has one insurable building. Table 20-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 20-2. ALL PROPERTIES IN ROWLAND HEIGHTS REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
ROW1	1	Slab	Good	Extend existing side wall and provide ditch to convey flows from the slope Construct terraced wall to avoid slope failure (Construction will require neighbor's consent) Public education
Total	1			

CHAPTER 21. TOPANGA CANYON A REPETITIVE LOSS AREA

21.1 PROBLEM STATEMENT

Figure 21-1 shows the Topanga Canyon A Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is near Garapito Creek, approximately 550 feet upstream of its confluence with Topanga Canyon. The studies of Garapito Creek show Flood Hazard Zones A and AE, high-risk flood zones near RL Map 30. The property is located on the bank of Garapito Creek and is being accessed by a private bridge from the street (see Figure 21-1). The ground elevation of the house seems to be lower than the street, and the front door and wall were built on the bank slope. The problem associated with limited creek capacity and backwater effect caused by the small bridge. The property, however, is subject to much greater risk due to high flood discharges estimated for the 100-year and the Los Angeles County capital flood. The elevation for the lowest point of the house is about 920 feet, while the FEMA FIRM in Figure 21-1 shows that the 100-year water surface elevation of Garapito Creek at the location is approximately 926 feet. The creek is moderately vegetated, which may also contribute to the high water. This repetitive flooding problem appears to be isolated to the subject property.

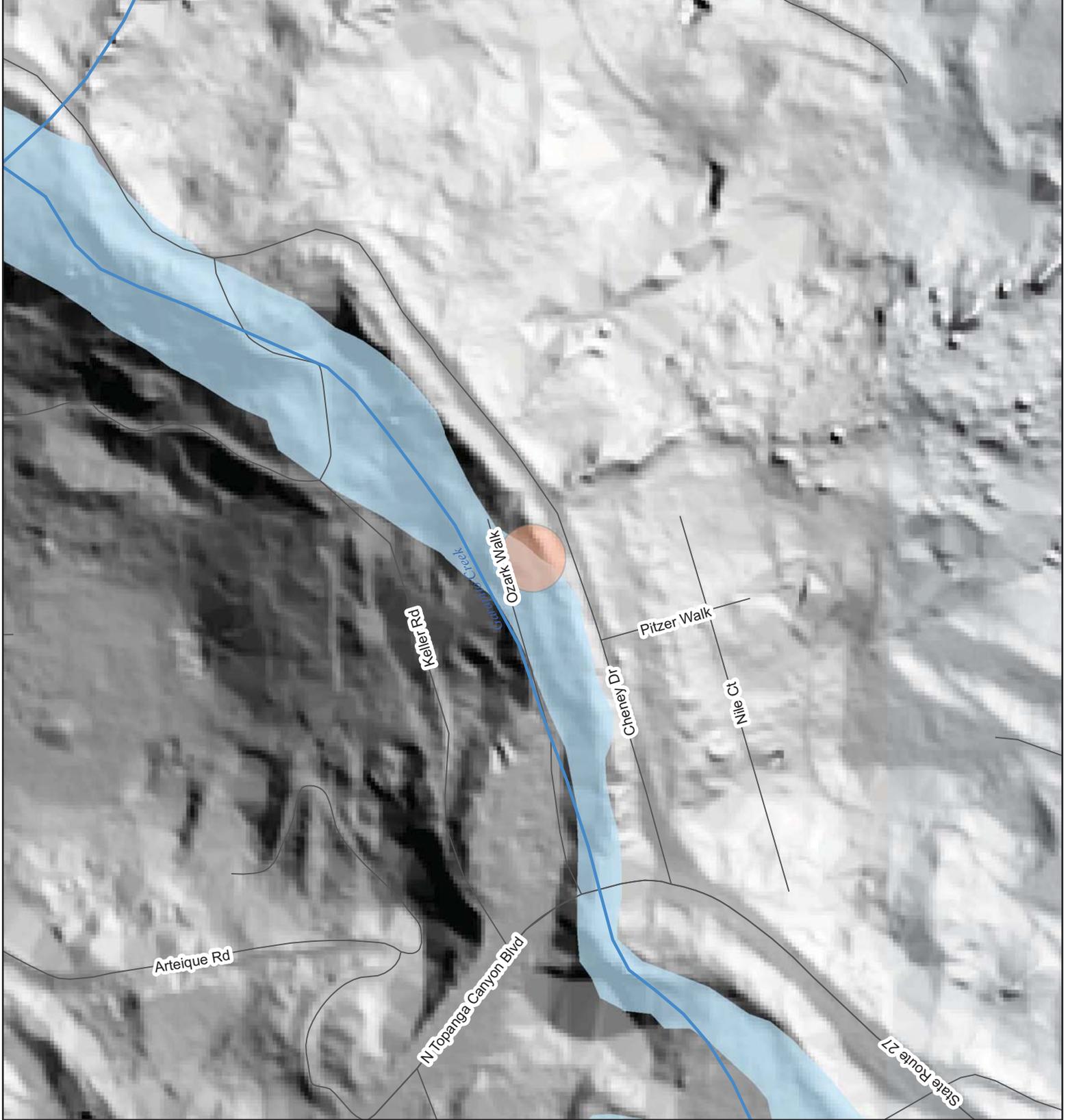
21.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 21-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 21-1. REPETITIVE LOSS PROPERTIES IN REPETITIVE TOPANGA CANYON A LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0028394	30	3/78, 2/80, 3/83, 2/92, 1/93	\$9,247	No	
<i>Identified Flood Cause:</i> The subject property is on the channel bank and partially in Garapito Creek. The problem is associated with limited creek capacity and a backwater effect caused by the small bridge					

Topanga Canyon A Repetitive Loss Area

Figure 21-1



Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.0225 0.045 Miles

21.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #30 property is the only property included in this repetitive loss area. It has one insurable building. Table 21-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 21-2. ALL PROPERTIES IN TOPANGA CANYON A REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TOP-A1	1	Slab	Fair	Acquisition Elevation Convert flood-prone living space and replace with new story Public education
Total	1			

CHAPTER 22. TOPANGA CANYON B REPETITIVE LOSS AREA

22.1 PROBLEM STATEMENT

Figure 22-1 shows the Topanga Canyon B Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in the vicinity of Topanga Canyon, approximately 600 feet upstream of the Old Topanga Canyon confluence. RL Map 34 is subject to flooding from Topanga Canyon, which is commensurate with the flood risk reflected on the Flood Insurance Rate Map.

22.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 22-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 22-1. REPETITIVE LOSS PROPERTIES IN TOPANGA CANYON B REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0012818	34	1/80, 2/80, 3/91, 2/92, 1/95	\$7,872	No
<p>Identified Flood Cause: Property in the channel and Flood Zone AE of Topanga Canyon. The elevation for the lowest point of the house is about 770 feet and is higher than the channel invert of Topanga Canyon (765 feet) by only 5 feet. Based on the FEMA FIRM in Figure 22-1, the water surface elevation of the area is approximately 772 feet, which could cause flooding of the house.</p>				

Topanga Canyon B Repetitive Loss Area

Figure 22-1

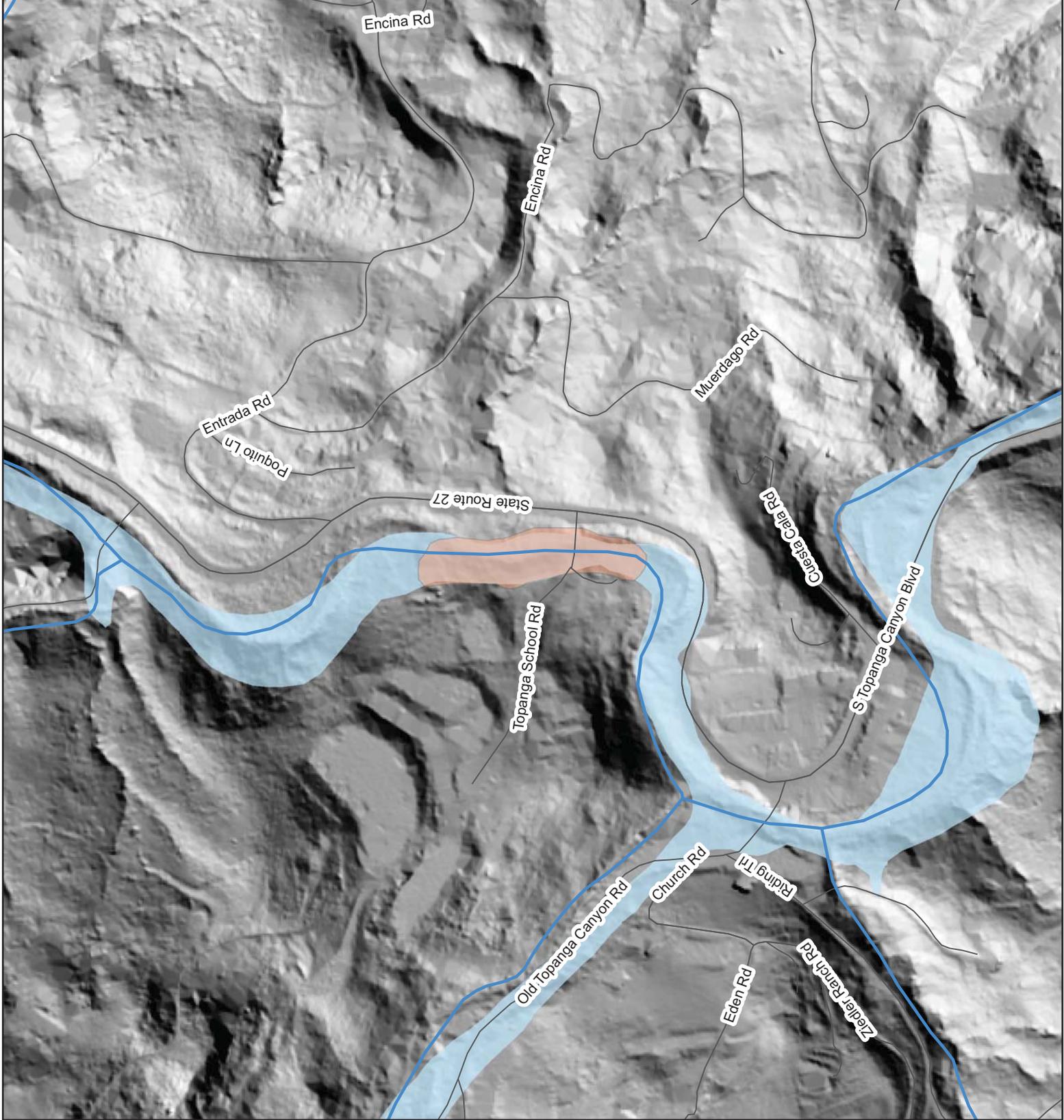
- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



22.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Two properties with two insurable buildings have been identified in this repetitive loss area. Table 22-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 22-2. ALL PROPERTIES IN TOPANGA CANYON B REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TOP-B1	1	Slab	Good	Acquisition Elevation Convert flood-prone living space and replace with new story Public education
TOP-B2	1	Crawlspace	Good	Acquisition Elevation Convert flood-prone living space and replace with new story Public education
Total	2			

CHAPTER 23. TOPANGA CANYON C REPETITIVE LOSS AREA

23.1 PROBLEM STATEMENT

Figure 23-1 shows the Topanga Canyon C Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is located in Calabasas. The identified RL property is newer construction and is located on a knoll of an area with a lot of topographic relief. The cause of flooding for this property appears to be associated with drainage from a surrounding hillside and is isolated to the identified repetitive loss property. This repetitive flooding problem is considered to be localized and isolated to the identified repetitive loss property. The fact that no subsequent claims have been filed in the last 10 years suggests that the problem has been rectified. No additional properties are identified for this area.

23.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 23-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 23-1. REPETITIVE LOSS PROPERTIES IN TOPANGA CANYON C REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0111971	48	2/98, 3/01	\$11,698	No
<i>Identified Flood Cause:</i> Localized flooding associated with hillside drainage.				

Topanga Canyon C Repetitive Loss Area

Figure 23-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

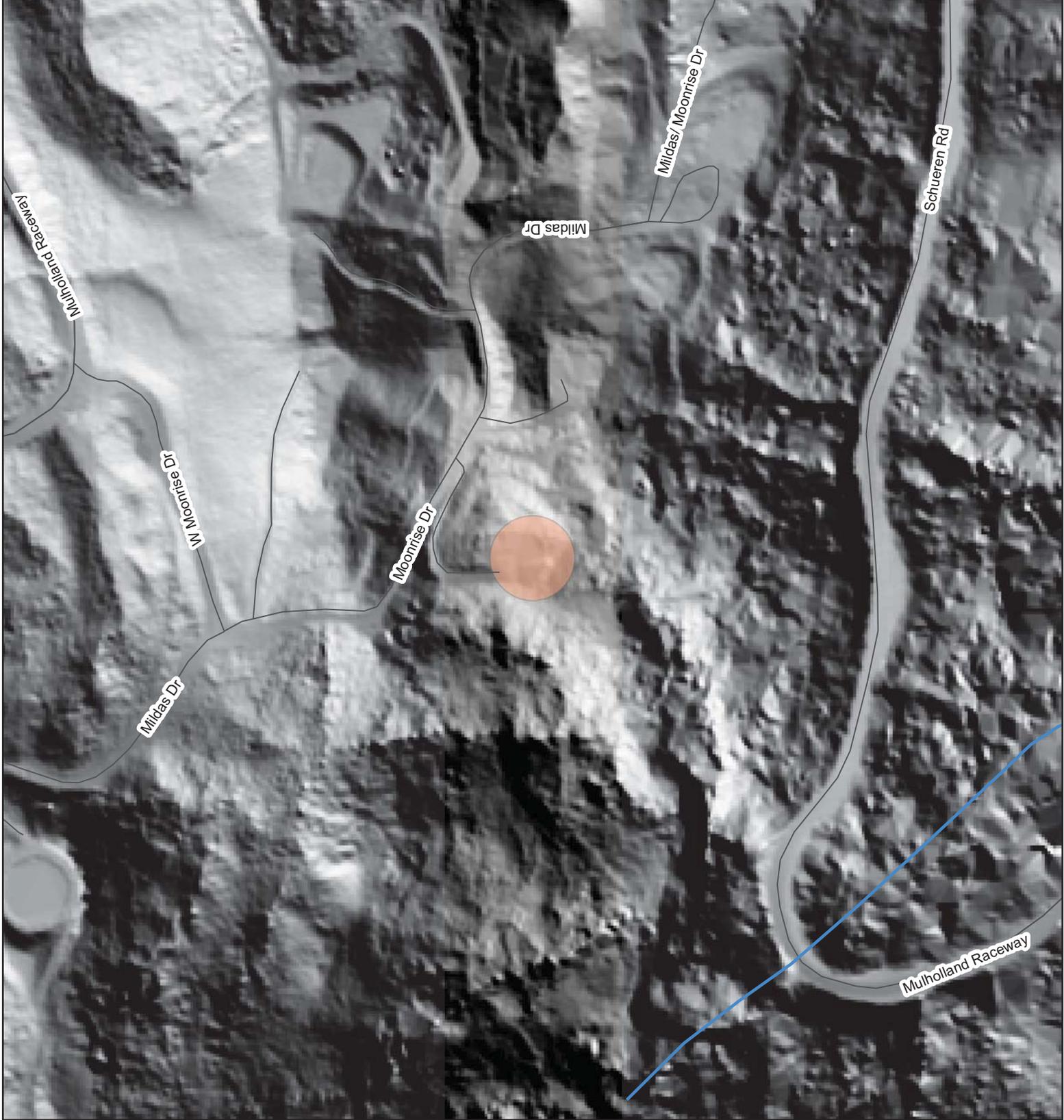
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



23.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #48 property is the only property included in this repetitive loss area. It has one insurable building. Table 23-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 23-2. ALL PROPERTIES IN TOPANGA CANYON C REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TOP-C1	1	Crawlspace	Good	Establish drainage flow paths around structure Drainage system maintenance Floodwall Public education
Total	1			

CHAPTER 24. TOPANGA CANYON D REPETITIVE LOSS AREA

24.1 PROBLEM STATEMENT

Figure 24-1 shows the Topanga Canyon D Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in Topanga within the Santa Monica Mountains in western Los Angeles County. The identified repetitive loss property for this area is not located in a FEMA mapped flood zone and the source of repetitive flood risk appears to be localized. The dates of loss correspond to 13-year storm events that occurred in early 2005. The property is located in a cul-de-sac. There is a gradient slope in this vicinity with properties above the identified RL property as well as below it. The cause of flooding is most likely associated drainage flows from the uphill neighbor. The other properties within this area are at ground elevations similar to that of the identified repetitive loss property and have lowest floors with similar elevations as well.

24.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 24-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 24-1. REPETITIVE LOSS PROPERTIES IN TOPANGA CANYON D REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0137970	49	1/05, 2/05	\$10,822	No	
<i>Identified Flood Cause:</i> Localized drainage issue associated with interior drainage from private property					

Topanga Canyon D Repetitive Loss Area

Figure 24-1

-  Final Mapped Repetitive Loss Area
-  FEMA Flood Hazard Area
-  Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.0325 0.065 Miles



24.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Two properties with two insurable buildings have been identified in this repetitive loss area. Table 24-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 24-2. ALL PROPERTIES IN TOPANGA CANYON D REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TOP-D1	1	Crawlspace	Good	Create/maintain flow paths to public storm drains Drainage system maintenance Public education
TOP-D2	1	Crawlspace	Good	Create/maintain flow paths to public storm drains Drainage system maintenance Public education
Total	2			

CHAPTER 25. TOPANGA CANYON E REPETITIVE LOSS AREA

25.1 PROBLEM STATEMENT

Figure 25-1 shows the Topanga Canyon E Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in the Santa Monica Mountains, in the western area of Los Angeles County and the southeastern area of Ventura County. The identified repetitive loss property for this area is located in Calabasas, in the northwest Santa Monica Mountains between Woodland Hills, Agoura Hills, West Hills, Hidden Hills, and Malibu. The property backs up to steep slope terrain of the Santa Monica Mountains. The two events in 1995 and 2005 were 5-year and 13-year storm events, respectively, based on stream gauging records. Based on topography, the flooding problem appears to be associated with runoff from the surrounding hillside. This problem could be exacerbated by wildfire activity within the region.

25.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 25-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 25-1. REPETITIVE LOSS PROPERTIES IN TOPANGA CANYON E REPETITIVE LOSS AREA					
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?	
0138321	50	3/95, 1/05	\$28,727	No	
<i>Identified Flood Cause:</i> Hillside drainage.					

Topanga Canyon E Repetitive Loss Area

Figure 25-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

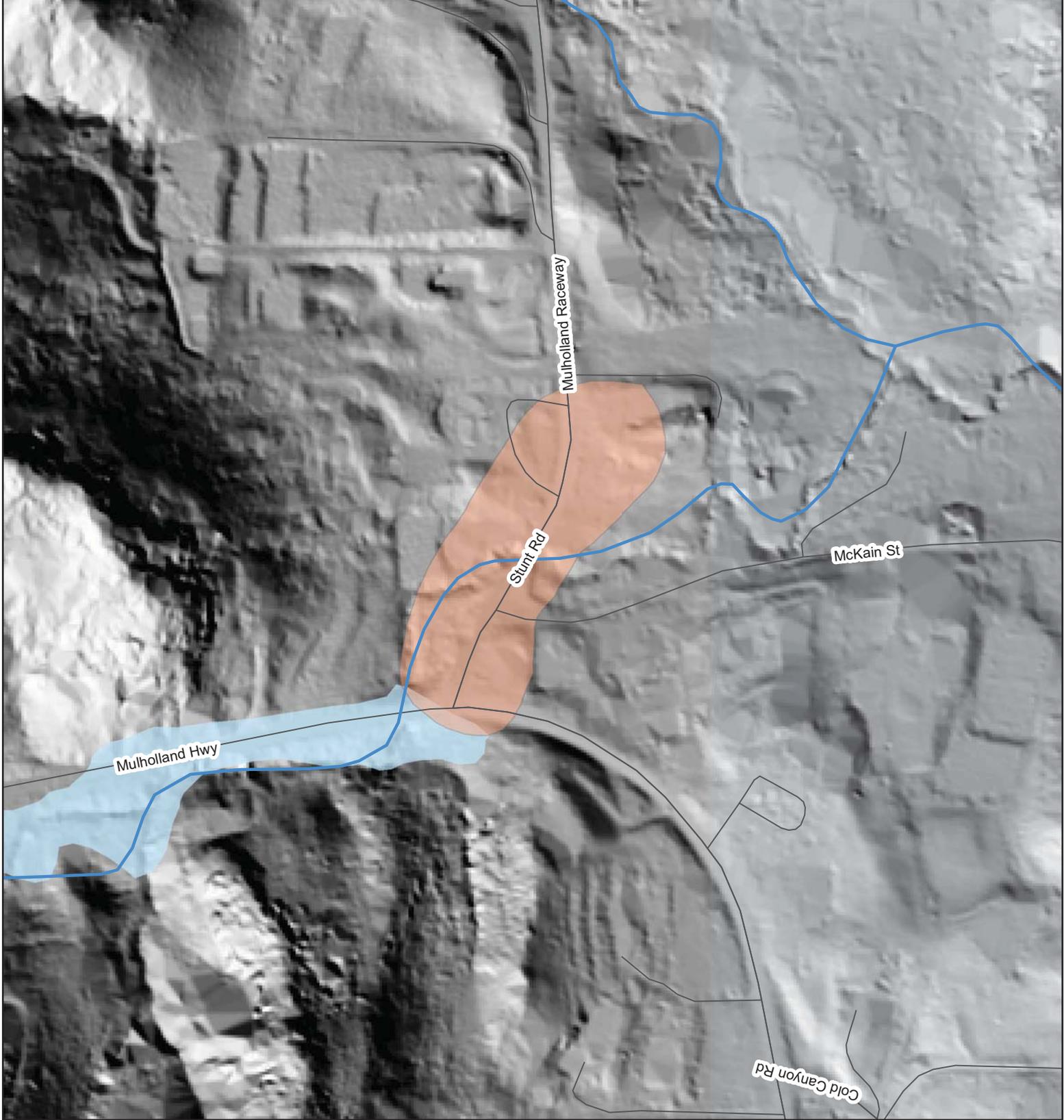
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.0325 0.065 Miles



25.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Five properties with five insurable buildings have been identified in this repetitive loss area. Table 25-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 25-2. ALL PROPERTIES IN TOPANGA CANYON E REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TOP-E1	1	Crawlspace	Good	Establish/maintain flow paths around structure to improved drainage system Hillside retaining wall Public education
TOP-E2	1	Crawlspace	Good	Establish/maintain flow paths around structure to improved drainage system Hillside retaining wall Public education
TOP-E3	1	Crawlspace	Good	Establish/maintain flow paths around structure to improved drainage system Hillside retaining wall Public education
TOP-E4	1	Crawlspace	Good	Establish/maintain flow paths around structure to improved drainage system Hillside retaining wall Public education
TOP-E5	1	Crawlspace	Good	Establish/maintain flow paths around structure to improved drainage system Hillside retaining wall Public education
Total	5			

CHAPTER 26. TRIUNFO CANYON A REPETITIVE LOSS AREA

26.1 PROBLEM STATEMENT

Figure 26-1 shows the Triunfo Canyon A Repetitive Loss Area. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. This is an offsite drainage problem isolated to the single property. The property is located in the floodplain and Flood Hazard Zone AE. In the past, small private bridges and culverts in the creek running behind the house clogged with debris, causing water to overflow and run along Lobo Canyon Road in front of the subject property.

26.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 26-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 26-1. REPETITIVE LOSS PROPERTIES IN TRIUNFO CANYON A REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0095737	24	1/95, 2/98	\$23,454	No
<p>Identified Flood Cause: Property is in flood Zone AE of Lobo Canyon (behind the house). Past clogging of small private bridges and culverts in the creek caused water to overflow onto the street and flood the property. No losses reported since 1998. The structure's windows are boarded up and it is assumed to be vacant.</p>				

Triunfo Canyon A Repetitive Loss Area

Figure 26-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

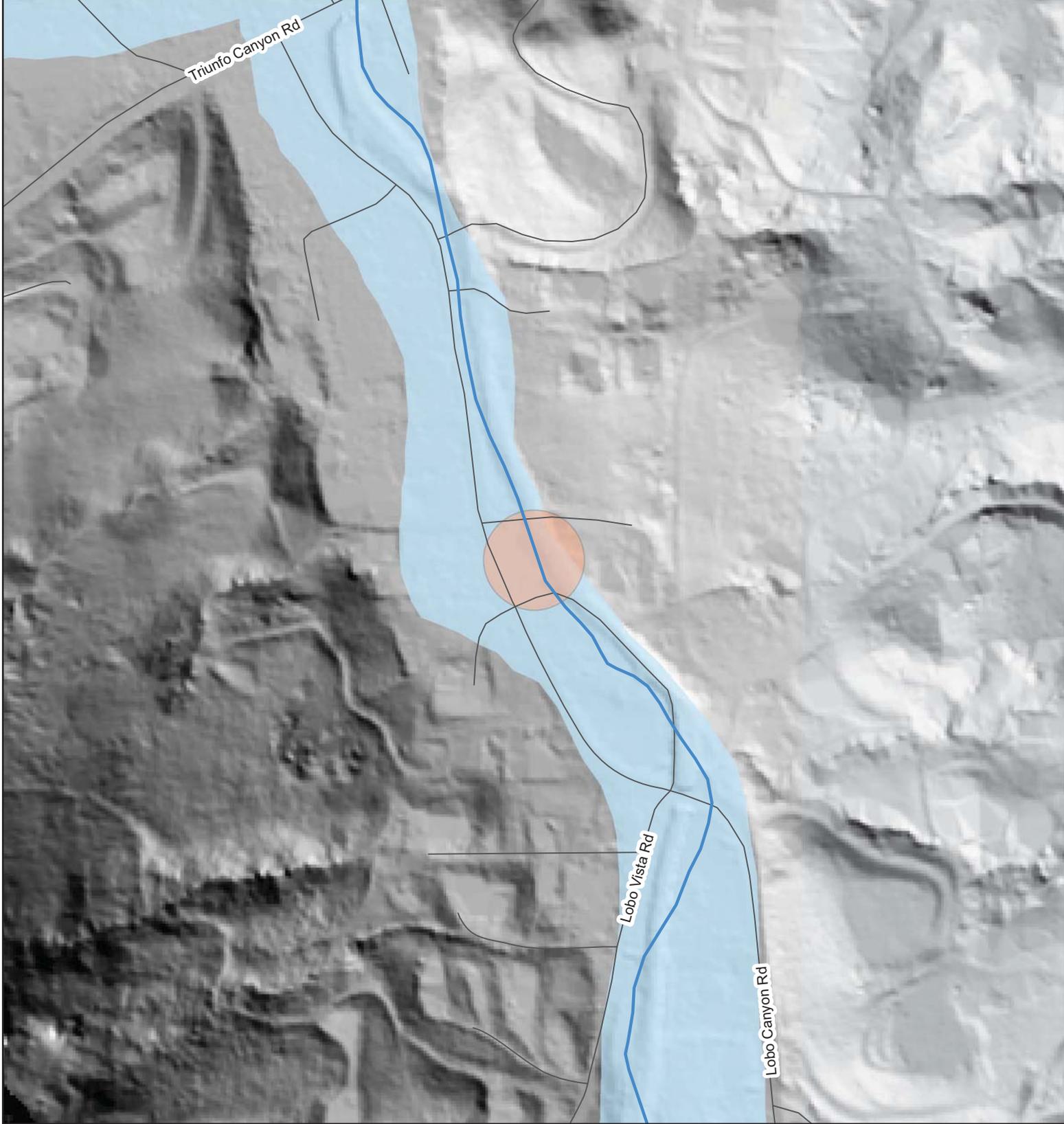
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.03 0.06 Miles



26.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #24 property is the only property included in this repetitive loss area. It has one insurable building. Table 26-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 26-2. ALL PROPERTIES IN TRIUNFO CANYON A REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TRI-A1	1	Slab	Fair	Acquisition Elevation Berm Floodwall Public education
Total	1			

CHAPTER 27. TRIUNFO CANYON B REPETITIVE LOSS AREA

27.1 PROBLEM STATEMENT

Figure 27-1 shows the Triunfo Canyon B Repetitive Loss Area. This area is in the Santa Monica Mountains in the northwestern portion of Los Angeles County. RL Map 43 is at the base of a hillside and receives runoff from the adjacent hills. Based on topography, the property is subject to runoff from the hillside behind the property.

27.2 IDENTIFIED REPETITIVE LOSS PROPERTY

Table 27-1 lists the FEMA-designated repetitive loss property within this repetitive loss area.

TABLE 27-1. REPETITIVE LOSS PROPERTIES IN TRIUNFO CANYON B REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0137793	43	2/98, 1/05	\$13,473	No
<i>Identified Flood Cause:</i> There is no house on the subject property. Based on topography, the property is subject to runoff from the hillside behind the property.				

Triunfo Canyon B Repetitive Loss Area

Figure 27-1

- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

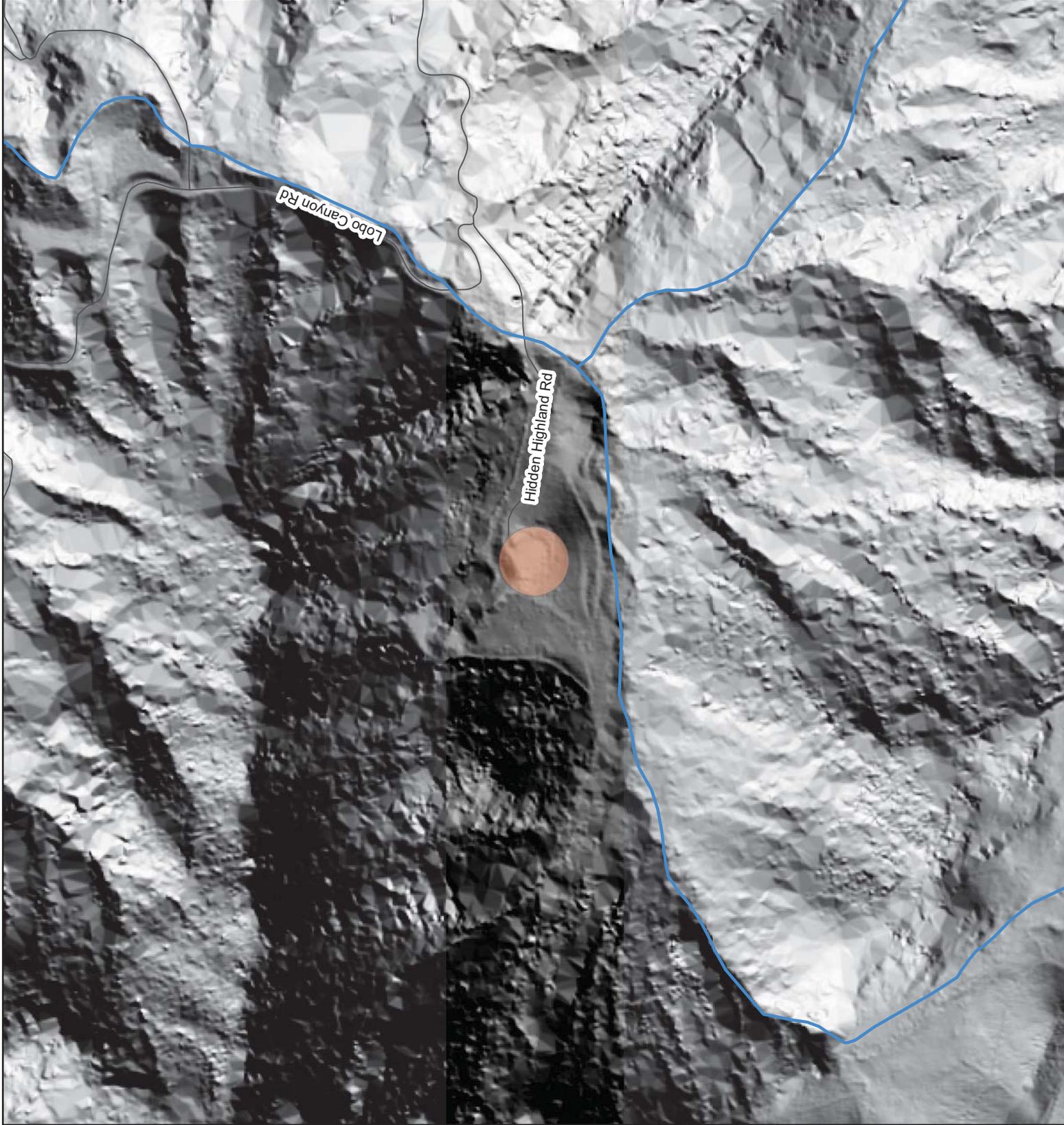
Base Map Data Sources:
Los Angeles County, ESRI



TETRA TECH



0 0.05 0.1 Miles



27.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

The RL Map #43 property is the only property included in this repetitive loss area. It has one insurable building. Table 27-2 provides general information for the property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 27-2. ALL PROPERTIES IN TRIUNFO CANYON B REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
TRI-B1	1	Slab	Good	Establish drainage flow paths around structure Elevation Drainage system maintenance Public education
Total	1			

CHAPTER 28. UPPER TOPANGA CANYON REPETITIVE LOSS AREA

28.1 PROBLEM STATEMENT

Figure 28-1 shows the Upper Topanga Canyon Repetitive Loss Area, which is inclusive of RL Map areas 29, 31, 32, 33 and 47 from past planning efforts. Flood zones as mapped on FEMA Flood Insurance Rate Maps are also shown on the figure. These areas are in the Topanga Canyon area of Los Angeles County, approximately 26 miles northwest of the City of Los Angeles. All properties in these designated areas are either in or immediately adjacent to the FEMA-mapped 100-year floodplain for Topanga Canyon. The Topanga Canyon is located in the western area of Los Angeles County, and its contributing watershed is the second largest watershed in the Santa Monica Mountains. Sources of flooding in the Topanga Canyon area consist of storm runoff in Topanga Creek and associated storm drainage facilities. Historically, flooding occurs from 5-year or greater flood events. Because most of the repetitive loss properties are located within the low-lying floodplain areas immediately adjacent to the low-flow channels, it is expected that without mitigation, these properties will continue to be subject to future floods.

Upper Topanga Canyon Repetitive Loss Area

Figure 28-1

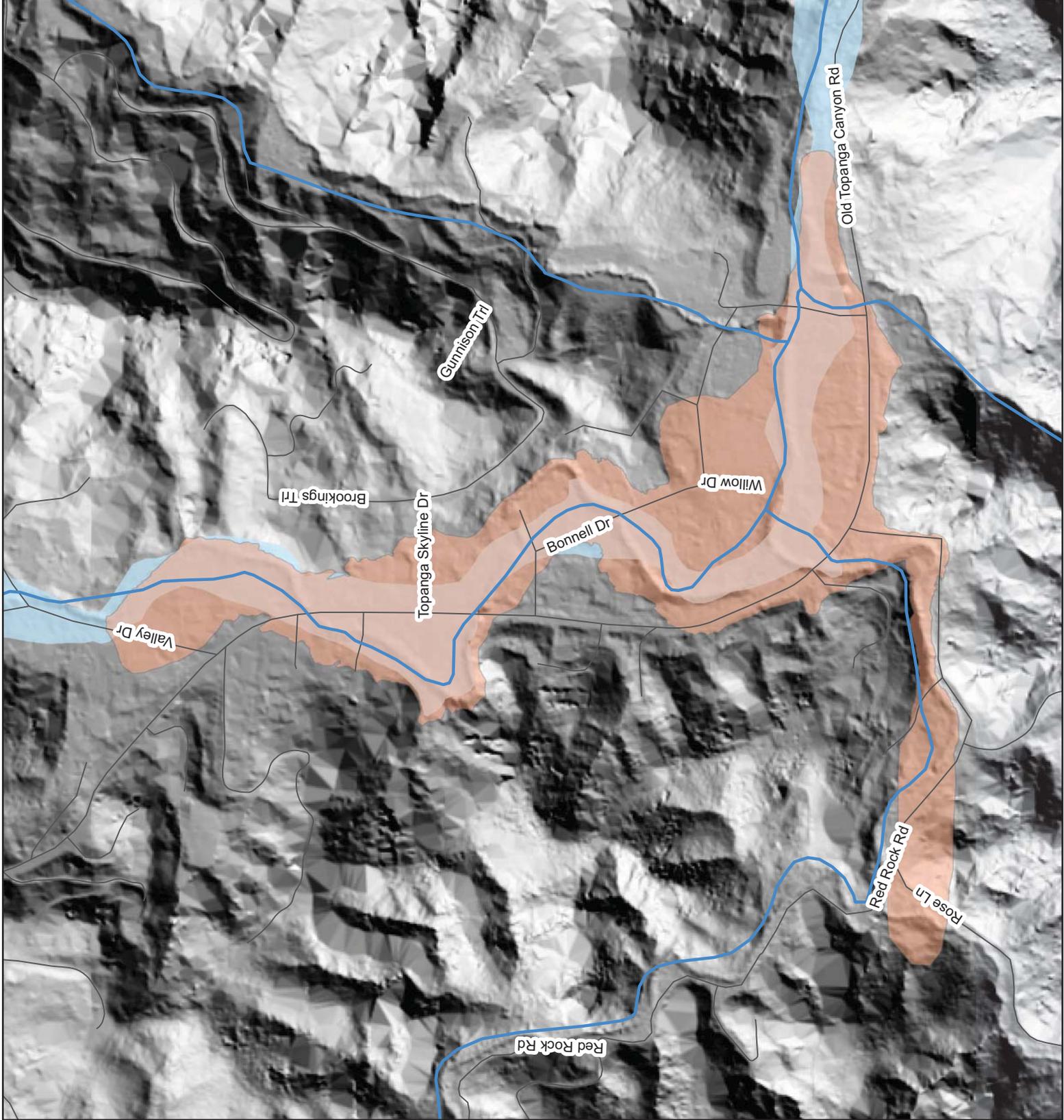
- Final Mapped Repetitive Loss Area
- FEMA Flood Hazard Area
- Incorporated Areas

Note: Mapped Repetitive Loss Areas are approximate.

Base Map Data Sources: Los Angeles County, ESRI



TETRA TECH



28.2 IDENTIFIED REPETITIVE LOSS PROPERTIES

Table 28-1 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

TABLE 28-1. REPETITIVE LOSS PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA				
FEMA RL #	RL Map #	Flood Dates of Previous Claims	Average Claim Paid	Mitigated?
0074656	29	1/95, 3/95	\$6,972	No
Identified Flood Cause: Property on the bank next to Old Topanga Canyon. Crawlspace foundation with finished floor below 100-year water surface elevation. Damage caused by 5-year return interval event in 1995. No reported damage since.				
0074334	31	2/92, 1/95	\$11,451	No
Identified Flood Cause: Property on the bank next to Old Topanga Canyon. Crawlspace foundation with finished floor below 100-year water surface elevation. Damage caused by 5-year return interval event in 1995. No reported damage since.				
0074553	32	1/95, 3/95	\$10,276	No
Identified Flood Cause: In 1983 & 1993, the water from the natural creek tributary east of the house, overtopping Old Topanga Cyn Road and pouring into the house. The owner claimed no more problems with the tributary flooding. 2) The property is still subject to flooding from Old Topanga Cyn channel (Zone AE). The property is in Zone AE, which has significant risk from a 100-year flood. The tributary flow may continue to overtop the street if the culvert inlet becomes obstructed by debris from the upstream reach.				
0076269	33	1/95, 3/95	\$29,354	No
Identified Flood Cause: Property No. 33 was not mapped by FEMA, but was confirmed by field investigation to be subject to a high risk from Red Rock Canyon flooding. The property is located on the opposite bank from Red Rock Road and is being accessed by a pedestrian bridge crossing the creek. The creek is very shallow without the capacity to carry the estimated 810 cubic feet per second of the 100-year flood discharge, and the bridge has a very low clearance, which can cause further flow blockage and higher backwater.				
0074498	47	1/95, 3/95	\$9,692	No
Identified Flood Cause: Crawlspace foundation with finished floor below 100-year water surface elevation. Damage caused by 5-year return interval event in 1995. No reported damage since.				

28.3 PROPERTIES INCLUDED IN REPETITIVE LOSS AREA

Forty-nine properties with 53 insurable buildings have been identified in this repetitive loss area. Table 28-2 provides general information for each property, along with mitigation measures that could be employed to address repetitive flood losses. For private properties, the decision on whether to implement the identified mitigation measures resides with the private property owner. These measures are recommended due to the flood risks, but owners are not obligated to implement them.

TABLE 28-2. ALL PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
UTC1	1	Crawlspace	Good	Maintain flow paths around structure Retaining wall Public education
UTC2	2	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC3	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC4	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC5	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC6	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC7	2	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC8	1	Crawlspace	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC9	1	Crawlspace	Fair	Elevation Acquisition Flood-proofing Public education
UTC10	1	Slab	Good	Maintain flow paths around structure Retaining wall Public education

TABLE 28-2. ALL PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
UTC11	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC12	1	Crawlspace	Fair	Elevation Acquisition Flood-proofing Public education
UTC13	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC14	1	Crawlspace	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC15	1	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC16	1	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC17	2	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC18	1	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC19	1	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC20	1	Slab	Fair	Elevation Flood-proofing Retaining wall on creek side Public education
UTC21	1	Slab	Good	Elevation Acquisition Flood-proofing Public education

**TABLE 28-2.
ALL PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
UTC22	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
UTC23	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC24	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC25	1	Crawlspace	Fair	Elevation Acquisition Flood-proofing Public education
UTC26	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
UTC27	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
UTC28	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC29	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
UTC30	2	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC31	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC32	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC33	1	Slab	Good	Maintain flow paths around structure Retaining wall Public education

**TABLE 28-2.
ALL PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA**

Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
UTC34	1	Slab	Good	Maintain flow paths around structure Retaining wall Public education
UTC35	1	Slab	Good	Maintain flow paths around structure Retaining wall Public education
UTC36	1	Slab	Good	Flood-proof lower level and retaining wall on creek side Public Education
UTC37	1	Slab	Good	Flood-proof lower level and retaining wall on creek side Public Education
UTC38	1	Slab	Good	Elevation Acquisition Flood-proofing Public education
UTC39	1	Crawlspace	Fair	Elevation Acquisition Flood-proofing Public education
UTC40	1	Slab	Fair; Hotel/ Apartment Bldg.	Elevation Acquisition Flood-proofing Public education
UTC41	1	Slab	Fair	Elevation Acquisition Flood-proofing Public education
UTC42	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC43	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC44	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC45	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education

TABLE 28-2. ALL PROPERTIES IN UPPER TOPANGA CANYON REPETITIVE LOSS AREA				
Property ID	Number of Insurable Buildings	Building Description		Probable Mitigation Measures
		Foundation	Condition	
UTC46	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC47	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC48	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
UTC49	1	Crawlspace	Good	Elevation Acquisition Flood-proofing Public education
Total	53			

**Part 3 —
Repetitive Loss Area Action Plan**

CHAPTER 29.

REPETITIVE LOSS AREA ACTION PLAN

29.1 MITIGATION ACTIONS

This Los Angeles County Repetitive Loss Area Analysis was created in conjunction with the development of the 2015 Los Angeles County Comprehensive Floodplain Management Plan. The two processes were created simultaneously, and while each will be maintained separately by the County, they are both functional annexes of each other. The floodplain management plan identified and prioritized an action plan that will have direct relevance to this RLAA. This action plan has been adapted to apply to the RLAA and is shown in Table 29-1. The following information is presented for each action plan item:

- Action item **number** and **description**
- **Lead agency** responsible for implementing the action item
- **Support agencies** expected to participate in the implementation
- Agencies or programs that may be able to provide **funding** to implement the action item
- An estimated **cost** range:
 - **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.
- A statement of **timing** for implementing the action item:
 - Ongoing—This action already occurs and will continue
 - Short term—This action would be implemented within five years
 - Long term— This action would be implemented after five years
- A list of the **RL map numbers that would be affected** by the action item
- Indication of whether the action item was **included in the previous RLAA** and, if so, its number in that previous document.

**TABLE 29-1.
ACTION PLAN—FLOOD MITIGATION INITIATIVES**

Possible Funding Sources or Resources	Estimated Project Cost	Timeline	Affected RL Map #	In Previous Plan? Initiative #
<p>1—Promote awareness of flood hazards to residents in repetitive loss areas. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Public Works (Building and Safety Division) FEMA; California Emergency Management Agency (Cal EMA); County DPW; County Regional Planning Department</p>				
	Low	Ongoing	All	Yes-3
<p>2—Develop and distribute flood protection information and materials to property owners, renters, and developers in repetitive loss areas. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Public Relations Group, Building and Safety Division, Land Development Division, Program for Public Information) County DPW</p>				
	Low	Ongoing	All	Yes-21
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: CEO (Office of Emergency Management), Public Works (Disaster Services Group) County DPW; County OEM</p>				
	Low	Ongoing	1-25, 29-34, 37,45-47	No
<p>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:</p> <ul style="list-style-type: none"> • Annually notify owners regarding local flood hazards and proper protection activities • Provide technical advice regarding flood protection and flood preparedness • Distribute a revised questionnaire to new Repetitive Loss Properties. <p>Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Program for Public Information) County DPW</p>				
	Low	Ongoing	All	Yes-12, 20
<p>5—Make sand bags available to repetitive loss area property owners during the wet season, provide notifications of the availability of these materials, and track the distribution of the materials. Lead Agency: Fire Department, Public Works (Administrative Services Division, Watershed Management Division) Support Agencies: Public Works (Public Relations Group) FEMA; Cal EMA; Fire Department; County DPW</p>				
	Low	Ongoing	All	Yes-17
<p>6—Provide public education about maintaining the stormwater system free of debris. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Public Relations Group, Flood Maintenance Division, Road Maintenance Division, Program for Public Information) County DPW</p>				
	Low	Ongoing	All	Yes-22
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Public Works (Flood Maintenance Division, Water Resources Division, Program Development Division, Public Relations Group, Program for Public Information) County DPW</p>				
	Low	Ongoing	All	No

**TABLE 29-1.
ACTION PLAN—FLOOD MITIGATION INITIATIVES**

Possible Funding Sources or Resources	Estimated Project Cost	Timeline	Affected RL Map #	In Previous Plan? Initiative #
<p>8—Include repetitive loss areas in the implementation of the Program for Public Information (PPI) protocol identified in the Los Angeles County Comprehensive Floodplain Management Plan and include appropriate messaging for compliance with ADA. Lead Agency: Public Works (Watershed Management Division, Public Relations Group) FEMA; Cal EMA; County DPW</p>	Low	Ongoing	All	No
<p>9—Provide emergency preparedness and flood protection information to the repetitive loss areas. Lead Agency: CEO (Office of Emergency Management) Support Agencies: Public Works (Watershed Management Division, Program for Public Information, Water Resources Division, Public Relations Group) FEMA; Cal EMA; County OEM; County DPW; USC Sea Grant</p>	Low	Ongoing	All	Yes-23
<p>10—Distribute information to repetitive loss areas regarding flood prevention and flood insurance at emergency operations and emergency preparedness events. Lead Agency: CEO (Office of Emergency Management) Support Agencies: Public Works (Watershed Management Division, Water Resources Division, Public Relations Group, Program for Public Information) FEMA; Cal EMA; County OEM; County DPW</p>	Low	Ongoing	All	Yes-24
<p>11—Develop and maintain a list of problem sites, including those associated with the sources for repetitive flooding, where a maintenance solution would be the top priority Lead Agency: Public Works (Flood Maintenance Division) Support Agencies: Public Works (Watershed Management Division, Water Resources Division, Road Maintenance Division) County DPW</p>	Low	Ongoing	26-28, 35, 36, 38-44, 48-50	Yes-8
<p>12—Conduct routine maintenance of flood control facilities and additional maintenance as needed at identified problem sites, including identified repetitive loss areas. Lead Agency: Public Works (Flood Maintenance Division, Road Maintenance Division) County DPW</p>	Low	Ongoing	All	Yes-9
<p>13—Conduct a stormwater facilities condition assessment to identify the physical and hydraulic condition of the system and to support infrastructure upgrades or enhancements. Lead Agency: Public Works (Flood Maintenance Division) Support Agencies: Public Works (Watershed Management Division, Water Resources Division) County DPW</p>	Low	Ongoing	All	Yes-7
<p>14—Evaluate storm drain, open channel, and flood retention basin facilities for future improvements. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Design Division, Flood Maintenance Division, Water Resources Division) Stakeholders County DPW</p>	Low	Ongoing	All	Yes-18
<p>15—Pursue appropriate flood hazard mitigation grant funding. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Programs Development Division, Disaster Services Group), CEO (Office of Emergency Management) County DPW; County OEM</p>	Low	Ongoing	All	Yes-1

**TABLE 29-1.
ACTION PLAN—FLOOD MITIGATION INITIATIVES**

Possible Funding Sources or Resources	Estimated Project Cost	Timeline	Affected RL Map #	In Previous Plan? Initiative #
16—Where feasible and cost effective, consider the conversion of high-risk properties into open space.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Regional Planning Department, Parks and Recreation				
FEMA; U.S. EPA; Cal EMA; Cal EPA; County DPW; County Regional Planning Department; County Parks and Recreation	Medium	Ongoing	All	Yes-13
17—Refine the plan check system to track properties in the flood zone and address drainage.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Public Works (Building and Safety Division, Land Development Division)				
County DPW	Low	Ongoing	1-25, 29-34, 37,45-47	Yes-10
18—Flag Repetitive Loss Properties in the plan, and check database for review and approval of building permit applications.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Public Works (Building and Safety Division)				
County DPW	Low	Ongoing	All	Yes-11
19—Maintain a database system for tracking all reviewed and approved elevation certificates prior to the closure of a building permit.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Public Works (Building and Safety Division, Information Technology Division)				
County DPW	Low	Ongoing	1-25, 29-34, 37,45-47	No
20—Evaluate opportunities for incorporating watershed ecosystem restoration where feasible as an additional element of projects that protect repetitive loss areas.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Regional Planning Department, Public Works (Water Resources Division), Stakeholders				
FEMA, U.S. EPA; Cal EMA; Cal EPA; County DPW; County Regional Planning Department	Low	Ongoing	1-25, 29-34, 37,45-47	Yes-4
21—Where feasible, cost-effective and supported by the community, restore the natural and beneficial functions of floodplains.				
Lead Agency: Public Works (Watershed Management Division)				
Support Agencies: Public Works (Programs Development Division)				
FEMA; U.S. EPA; Cal EMA; Cal EPA; County DPW	High/Medium	Long term	1-25, 29-34, 37,45-47	No
22—Encourage the application of biological resource measures for the control of stormwater and erosion to the best of their applicable limits.				
Lead Agency: Fire Department, Public Works (Building and Safety Division, Design Division, Land Development Division)				
Support Agencies: Regional Planning Department, Public Works (Environmental Programs Division, Watershed Management Division, Project Management Division, Water Resources Division)				
FEMA; U.S. EPA; Cal EMA; Cal EPA; County Fire Department; County DPW	Low	Ongoing	All	Yes-16

**TABLE 29-1.
ACTION PLAN—FLOOD MITIGATION INITIATIVES**

Possible Funding Sources or Resources	Estimated Project Cost	Timeline	Affected RL Map #	In Previous Plan? Initiative #
23—Maintain the Operational Area Emergency Response Plan. Lead Agency: CEO (Office of Emergency Management) Support Agencies: Public Works (Disaster Services Group, Watershed Management Division) FEMA; Cal EMA; County DPW; County OEM				
	Low	Ongoing	All	Yes-2
24—Maintain standards for the use of structural and non-structural techniques that mitigate flood hazards and manage stormwater pollution. Lead Agency: Public Works (Building and Safety Division, Design Division, Land Development Division) Support Agencies: Public Works (Watershed Management Division) County DPW				
	Low	Ongoing	All	Yes-14
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. Lead Agency: Regional Planning Department Support Agencies: Public Works (Watershed Management Division, Programs Development Division, Land Development Division) County DPW; County Regional Planning Department				
	Low	Ongoing	All	Yes-15
26—Where appropriate, support retrofitting, purchase, or relocation of structures in hazard-prone repetitive loss areas to prevent future structure damage. Give priority to properties with exposure to repetitive losses. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Regional Planning Department, Parks and Recreation, Public Works (Building and Safety Division, Programs Development Division) FEMA Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, and Flood Mitigation Act; U.S. HUD; Cal EMA; County DPW; County OEM; County Regional Planning Department; County Parks and Recreation				
	Low	Ongoing	All	Yes-13
27—Use risk-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. Lead Agency: Regional Planning Department Support Agencies: Public Works (Watershed Management Division) County Regional Planning Department; County DPW				
	Low	Short term	1-25, 29-34, 37,45-47	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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Building and Safety Division, Land Development Division, Flood Maintenance Division, Water Resources Division), Regional Planning Department County DPW				
	Low	Ongoing	1-25, 29-34, 37,45-47	No

**TABLE 29-1.
ACTION PLAN—FLOOD MITIGATION INITIATIVES**

Possible Funding Sources or Resources	Estimated Project Cost	Timeline	Affected RL Map #	In Previous Plan? Initiative #
<p>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. Lead Agency: Public Works (Watershed Management Division) FEMA; U.S. EPA; Cal EMA; Cal EPA; County DPW; USC Sea Grant</p>				
	Low	Long term	All	No
<p>30—Identify flood-warning systems for properties where such systems can be beneficially deployed. These would include repetitive loss properties located in the Special Flood Hazard Area. Lead Agency: Public Works (Watershed Management Division) Support Agencies: CEO (Office of Emergency Management), Sheriff’s Department, Public Works (Flood Maintenance Division, Disaster Services Group, Water Resources Division)</p>				
FEMA Hazard Mitigation Grant Program , Pre-Disaster Mitigation Grant Program, and Flood Mitigation Act; Cal EMA; County DPW; County OEM	Low	Ongoing	1-25, 29-34, 37,45-47	Yes-6
<p>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. Lead Agency: Public Works (Watershed Management Division) Support Agencies: CEO (Office of Emergency Management), Public Works (Disaster Services Group)</p>				
FEMA; Cal EMA; County DPW; County OEM	Medium/Low	Long Term	All	No
<p>32—Continue to enforce the County’s development regulations to prevent increases of the flood hazard on adjacent properties. Lead Agency: Public Works (Building and Safety Division, Land Development Division) Support Agencies: Public Works (Watershed Management Division)</p>				
County DPW	Low	Ongoing	All	No
<p>33—Conduct an evaluation of FEMA-designated flood zones and revise/update them to reflect current conditions. Lead Agency: Public Works (Watershed Management Division) Support Agencies: Public Works (Water Resources Division)</p>				
FEMA; Cal EMA; County DPW	Medium/Low	Ongoing	1-25, 29-34, 37,45-47	No
<p>34—Continue to maintain and update the Hazus-MH model constructed to support the development of the Comprehensive Floodplain Management Plan, in order to make flood risk information available to repetitive loss area property owners. Lead Agency: Public Works (Watershed Management Division)</p>				
FEMA; Cal EMA; County DPW	Low	Ongoing	All	No
<p>35—Continue County coordination with other agencies and stakeholders on issues of flood control. Lead Agency: Public Works (Watershed Management Division)</p>				
County DPW	Low	Ongoing	All	No

29.2 BENEFIT/COST ANALYSIS

The action plan is prioritized according to a benefit/cost analysis of the proposed projects (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 some time, 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 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 floodplain management goals and objectives.

29.3 ACTION PLAN PRIORITIZATION

Table 29-2 lists the priority of each action item assigned by the planning team, using the same parameters used in selecting the action items. A qualitative benefit-cost review was performed for each action item. 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.

29.4 ANNUAL EVALUATION REPORT

Los Angeles County will prepare an annual evaluation report for its area analyses. The report will include a review of each action item, including a description of what was implemented or not implemented, and recommended changes to the actions items as appropriate. The report will be made available to the media and the public and will be submitted with the annual CRS recertification.

**TABLE 29-2.
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

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Los Angeles County
Repetitive Loss Area Analysis

**APPENDIX A.
GENERIC DEPTH-DAMAGE RELATIONSHIPS FOR
RESIDENTIAL STRUCTURES**

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements.

1. Purpose. The purpose of this memorandum is to release, and provide guidance for the use of, generic depth-damage curves for use in U.S. Army Corps of Engineers flood damage reduction studies.

2. Background. Proper planning and evaluation of flood damage reduction projects require knowledge of actual damage caused to various types of properties. The primary purpose of the Flood Damage Data Collection Program is to meet that requirement by providing Corps district offices with standardized relationships for estimating flood damage and other costs of flooding, based on actual losses from flood events. Under this program, data have been collected from major flooding that occurred in various parts of the United States from 1996 through 2001. Damage data collected are based on comprehensive accounting of losses from flood victims' records. The generic functions developed and provided in this EGM represent a substantive improvement over other generalized depth-damage functions such as the Flood Insurance Administration (FIA) Rate Reviews.

3. Results. Generic damage functions are attached for one-story homes with basement, two or more story homes with basement, and split-level homes with basement. Generic damage functions for similar structures without basements were published in 2000 and are included as enclosure 1 for ready reference.

a. Regression analysis was used to create the damage functions. While several independent variables, such as flood duration and flood warning lead-time, were examined in building the models, the models that were most efficient in explaining the percent damage to structure and contents were quadratic and cubic forms with depth as the only independent variable.

b. Content damage was modeled with the dependent variable being content damage as a percentage of structure value. This differs from the previous technique of first developing content valuations and then content damage relationships as a function of content valuations. The generic content damage models are statistically significant and their use eliminates the need to establish content-to-structure ratios through surveys.

c. While the data collected include information on all aspects of National Economic Development (NED) losses, only results and recommendations related to the structure and content damages for homes with basements are included in this EGM.

Direct costs for cleanup expenses, unpaid hours for cleanup and repair, emergency damage prevention actions, and other flood-related costs are not included in these damage functions. Information on other residential flood costs, beyond those included in these damage functions will found the summary report, discussed in paragraph 5. These costs should be developed using site-specific historical information.

4. Application. The following paragraphs provide information on the application of the generic curves within the HEC-FDA damage calculation program.

a. The economic section of HEC-FDA divides the quantification of flood damages into a direct method and an indirect method. The direct method allows the user to directly enter a stage-damage relationship for any structure. This approach is commonly used for large or unique properties such as industrial or public buildings. The indirect method quantifies the stage-damage relationship for a group of structures that have significant commonality. Typically damage to residential structures is calculated using the indirect method. The procedures described in the following paragraphs apply only when using the indirect method to determine the stage-damage relationship.

b. The traditional approach to quantifying damage to contents by the indirect method relies on three pieces of information: 1) structure value; 2) content-to-structure value ratio; and 3) the content depth-damage relationship. The content-to-structure value ratio and content depth-damage relationship are unique to the structure occupancy type to which a structure is assigned. The content depth-damage relationship provides the estimate of content flood damage as a percentage of content value. Thus, to calculate a content stage-damage function for an individual structure, the structure value for an individual structure is first multiplied by the content-to-structure value ratio to provide an estimate of the content value. This content value is then multiplied by each percent damage value of the content depth-damage relationship.

c. The new content depth-damage functions provided herein are different from those used by the Corps in the past in one important aspect. The new functions calculate content damage as a percent of structure value rather than content value. Using these functions within HEC-FDA requires care in specifying a content-to-structure value ratio. To understand the requirements for using the new content depth-damage functions requires a basic understanding of how HEC-FDA calculates content damage.

(1). To calculate damages by the indirect method, each structure must be assigned to a structure occupancy type. For each structure occupancy type a content-to-structure value ratio and content depth-damage relationship are defined. These data for calculating content damage within HEC-FDA is entered on the “Study Structure Occupancy Type” screen. As long as a content value is not entered for a structure in the Structure Inventory Data, HEC-FDA calculates the content stage-damage by first calculating content using the structure value multiplied by the content-to-structure value ratio.

In some instances, however, analysts develop unique estimates of content values for a structure, which are entered for the individual structure on the Structure Inventory Data screen. For each structure that has a content value entered, calculating a content value by using the content-to-structure value ratio is ignored and the user entered content value is used to calculate content damage.

(2). The new content depth-damage functions do not require this intermediate step of calculating content values. Therefore, the content-to-structure value ratio for each structure occupancy type using the new content depth-damage relationships must be set to one hundred percent (100). This forces the content depth-damage function to be multiplied by the structure value as required. Also, the “Error Associated with Content/Structure Value” on the “Study Structure Occupancy Type” screen should be left blank. This implies that the error in content-to-structure value ratio is part of the new content depth-damage relationship.

(3). Because entering a content value on the Structure Inventory Data window overrides the content-to-structure value ratio, the new content depth-damage relationships should not be used for structures that have separately entered content values.

(4). Questions concerning the use of the generic curves within the HEC-FDA model can be addressed to Dr. David Moser, Institute of Water Resources (IWR), (703) 428-8066.

5. Report. A report summarizing the data collection effort and analyses performed to derive these curves will shortly be available on the IWR website. More information may be obtained by contacting the program’s principal investigator, Stuart Davis, (703) 428-7086.

6. Waiver to Policy. These curves are developed for nation-wide applicability in flood damage reduction studies. When using these curves, the requirement to develop site-specific depth-damage curves contained in ER 1105-2-100, E-19q.(2) is waived. Additionally, the requirement to develop content valuations and content-to-structure ratios based on site-specific or comparable floodplain information, ER 1005-2-100, E-19q.(1)(a), is also waived. Note these waivers currently apply only to single-family homes with and without basements for which generic curves have been published, and not other categories of flood inundation damages for which no generic curves exist. Feasibility reports must state the generic curves are being used in the flood damage analysis for residential structures with and/or without basements. Use of these curves is optional and analysts should always endeavor to use the best available information to accurately quantify the damages and benefits in inundation reduction studies.

CECW-PG

SUBJECT: Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships

7. Point of Contact. Administrators of the Flood Damage Data Collection Program continue to collect and analyze flood-related damages to both residential and commercial properties. The HQUSACE program monitor is Lillian Almodovar, (202) 761-4233, who can address any questions concerning the program.

FOR THE COMMANDER:

Encl

/s/
WILLIAM R. DAWSON, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

CECW-PG

SUBJECT: Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships

DISTRIBUTION:

North Atlantic Division, ATTN: CENAD-ET-P

South Atlantic Division, ATTN: CESAD-ET-P

Great Lakes/Ohio River Division: ATTN: CELRD-E-P

Northwestern Division, ATTN: CENWD-PNP-ET-P

Pacific Ocean Division, ATTN: CEPOD-ET-E

South Pacific Division, ATTN: CESPDP-ET-P

Southwestern Division, ATTN: CESWD-ET-P

Mississippi Valley Division: ATTN: CEMVD-PM

**DAMAGE FUNCTIONS
FOR SINGLE FAMILY RESIDENTIAL
STRUCTURES WITH BASEMENTS**

Structure Depth-Damage

Table 1 Structure One Story, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	0.7%	1.34
-6	0.8%	1.06
-5	2.4%	0.94
-4	5.2%	0.91
-3	9.0%	0.88
-2	13.8%	0.85
-1	19.4%	0.83
0	25.5%	0.85
1	32.0%	0.96
2	38.7%	1.14
3	45.5%	1.37
4	52.2%	1.63
5	58.6%	1.89
6	64.5%	2.14
7	69.8%	2.35
8	74.2%	2.52
9	77.7%	2.66
10	80.1%	2.77
11	81.1%	2.88
12	81.1%	2.88
13	81.1%	2.88
14	81.1%	2.88
15	81.1%	2.88
16	81.1%	2.88

**Table 2
Structure
Two or More Stories, With Basement**

Depth	Mean of Damage	Standard Deviation of Damage
-8	1.7%	2.70
-7	1.7%	2.70
-6	1.9%	2.11
-5	2.9%	1.80
-4	4.7%	1.66
-3	7.2%	1.56
-2	10.2%	1.47
-1	13.9%	1.37
0	17.9%	1.32
1	22.3%	1.35
2	27.0%	1.50
3	31.9%	1.75
4	36.9%	2.04
5	41.9%	2.34
6	46.9%	2.63
7	51.8%	2.89
8	56.4%	3.13
9	60.8%	3.38
10	64.8%	3.71
11	68.4%	4.22
12	71.4%	5.02
13	73.7%	6.19
14	75.4%	7.79
15	76.4%	9.84
16	76.4%	12.36

Table 3
Structure
Split Level, With Basement

Depth	Mean of Damage	Standard Deviation of Damage
-8		
-7		
-6	2.5%	1.8%
-5	3.1%	1.6%
-4	4.7%	1.5%
-3	7.2%	1.6%
-2	10.4%	1.6%
-1	14.2%	1.6%
0	18.5%	1.6%
1	23.2%	1.7%
2	28.2%	1.9%
3	33.4%	2.1%
4	38.6%	2.4%
5	43.8%	2.6%
6	48.8%	2.9%
7	53.5%	3.2%
8	57.8%	3.4%
9	61.6%	3.6%
10	64.8%	3.9%
11	67.2%	4.2%
12	68.8%	4.8%
13	69.3%	5.7%
14	69.3%	5.7%
15	69.3%	5.7%
16	69.3%	5.7%

Content Depth-Damage

**Table 4
Content
One Story, With Basement**

Depth	Mean of Damage	Standard Deviation of Damage
-8	0.1%	1.60
-7	0.8%	1.16
-6	2.1%	0.92
-5	3.7%	0.81
-4	5.7%	0.78
-3	8.0%	0.76
-2	10.5%	0.74
-1	13.2%	0.72
0	16.0%	0.74
1	18.9%	0.83
2	21.8%	0.98
3	24.7%	1.17
4	27.4%	1.39
5	30.0%	1.60
6	32.4%	1.81
7	34.5%	1.99
8	36.3%	2.13
9	37.7%	2.25
10	38.6%	2.35
11	39.1%	2.45
12	39.1%	2.45
13	39.1%	2.45
14	39.1%	2.45
15	39.1%	2.45
16	39.1%	2.45

Table 5
Content
Two or More Stories-With Basement

Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	1.0%	2.27
-6	2.3%	1.76
-5	3.7%	1.49
-4	5.2%	1.37
-3	6.8%	1.29
-2	8.4%	1.21
-1	10.1%	1.13
0	11.9%	1.09
1	13.8%	1.11
2	15.7%	1.23
3	17.7%	1.43
4	19.8%	1.67
5	22.0%	1.92
6	24.3%	2.15
7	26.7%	2.36
8	29.1%	2.56
9	31.7%	2.76
10	34.4%	3.04
11	37.2%	3.46
12	40.0%	4.12
13	43.0%	5.08
14	46.1%	6.39
15	49.3%	8.08
16	52.6%	10.15

Table 6
Content
Split-Level-With Basement

Depth	Mean of Damage	Standard Deviation of Damage
-8	0.6%	2.09
-7	0.7%	1.49
-6	1.4%	1.14
-5	2.4%	1.01
-4	3.8%	1.00
-3	5.4%	1.02
-2	7.3%	1.03
-1	9.4%	1.04
0	11.6%	1.06
1	13.8%	1.12
2	16.1%	1.23
3	18.2%	1.38
4	20.2%	1.57
5	22.1%	1.76
6	23.6%	1.95
7	24.9%	2.13
8	25.8%	2.28
9	26.3%	2.44
10	26.3%	2.44
11	26.3%	2.44
12	26.3%	2.44
13	26.3%	2.44
14	26.3%	2.44
15	26.3%	2.44
16	26.3%	2.44

**ENCLOSURE
DAMAGE FUNCTIONS
FOR SINGLE FAMILY RESIDENTIAL**

STRUCTURES WITHOUT BASEMENTS

Structure One Story, No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	2.5%	2.7%
0	13.4%	2.0%
1	23.3%	1.6%
2	32.1%	1.6%
3	40.1%	1.8%
4	47.1%	1.9%
5	53.2%	2.0%
6	58.6%	2.1%
7	63.2%	2.2%
8	67.2%	2.3%
9	70.5%	2.4%
10	73.2%	2.7%
11	75.4%	3.0%
12	77.2%	3.3%
13	78.5%	3.7%
14	79.5%	4.1%
15	80.2%	4.5%
16	80.7%	4.9%

Structure Two or More Stories-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	3.0%	4.1%
0	9.3%	3.4%
1	15.2%	3.0%
2	20.9%	2.8%
3	26.3%	2.9%
4	31.4%	3.2%
5	36.2%	3.4%
6	40.7%	3.7%
7	44.9%	3.9%
8	48.8%	4.0%
9	52.4%	4.1%
10	55.7%	4.2%
11	58.7%	4.2%
12	61.4%	4.2%
13	63.8%	4.2%
14	65.9%	4.3%
15	67.7%	4.6%
16	69.2%	5.0%

Structure Split-Level-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	6.4%	2.9%
0	7.2%	2.1%
1	9.4%	1.9%
2	12.9%	1.9%
3	17.4%	2.0%
4	22.8%	2.2%
5	28.9%	2.4%
6	35.5%	2.7%
7	42.3%	3.2%
8	49.2%	3.8%
9	56.1%	4.5%
10	62.6%	5.3%
11	68.6%	6.0%
12	73.9%	6.7%
13	78.4%	7.4%
14	81.7%	7.9%
15	83.8%	8.3%
16	84.4%	8.7%

Content One Story, No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	2.4%	2.1%
0	8.1%	1.5%
1	13.3%	1.2%
2	17.9%	1.2%
3	22.0%	1.4%
4	25.7%	1.5%
5	28.8%	1.6%
6	31.5%	1.6%
7	33.8%	1.7%
8	35.7%	1.8%
9	37.2%	1.9%
10	38.4%	2.1%
11	39.2%	2.3%
12	39.7%	2.6%
13	40.0%	2.9%
14	40.0%	3.2%
15	40.0%	3.5%
16	40.0%	3.8%

Content		
Two or More Stories-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	1.0%	3.5%
0	5.0%	2.9%
1	8.7%	2.6%
2	12.2%	2.5%
3	15.5%	2.5%
4	18.5%	2.7%
5	21.3%	3.0%
6	23.9%	3.2%
7	26.3%	3.3%
8	28.4%	3.4%
9	30.3%	3.5%
10	32.0%	3.5%
11	33.4%	3.5%
12	34.7%	3.5%
13	35.6%	3.5%
14	36.4%	3.6%
15	36.9%	3.8%
16	37.2%	4.2%

Content Split-Level-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	2.2%	2.2%
0	2.9%	1.5%
1	4.7%	1.2%
2	7.5%	1.3%
3	11.1%	1.4%
4	15.3%	1.5%
5	20.1%	1.6%
6	25.2%	1.8%
7	30.5%	2.1%
8	35.7%	2.5%
9	40.9%	3.0%
10	45.8%	3.5%
11	50.2%	4.1%
12	54.1%	4.6%
13	57.2%	5.0%
14	59.4%	5.4%
15	60.5%	5.7%
16	60.5%	6.0%

Los Angeles County
Repetitive Loss Area Analysis

APPENDIX B.
PUBLIC OUTREACH MATERIALS

APPENDIX B. PUBLIC OUTREACH MATERIALS

SUMMARY OF SURVEY RESULTS

About the Survey

The Los Angeles County Department of Public Works developed and disseminated a 33-question online survey to assist with the incorporation of public outreach in its 2015 Comprehensive Floodplain Management Plan. The survey was available through a link on the County website. In addition to multiple choice questions, Los Angeles County residents were offered the opportunity to provide additional information and detail through several open response sections, the majority of which were associated with a closed response question to ensure as much detail as possible. The survey, completed by 136 County residents, sought to determine public awareness and perception on several flood-related issues, including:

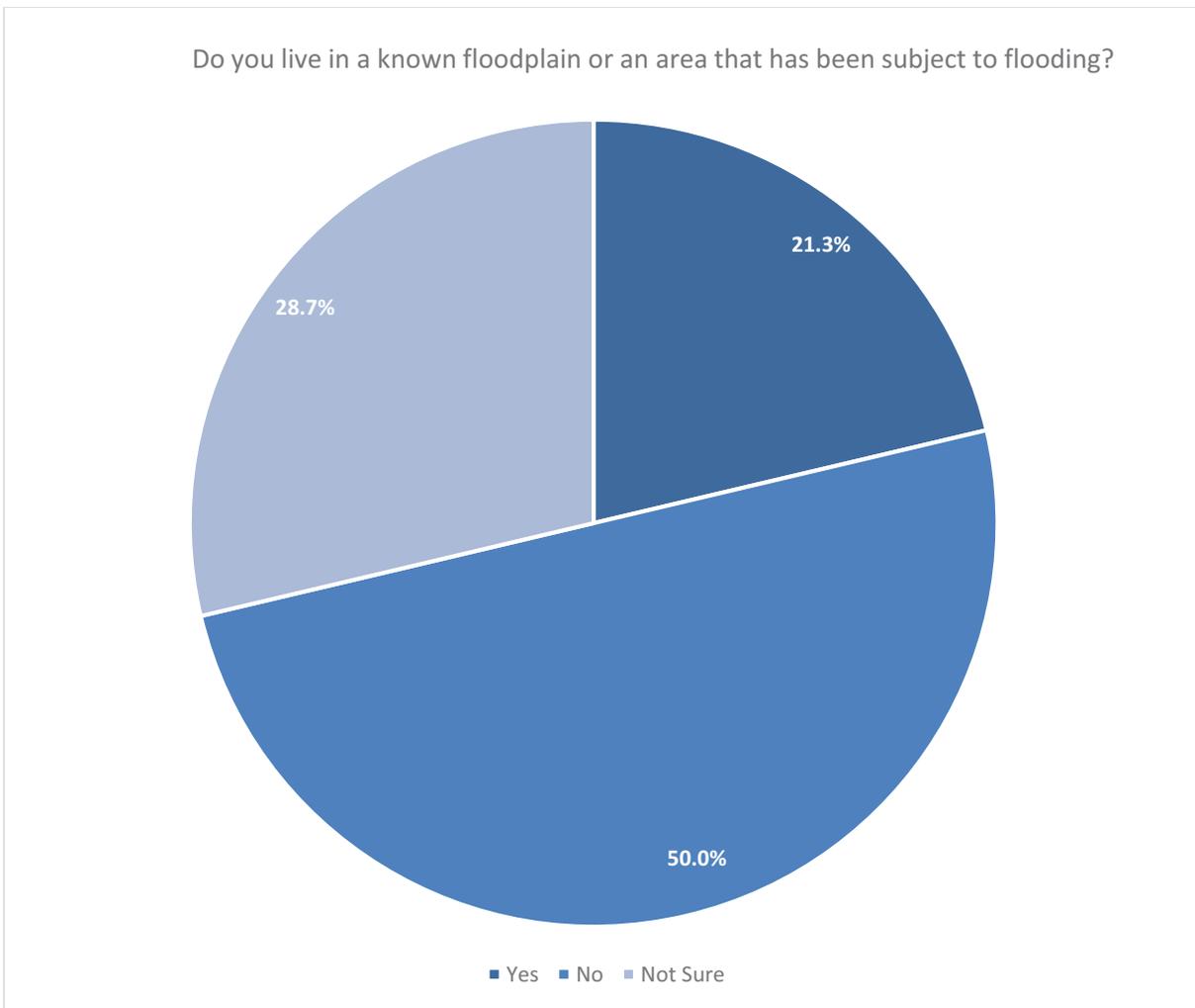
- Flood Hazards
- Flood Preparedness and Education
- Flood Control and Risk Reduction Measures

About the Survey Respondents

As noted above, 136 residents provided information via the survey to enhance the 2015 Comprehensive Floodplain Management Plan. All respondents were over the age of 18, and the number of responses per age group divided into a fairly even distribution (Question 27). While the majority of respondents were male (64.1 percent), women still provided a sizeable contribution of responses (Question 28). The majority of respondents had at least some college experience, if not a degree or graduate degree (combined total of 97.2 percent) (Question 29). Nine of the respondents also identified themselves as having a special access or functional need, alerting the County to their need for early warning or specialized response during a disaster event (Question 26).

The survey respondents were from a wide geographical range, representing 64 different ZIP codes (Question 2). Additionally, the majority of respondents were homeowners (80.9 percent) and not renters (Question 4). In Question 30, residents noted how long they had lived at their current property, with the largest response at 1 to 5 years (36.2 percent), followed by more than 20 years (21.9 percent), and then 11 to 20 years (18.1 percent). Of the respondents who definitely live in the floodplain, 25 percent indicated that the presence of a flood hazard was not disclosed to them prior to the purchase of their home (Question 18). Over 20 percent of respondents believe they live in a known floodplain or area subject to flooding, per Question 3. Of all respondents whose addresses could be geo-located for confirmation, 10.8 percent live in a known floodplain. Therefore, 65.5 percent of respondents who responded “yes” were unable to be confirmed as mapped floodplain residents.

The high percentage of residents who stated that they live in flood prone areas suggests several possibilities – (1) residents may be vulnerable to stormwater-flooding or flood-related hazards which can occur outside the floodplain, (2) current mapped floodplain boundaries may not accurately reflect changes in development or land use, or (3) residents would benefit from a public education and outreach program on flood zones and floodplains.



In the same question, respondents also provided feedback on areas that have experienced flooding, as well as different flood problems. While most flood instances were relatively minor (dirt and mud on roads after hard rains, minimal roadway easement runoff) or due to older infrastructure, including storm drains with insufficient capacity, some residents listed more severe problems. One person was not able to get home from their job in Burbank for over a week when Avenues J to T flooded from El Nino rains. Another shared that there is no flood control structure for a mile above their home in Altadena, resulting in their home routinely flooding.

Several residents also used the open response areas in the survey to request an evaluation of whether their home is located in the floodplain. Comments have indicated that, either due to a higher elevation or lack of flooding during their time of residency, their homes may not have the appropriate flood risk applied.

Perception of Flood Hazards

Question 12 asked respondents to rank how concerned they are about flood-related hazards in Los Angeles County, including hazards such as climate change impacts, tsunami, groundwater flooding, coastal flooding, river/channel migration, stream bank erosion, coastal erosion, urban flooding/drainage issues, land subsidence, and mudflow hazards.

Residents identified urban flooding/drainage issues as the hazard that they were most concerned, very concerned, or extremely concerned about (with 40.4 percent of residents indicating one of those levels). Climate change impacts were the second highest concern (with 35.6 percent concerned or higher), and mudflow hazards were the third highest concern (with 33.9 percent concerned or higher). Climate change and mudflow hazards were also selected as the two hazards where the most respondents indicated extremely concerned (5.8 percent and 4.1 percent, respectively, compared to other concern levels). Some respondents also identified other flood-related hazards, including heavy rains, earthquakes, the California aqueduct failure, and burn areas flooding after severe storms. California aqueduct failure was listed by two respondents, while the other hazards were only listed once.

Flood Preparedness and Education

Survey respondents were also asked a series of questions to gauge their level of preparedness and how they would like to receive preparedness/outreach information. When asked how prepared their household was in Question 9, 40.6 percent indicated feeling somewhat prepared. Only 10.4 percent felt either well prepared or very well prepared. In Question 24, where residents were asked to indicate how they felt about the statement, “Information about the risks associated with flood hazards is readily available and easy to locate,” 41.4 percent disagreed or strongly disagreed. These responses suggest that a potential area for the County to strengthen their flood management program to be helping residents understand where they can go to learn more about flood hazards and risk. Since 48.6 percent of respondents strongly agree (along with 30.5 percent of respondents somewhat agreeing) that it is one’s personal responsibility to educate themselves about flood risks, such a program should be well-received by residents (Question 23).

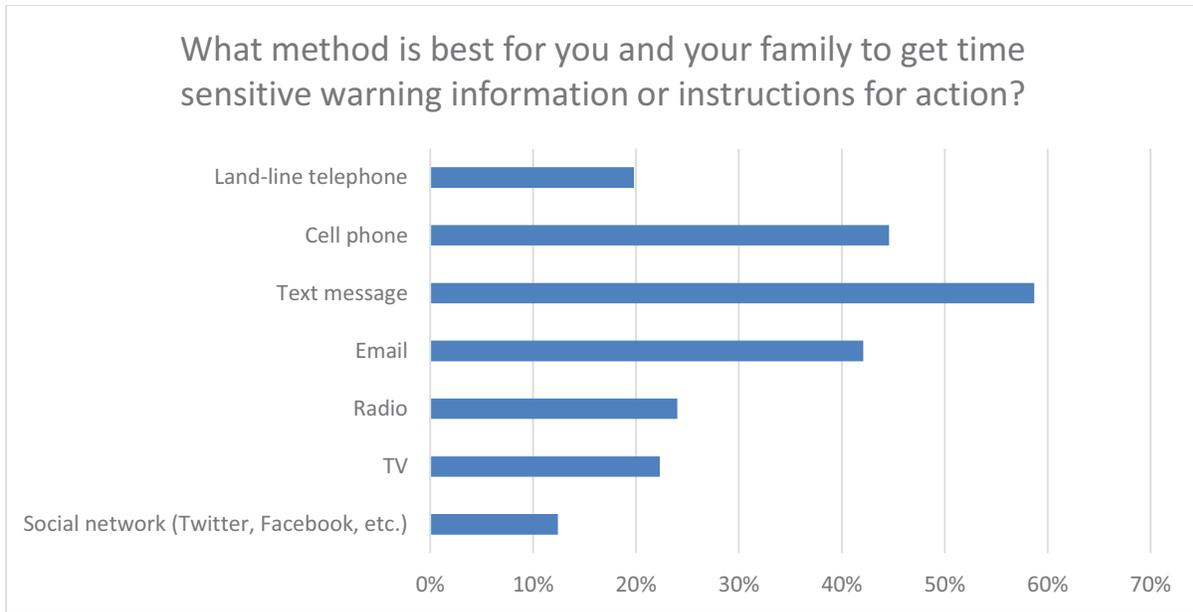
In Question 10, respondents checked all the sources that they believe to have provided them with useful information to prepare for a flood event. Federal, state, or local emergency management (45.6 percent) was the most frequent source. The other main sources of information included locally-provided news or media (29.8 percent) and personal experience (20.2 percent). Several respondents indicated work as an “other” source, and 25.4 percent did not use any information source.

Respondents additionally identified the top five methods they thought to be most effective in providing flood hazard information (Question 13), along with their preferred contact means for an emergency alert (Question 14). The top five flood information methods were:

- Internet (52.1 percent)
- TV News (47.9 percent)
- Radio News (43.8 percent)
- Public Awareness Campaign, e.g., Flood Awareness Week, Winter Storm Preparedness Month (32.2. percent)
- Social Media, e.g., Twitter, Facebook, etc. (32.2 percent)

Public Meetings, Local Government Newsletters, and the Newspaper also ranked at over 20 percent. The Chamber of Commerce and the Telephone Book were the lowest ranked, at 0.0 percent and 0.8 percent, respectively.

In regards to emergency alerts, respondents most preferred text messages (58.7 percent), cell phones (44.6 percent), and email (42.1 percent). Respondents also suggested amateur radio, US mail, and Community Emergency Response Team (CERT) networks as alternate contact methods beyond those listed by the County.

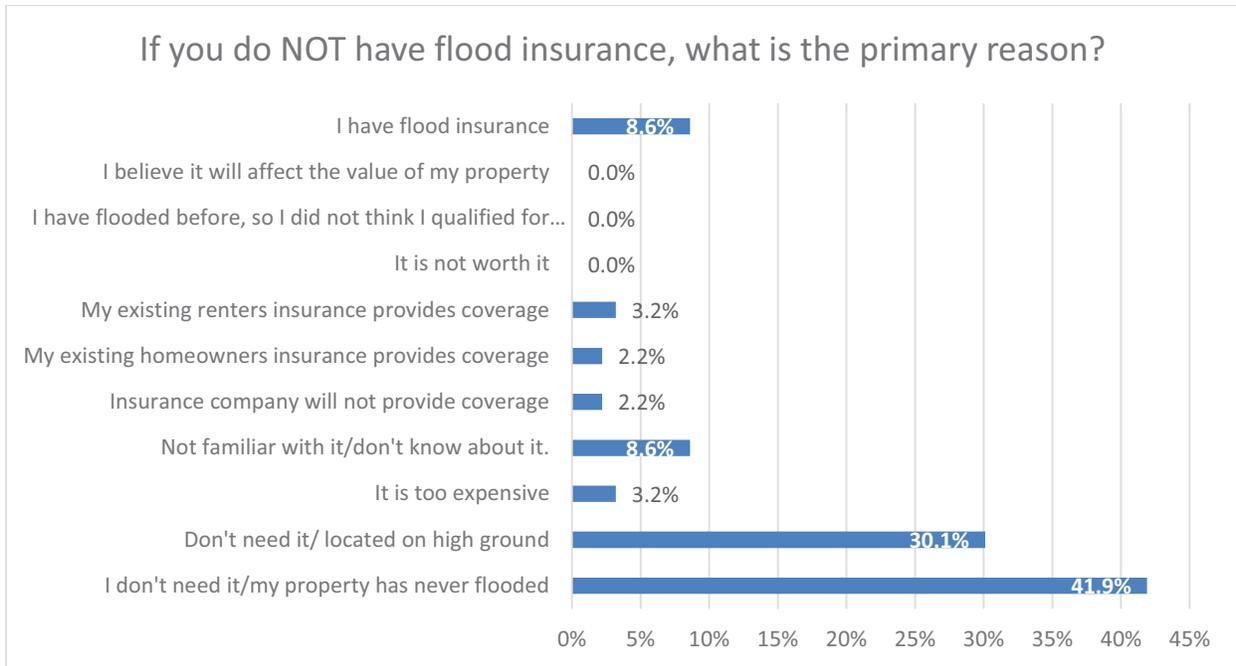


Flood Control and Risk Reduction Measures

Respondents had the opportunity to comment on different flood control and management measures, including both personal/residential activities and County-managed activities.

Flood Insurance

The National Flood Insurance Program (NFIP) is one of the more well-known flood risk management programs in place. Question 15 evaluated how many respondents have flood insurance, with 14.9 percent of respondents answering yes, 69.4 with no, and 15.7 percent as not sure. Most respondents that do not have flood insurance said that this is due to not needing it (property never having flooded) (41.9 percent) or not needing it (property located at high ground) (30.1 percent) (Question 16). Other reasons listed included an inability to afford more insurance, living on the 2nd floor, and not being sure how to tell whether homeowners insurance includes flood insurance. Some residents used the open response portion of this question to request clarification on their flood zone risk and whether they were required to have it, similar to in Question 3.



Government-Sponsored Programs

In Question 22, respondents indicated whether they believed that the government (local, state, and federal) has the responsibility to provide education and programs promoting citizen action to reduce exposure to risks associated with flood hazard. The response was positive, with 33.3 percent strongly agreeing and 37.1 percent somewhat agreeing. In Question 21, respondents ranked the types of government-sponsored projects they support in the following order:

- Retrofitting infrastructure (improving culverts, bridges, and local drainage)
- Capital projects (dams, levees, floodwalls, and drainage improvements)
- Providing better flood risk information to the public
- Strengthening codes and regulations to higher regulatory standards
- Acquiring vulnerable properties and maintaining them as open space
- Assisting vulnerable property owners with securing mitigation funding
- Other measures (including raising flood insurance rates for repetitive loss properties and updated flood maps)

At a personal level, most respondents were not sure (39.2 percent) how much they would be willing to spend to retrofit their homes against flood disasters (Question 6). Of those willing to invest in retrofitting their homes, 7.8 percent would spend \$10,000 or more, 4.9 percent would spend \$5,000 to \$9,999, 12.7 percent would spend \$1,000 to \$4,999, and 7.8 percent would spend less than \$1,000. The most popular incentive to retrofit, as identified in Question 7, was grant funding (62.4 percent), with low-interest rate home improvement loans (27.7 percent) and none (24.8 percent) scoring close together. Other suggested incentives included tax deductions, removal of flood insurance requirements, and budgeting for the entity that maintains a local flood channel.

SURVEY RESPONSES AND CHARTS

Question 1

What is your home address?		
Answer Options	Response Percent	Response Count
Street Address	99.0%	102
City	100.0%	103
	<i>answered question</i>	103
	<i>skipped question</i>	33

Question 2

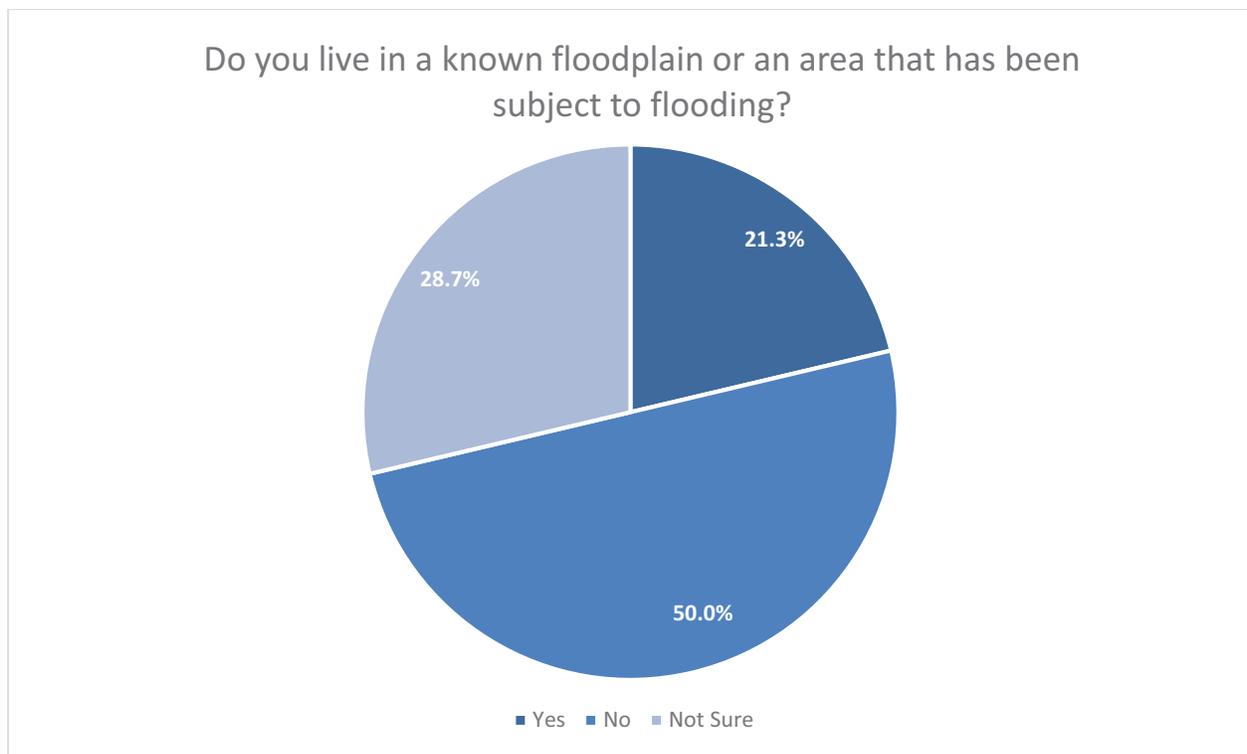
What is your zip code?			
Answer Options	Response Average	Response Total	Response Count
Zip Code	N/A	N/A	128
<i>answered question</i>			128
<i>skipped question</i>			8

ZIP Code	Number of Respondents	Percent of Total	ZIP Code	Number of Respondents	Percent of Total
90005	1	1.56%	91301	7	10.94%
90022	1	1.56%	91302	2	3.13%
90027	1	1.56%	91304	1	1.56%
90034	1	1.56%	91324	3	4.69%
90046	1	1.56%	91364	1	1.56%
90069	1	1.56%	91387	2	3.13%
90230	1	1.56%	91390	4	6.25%
90245	1	1.56%	91501	1	1.56%
90265	1	1.56%	91702	1	1.56%
90270	1	1.56%	91724	1	1.56%
90272	1	1.56%	91745	1	1.56%
90275	1	1.56%	91754	2	3.13%
90501	1	1.56%	91765	2	3.13%
90504	1	1.56%	91780	1	1.56%
90604	1	1.56%	91784	1	1.56%
90606	2	3.13%	91789	2	3.13%
90650	1	1.56%	91791	2	3.13%
90731	1	1.56%	91801	1	1.56%
90815	2	3.13%	91803	1	1.56%
90909	1	1.56%	92503	1	1.56%
91001	9	14.06%	92647	1	1.56%
91006	2	3.13%	93455	1	1.56%
91016	1	1.56%	93510	4	6.25%
91020	1	1.56%	93535	3	4.69%
91030	2	3.13%	93536	3	4.69%
91040	1	1.56%	93544	20	31.25%
91101	1	1.56%	93551	1	1.56%
91103	1	1.56%	93552	1	1.56%
91104	4	6.25%	93553	1	1.56%
91107	2	3.13%	93560	1	1.56%
91206	1	1.56%	93591	6	9.38%
91208	1	1.56%	93644	1	1.56%

Question 3

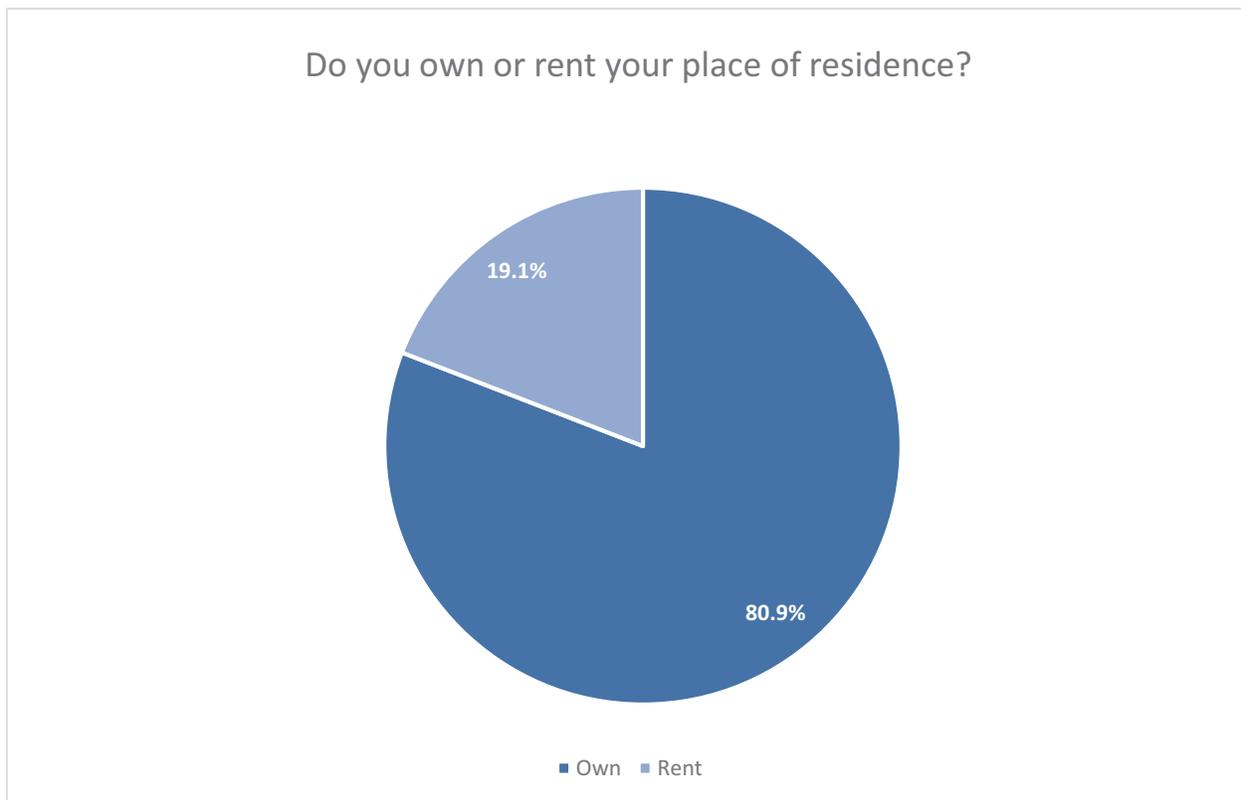
Do you live in a known floodplain or an area that has been subject to flooding?		
Answer Options	Response Percent	Response Count
Yes	21.3%	29
No	50.0%	68
Not Sure	28.7%	39
Please describe any experiences you have had with flooding at your current residence:		63
answered question		136
skipped question		0

Note: Responses above are based on respondents' personal knowledge and perception. In contrast, based on geo-located addresses, 10.8 percent of respondents live in a known floodplain. 34.5 percent of respondents who indicated "yes" correctly identified themselves as living in the floodplain. The other 65.5 percent were either incorrect, did not provide their addresses, live in addresses that could not be geo-located or live in areas that are not mapped floodplains. Only 1.5 percent of respondents who indicated "no" incorrectly identified themselves as not living in the floodplain. All respondents who selected "not sure" either do not live in the floodplain or had addresses that could not be geo-located for confirmation. 72 percent of respondents provided addresses that could be geo-located to confirm location in relation to the mapped floodplain.



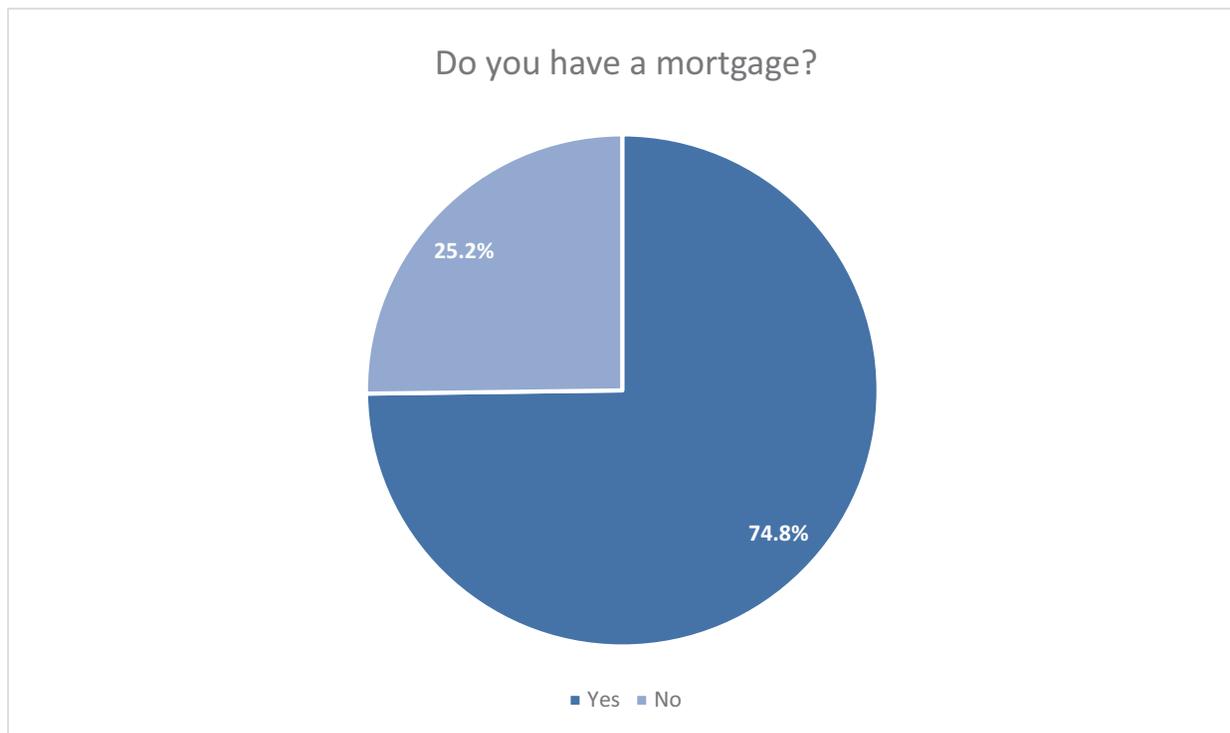
Question 4

Do you own or rent your place of residence?		
Answer Options	Response Percent	Response Count
Own	80.9%	110
Rent	19.1%	26
answered question		136
skipped question		0



Question 5

Do you have a mortgage?		
Answer Options	Response Percent	Response Count
Yes	74.8%	80
No	25.2%	27
answered question		107
skipped question		29

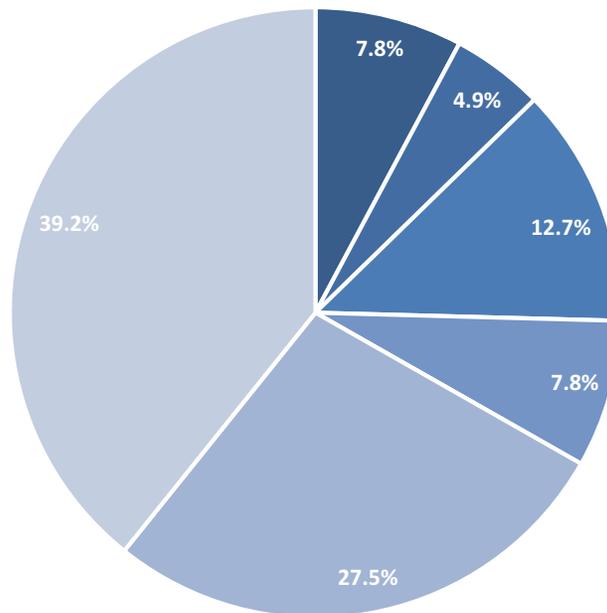


Question 6

How much money would you be willing to spend to retrofit your home to reduce risks associated with flood disasters? (e.g., elevating a home above flood level, flood-proofing, building berms or floodwalls)

Answer Options	Response Percent	Response Count
\$10,000 or above	7.8%	8
\$5,000 to \$9,999	4.9%	5
\$1,000 to \$4,999	12.7%	13
Less than \$1,000	7.8%	8
Nothing	27.5%	28
Not Sure	39.2%	40
answered question		102
skipped question		34

How much money would you be willing to spend to retrofit your home to reduce risks associated with flood disasters? (e.g., elevating a home above flood level, flood-proofing, building berms or floodwalls)

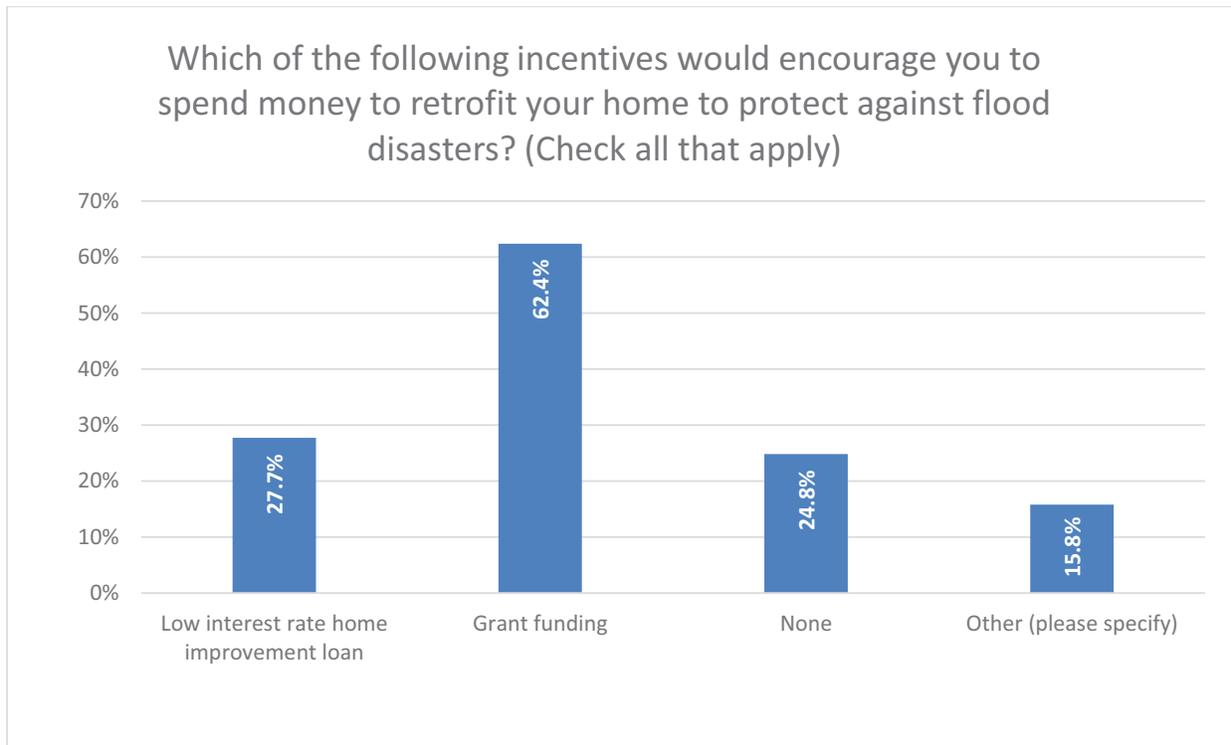


■ \$10,000 or above ■ \$5,000 to \$9,999 ■ \$1,000 to \$4,999 ■ Less than \$1,000 ■ Nothing ■ Not Sure

Question 7

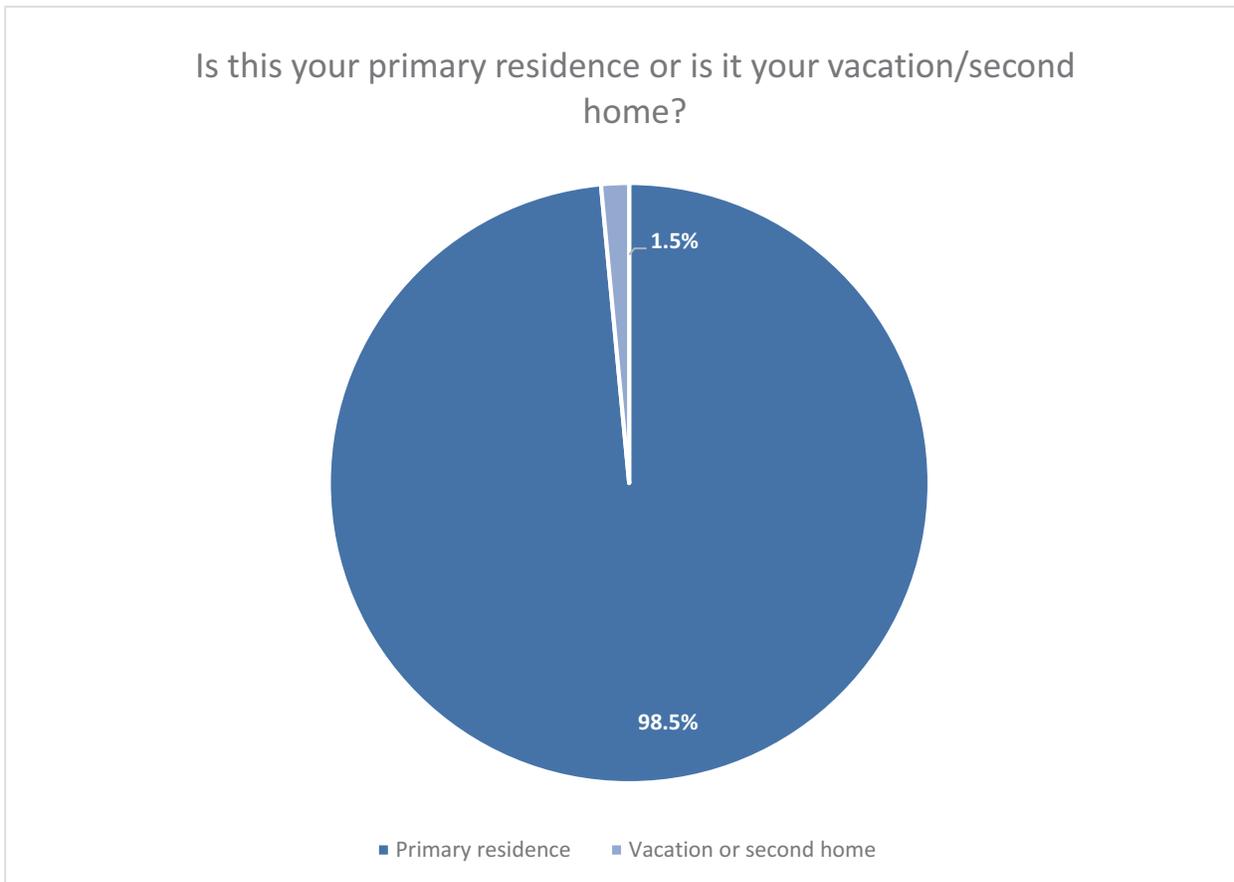
Which of the following incentives would encourage you to spend money to retrofit your home to protect against flood disasters? (Check all that apply)

Answer Options	Response Percent	Response Count
Low interest rate home improvement loan	27.7%	28
Grant funding	62.4%	63
None	24.8%	25
Other (please specify)	15.8%	16
answered question		101
skipped question		35



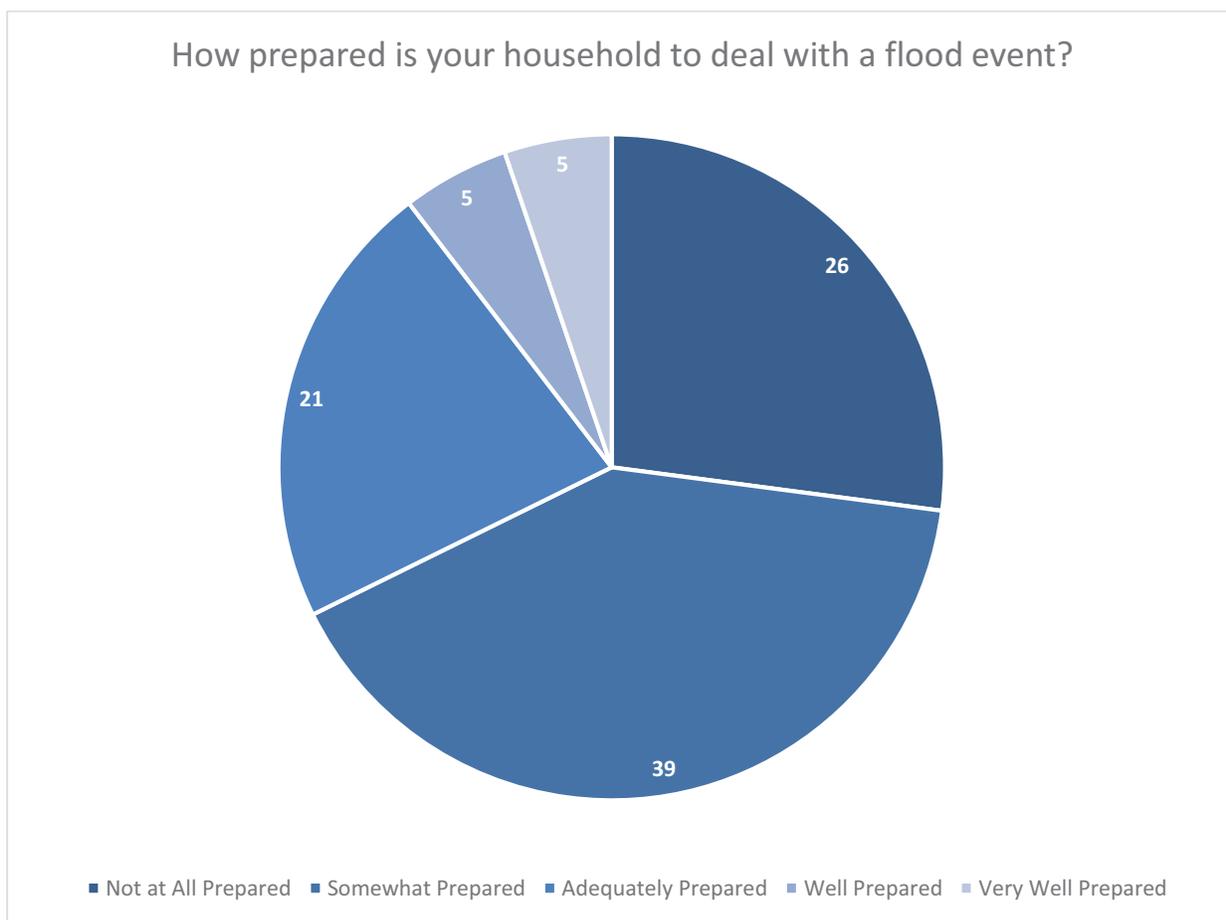
Question 8

Is this your primary residence or is it your vacation/second home?		
Answer Options	Response Percent	Response Count
Primary residence	98.5%	131
Vacation or second home	1.5%	2
answered question		133
skipped question		3



Question 9

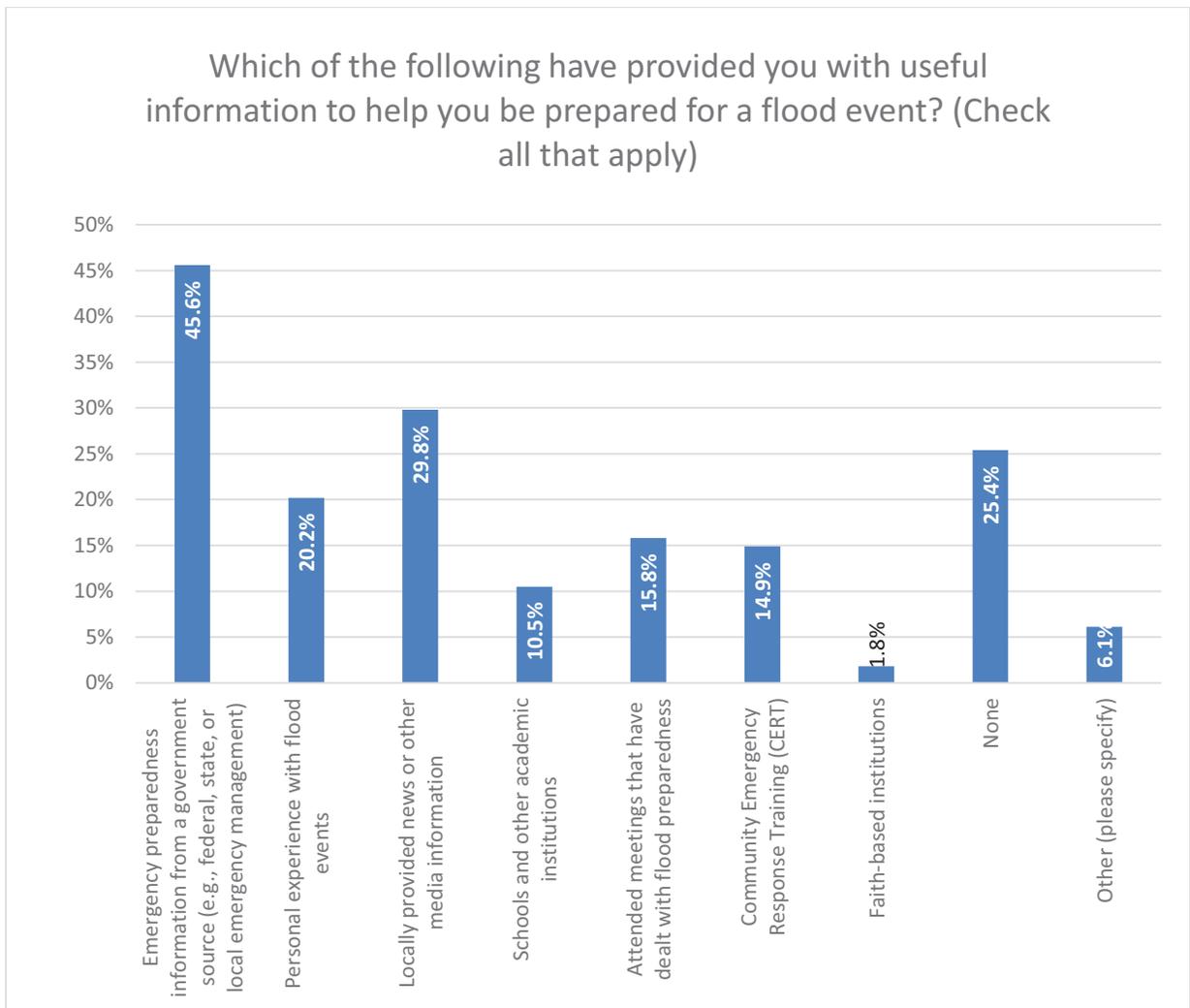
How prepared is your household to deal with a flood event?							
Answer Options	Not at All Prepared	Somewhat Prepared	Adequately Prepared	Well Prepared	Very Well Prepared	Rating Average	Response Count
Check one (Count):	26	39	21	5	5	2.21	96
Percent:	27%	41%	22%	5%	5%		
answered question							96
skipped question							40



Question 10

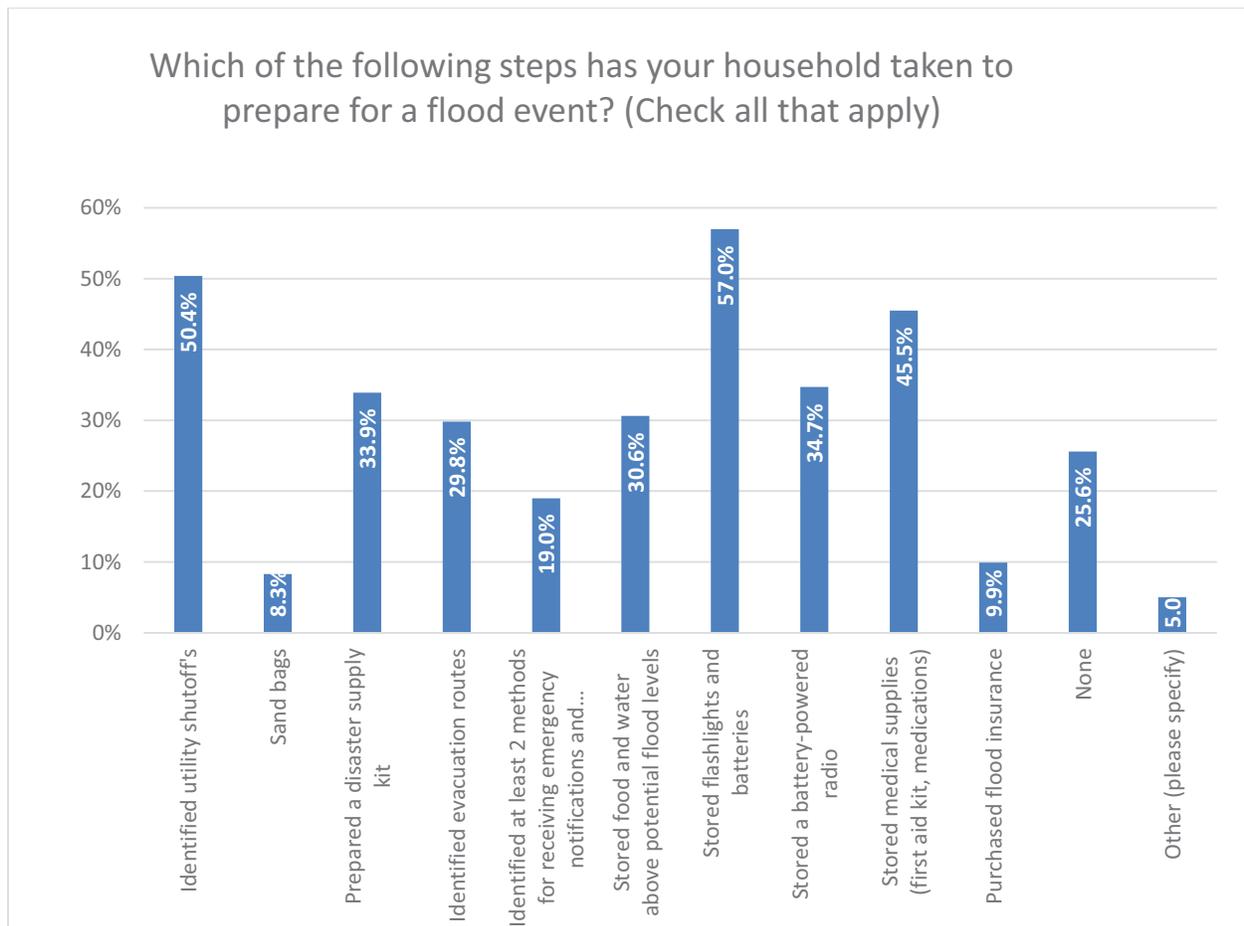
Which of the following have provided you with useful information to help you be prepared for a flood event? (Check all that apply)

Answer Options	Response Percent	Response Count
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	45.6%	52
Personal experience with flood events	20.2%	23
Locally provided news or other media information	29.8%	34
Schools and other academic institutions	10.5%	12
Attended meetings that have dealt with flood preparedness	15.8%	18
Community Emergency Response Training (CERT)	14.9%	17
Faith-based institutions	1.8%	2
None	25.4%	29
Other (please specify)	6.1%	7
answered question		114
skipped question		22



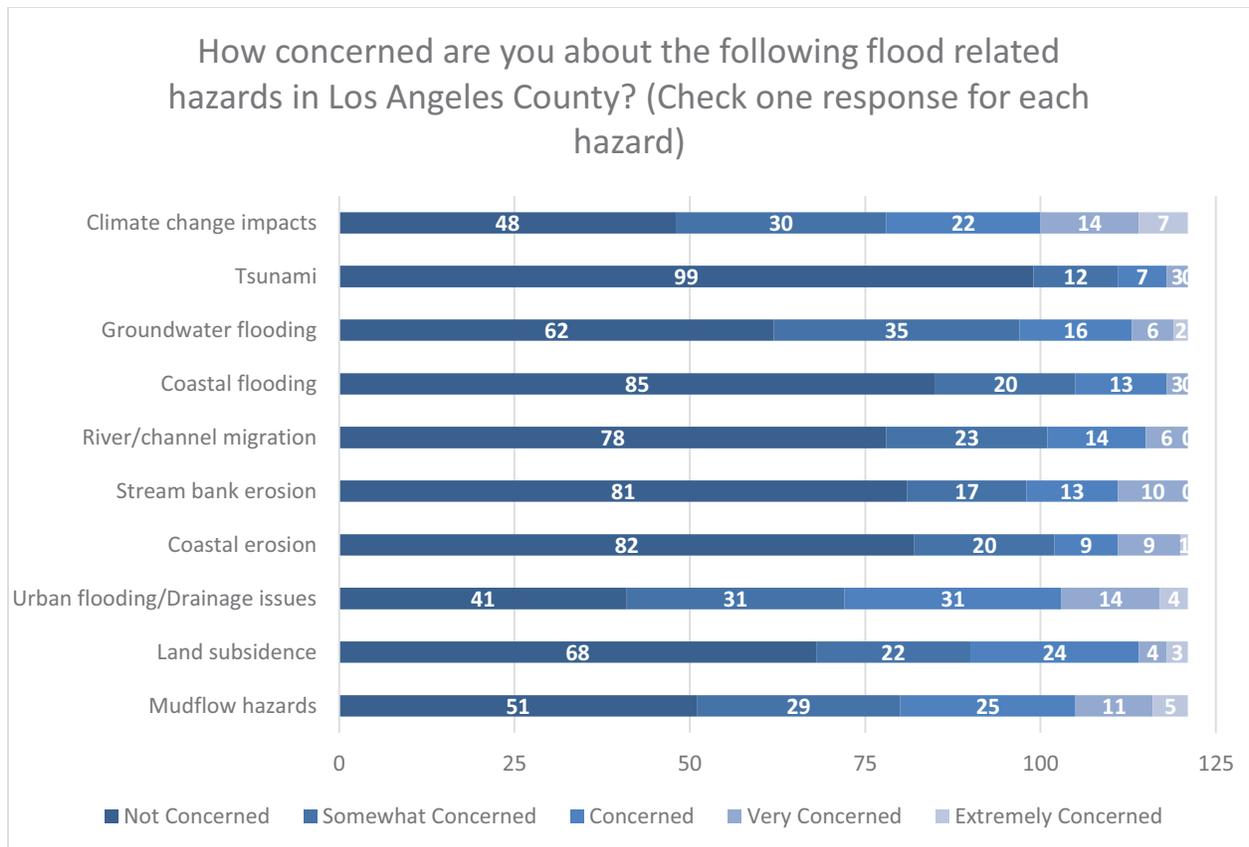
Question 11

Which of the following steps has your household taken to prepare for a flood event? (Check all that apply)		
Answer Options	Response Percent	Response Count
Identified utility shutoff's	50.4%	61
Sand bags	8.3%	10
Prepared a disaster supply kit	33.9%	41
Identified evacuation routes	29.8%	36
Identified at least 2 methods for receiving emergency notifications and information during emergencies	19.0%	23
Stored food and water above potential flood levels	30.6%	37
Stored flashlights and batteries	57.0%	69
Stored a battery-powered radio	34.7%	42
Stored medical supplies (first aid kit, medications)	45.5%	55
Purchased flood insurance	9.9%	12
None	25.6%	31
Other (please specify)	5.0%	6
answered question		121
skipped question		15



Question 12

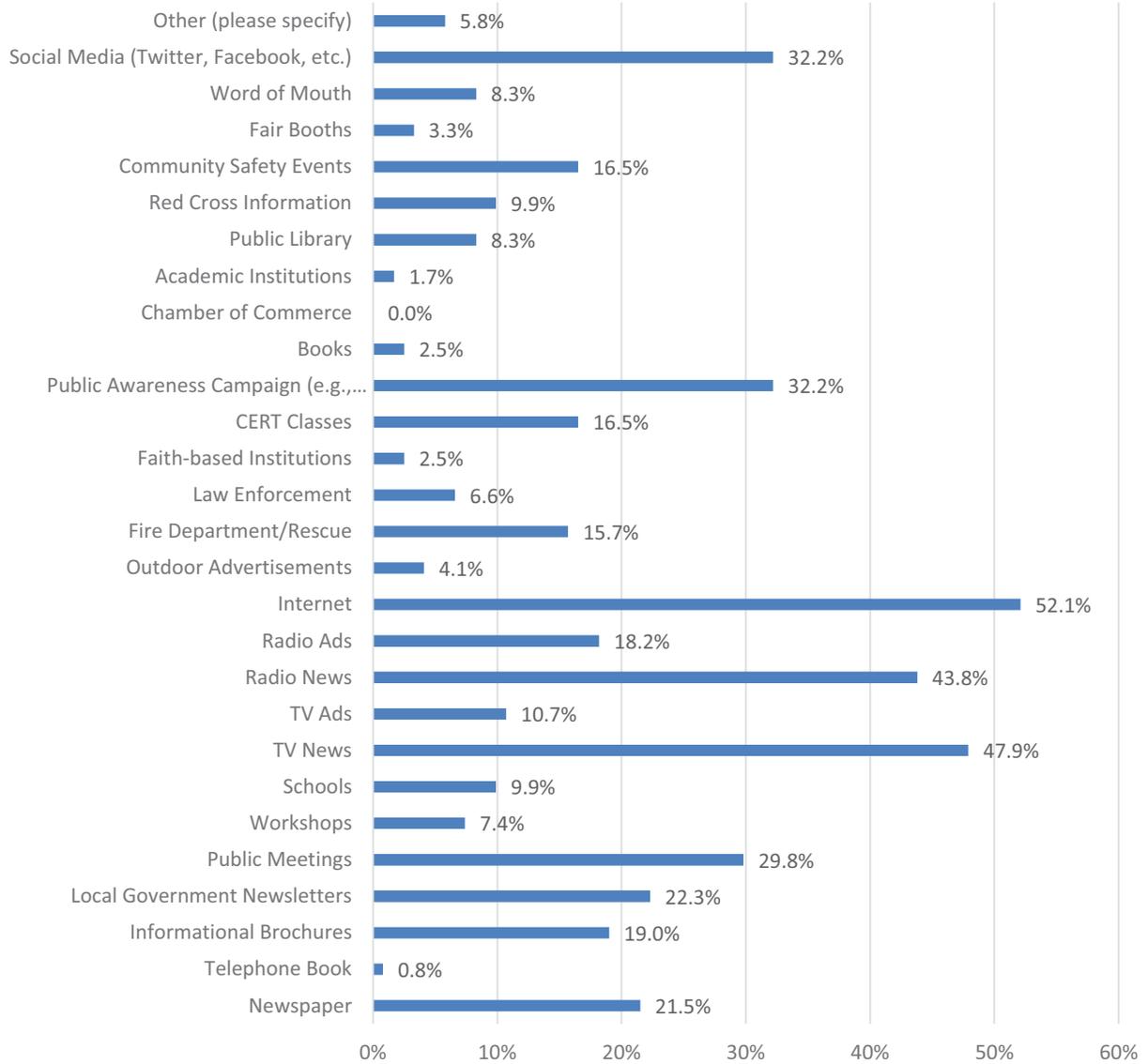
How concerned are you about the following flood related hazards in Los Angeles County? (Check one response for each hazard)							
Answer Options	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	Rating Average	Response Count
Climate change impacts	48	30	22	14	7	2.19	121
Tsunami	99	12	7	3	0	1.29	121
Groundwater flooding	62	35	16	6	2	1.77	121
Coastal flooding	85	20	13	3	0	1.45	121
River/channel migration	78	23	14	6	0	1.57	121
Stream bank erosion	81	17	13	10	0	1.60	121
Coastal erosion	82	20	9	9	1	1.57	121
Urban flooding/Drainage issues	41	31	31	14	4	2.25	121
Land subsidence	68	22	24	4	3	1.78	121
Mudflow hazards	51	29	25	11	5	2.09	121
Other (Please specify other flood-related hazard and level of concern)							6
answered question							121
skipped question							15



Question 13

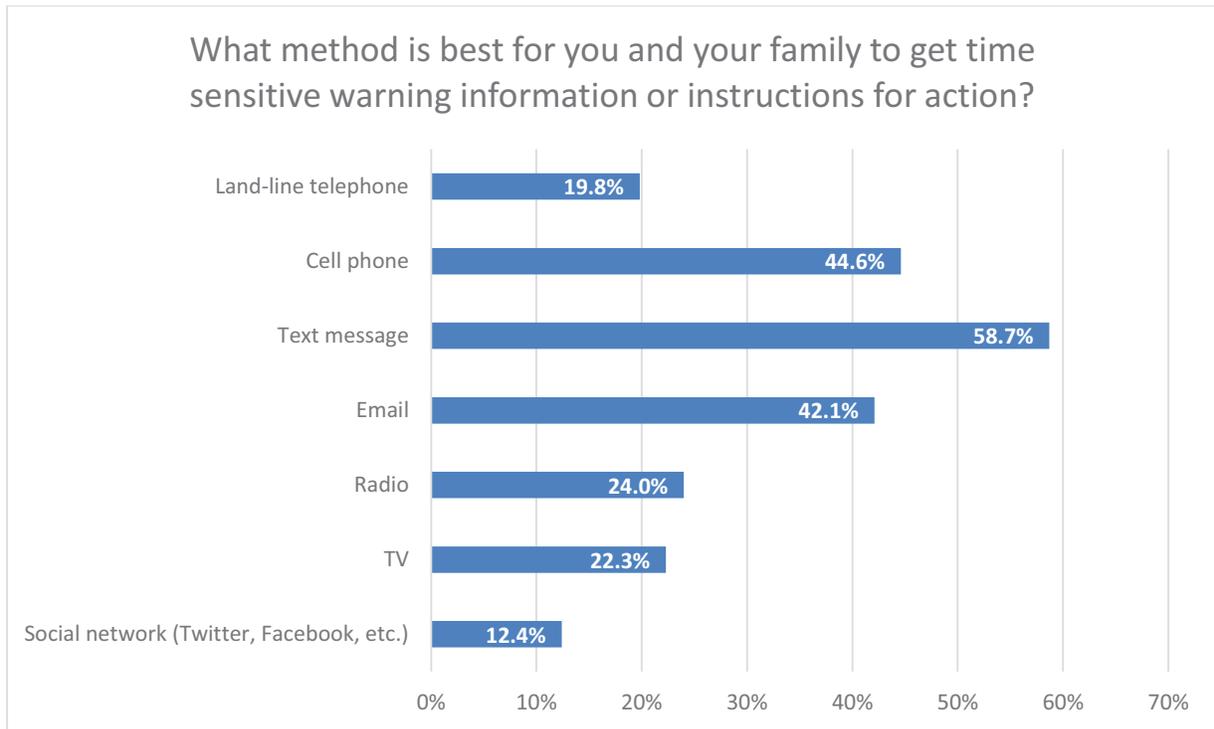
Choose five of the following methods you think are most effective for providing flood hazard and disaster information? (Choose up to 5 answers)		
Answer Options	Response Percent	Response Count
Newspaper	21.5%	26
Telephone Book	0.8%	1
Informational Brochures	19.0%	23
Local Government Newsletters	22.3%	27
Public Meetings	29.8%	36
Workshops	7.4%	9
Schools	9.9%	12
TV News	47.9%	58
TV Ads	10.7%	13
Radio News	43.8%	53
Radio Ads	18.2%	22
Internet	52.1%	63
Outdoor Advertisements	4.1%	5
Fire Department/Rescue	15.7%	19
Law Enforcement	6.6%	8
Faith-based Institutions	2.5%	3
CERT Classes	16.5%	20
Public Awareness Campaign (e.g., Flood Awareness Week, Winter Storm Preparedness Month)	32.2%	39
Books	2.5%	3
Chamber of Commerce	0.0%	0
Academic Institutions	1.7%	2
Public Library	8.3%	10
Red Cross Information	9.9%	12
Community Safety Events	16.5%	20
Fair Booths	3.3%	4
Word of Mouth	8.3%	10
Social Media (Twitter, Facebook, etc.)	32.2%	39
Other (please specify)	5.8%	7
	answered question	121
	skipped question	15

Choose five of the following methods you think are most effective for providing flood hazard and disaster information? (Choose up to 5 answers)



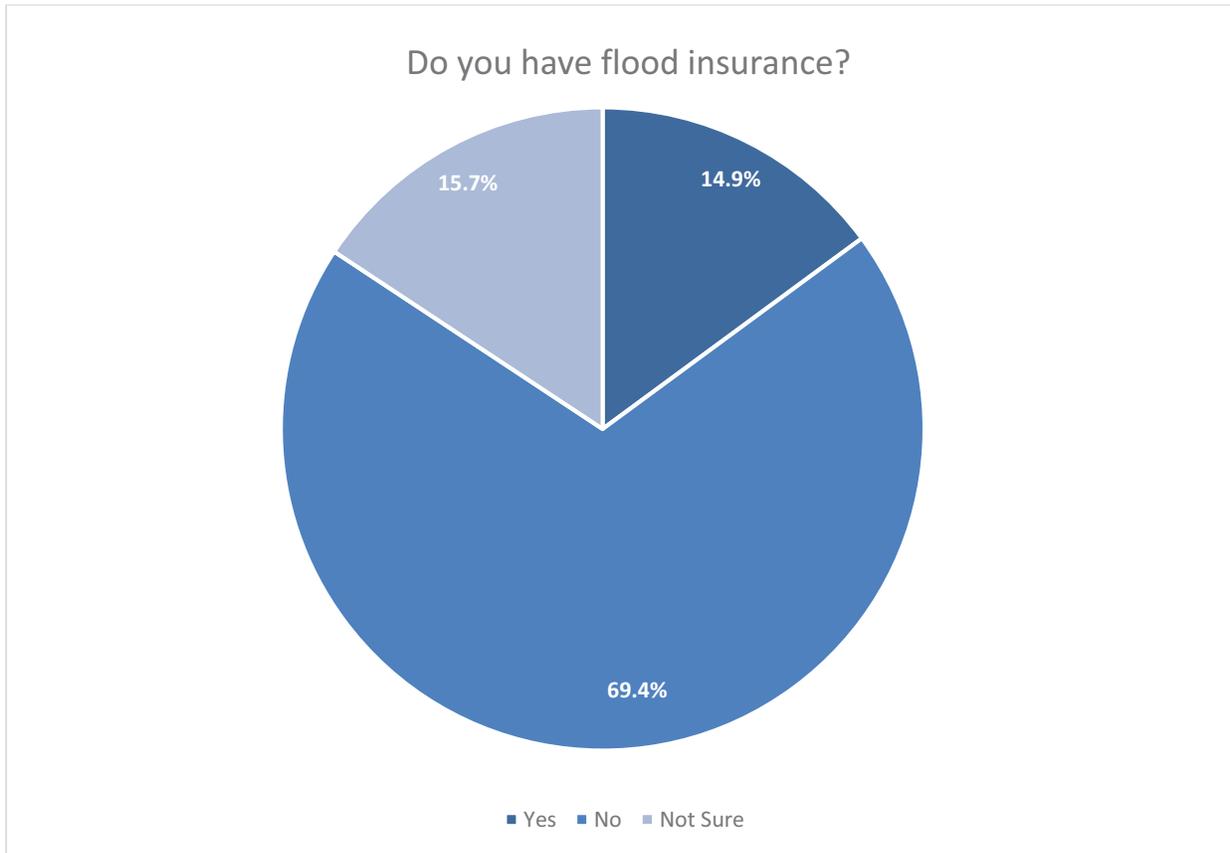
Question 14

What method is best for you and your family to get time sensitive warning information or instructions for action?		
Answer Options	Response Percent	Response Count
Land-line telephone	19.8%	24
Cell phone	44.6%	54
Text message	58.7%	71
Email	42.1%	51
Radio	24.0%	29
TV	22.3%	27
Social network (Twitter, Facebook, etc.)	12.4%	15
Other (please specify)		4
answered question		121
skipped question		15



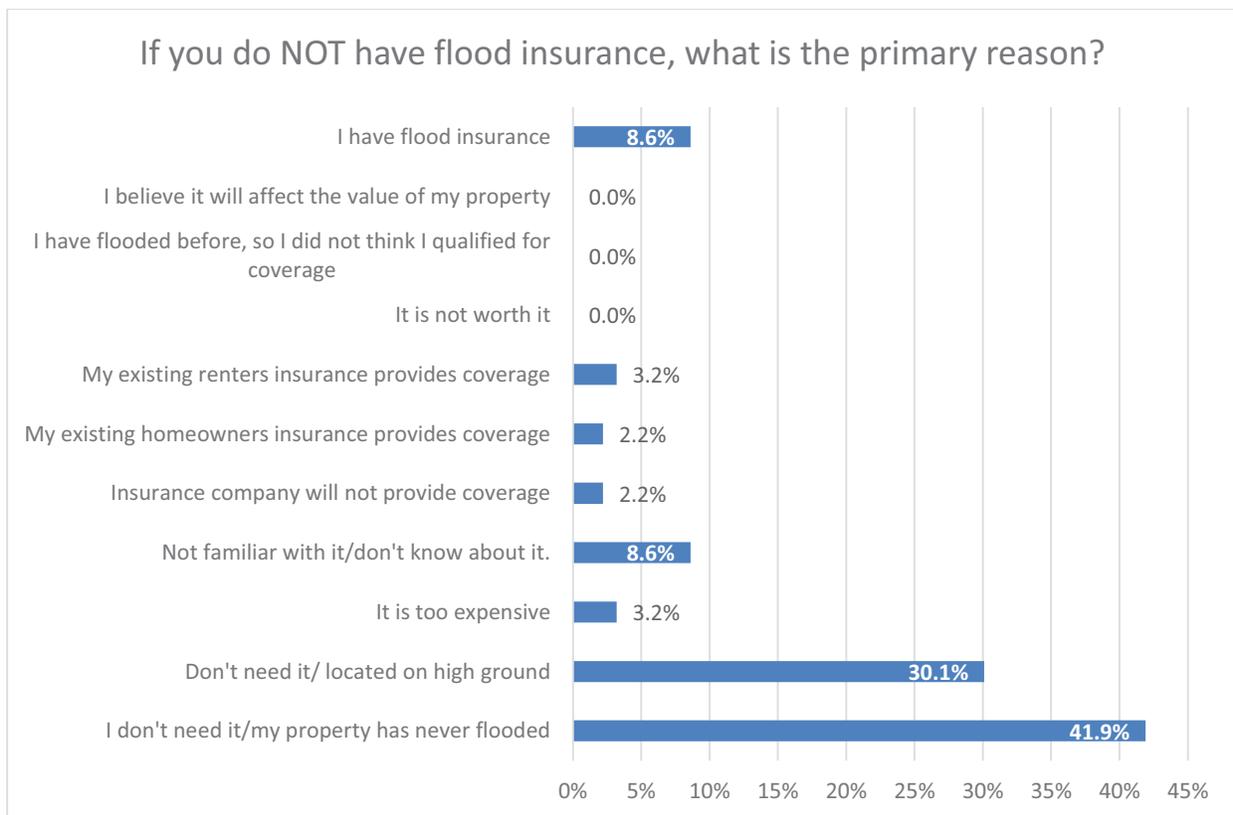
Question 15

Do you have flood insurance?		
Answer Options	Response Percent	Response Count
Yes	14.9%	18
No	69.4%	84
Not Sure	15.7%	19
answered question		121
skipped question		15



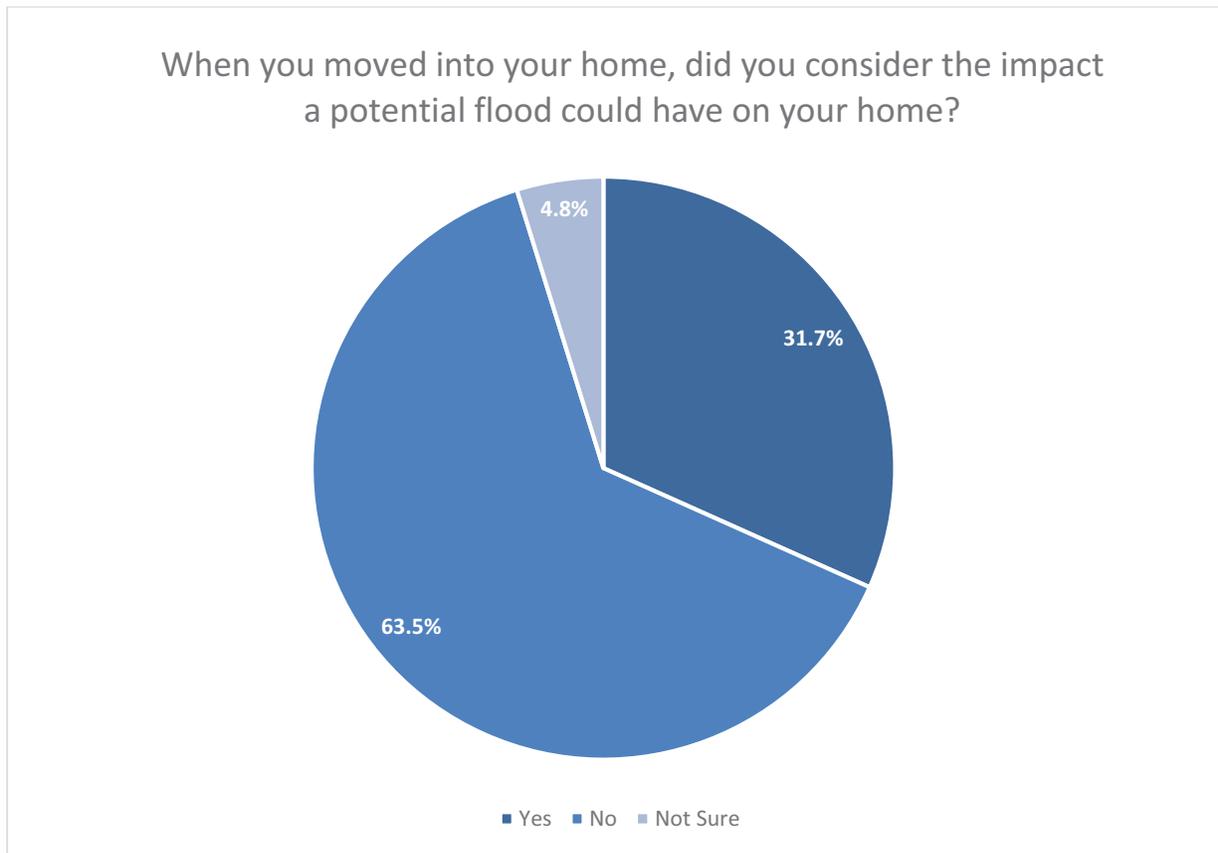
Question 16

If you do NOT have flood insurance, what is the primary reason?		
Answer Options	Response Percent	Response Count
I don't need it/my property has never flooded	41.9%	39
Don't need it/ located on high ground	30.1%	28
It is too expensive	3.2%	3
Not familiar with it/don't know about it.	8.6%	8
Insurance company will not provide coverage	2.2%	2
My existing homeowners insurance provides coverage	2.2%	2
My existing renters insurance provides coverage	3.2%	3
It is not worth it	0.0%	0
I have flooded before, so I did not think I qualified for coverage	0.0%	0
I believe it will affect the value of my property	0.0%	0
I have flood insurance	8.6%	8
Other (please specify)		7
answered question		93
skipped question		43



Question 17

When you moved into your home, did you consider the impact a potential flood could have on your home?		
Answer Options	Response Percent	Response Count
Yes	31.7%	33
No	63.5%	66
Not Sure	4.8%	5
answered question		104
skipped question		32

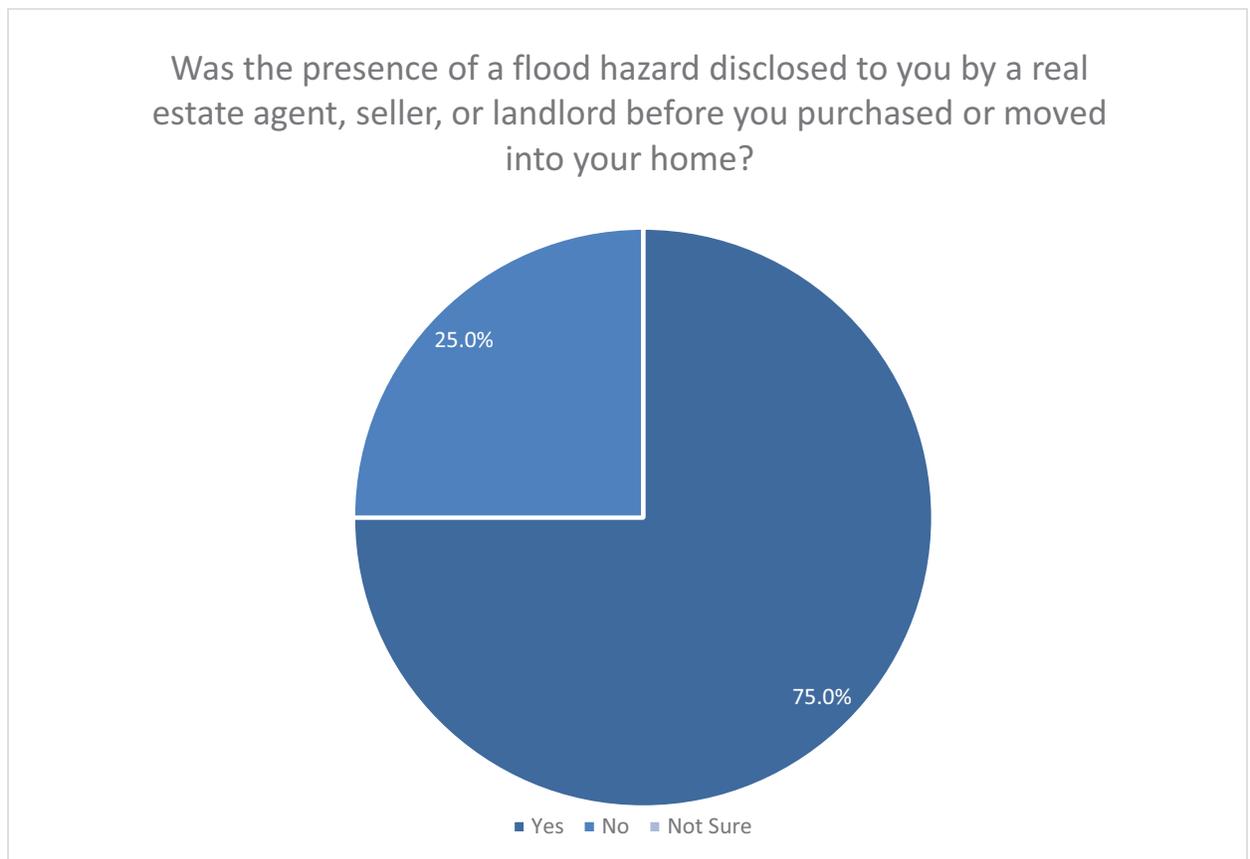


Question 18

Was the presence of a flood hazard disclosed to you by a real estate agent, seller, or landlord before you purchased or moved into your home?

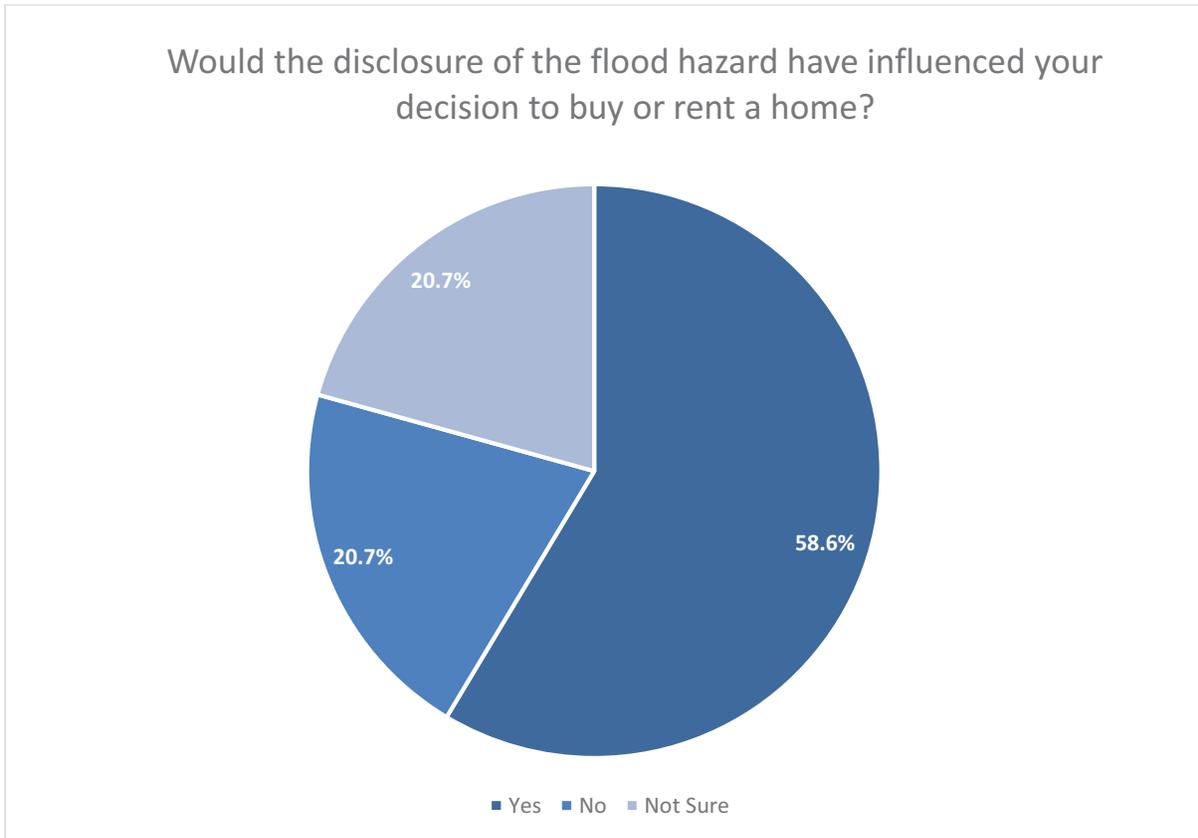
Answer Options	Response Percent	Response Count
Yes	75.0%	6
No	25.0%	2
Not Sure	0.0%	0
answered question		8
skipped question		3

Note: Only responses from residents located in the floodplain are indicated here.



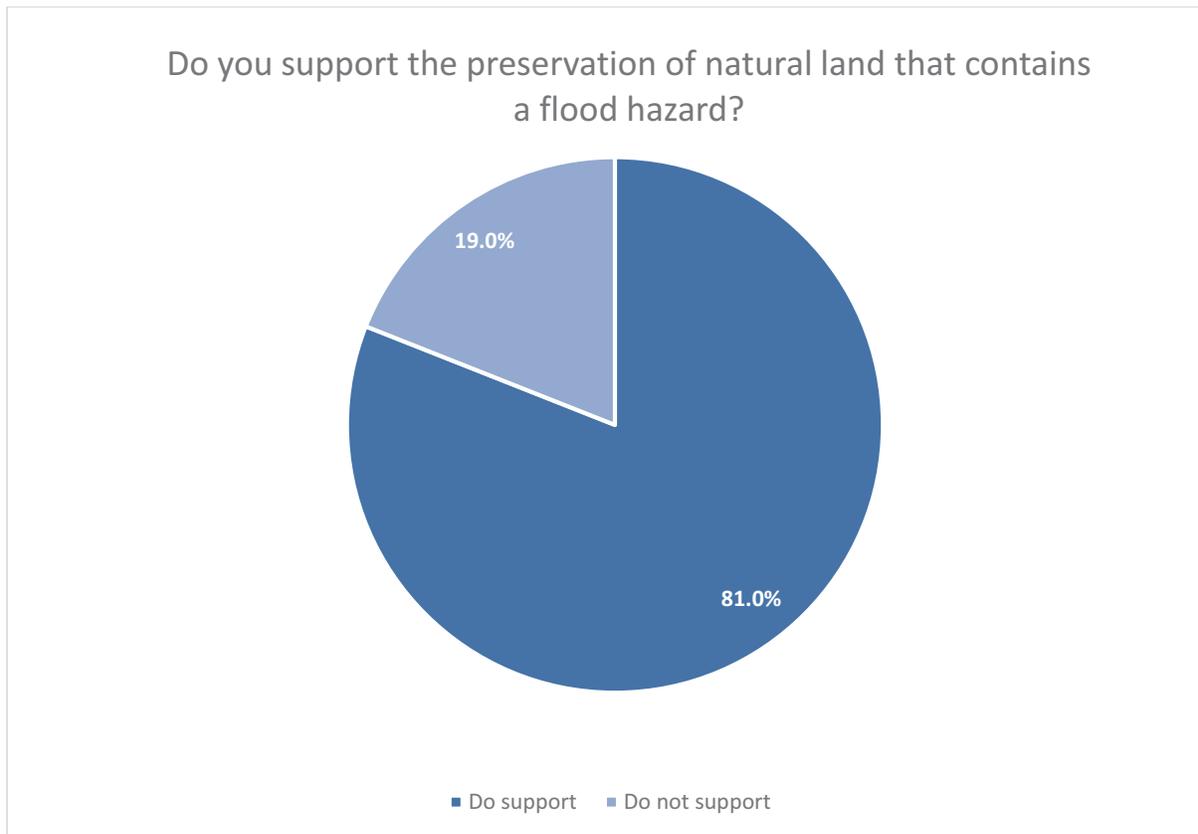
Question 19

Would the disclosure of the flood hazard have influenced your decision to buy or rent a home?		
Answer Options	Response Percent	Response Count
Yes	58.6%	65
No	20.7%	23
Not Sure	20.7%	23
answered question		111
skipped question		25



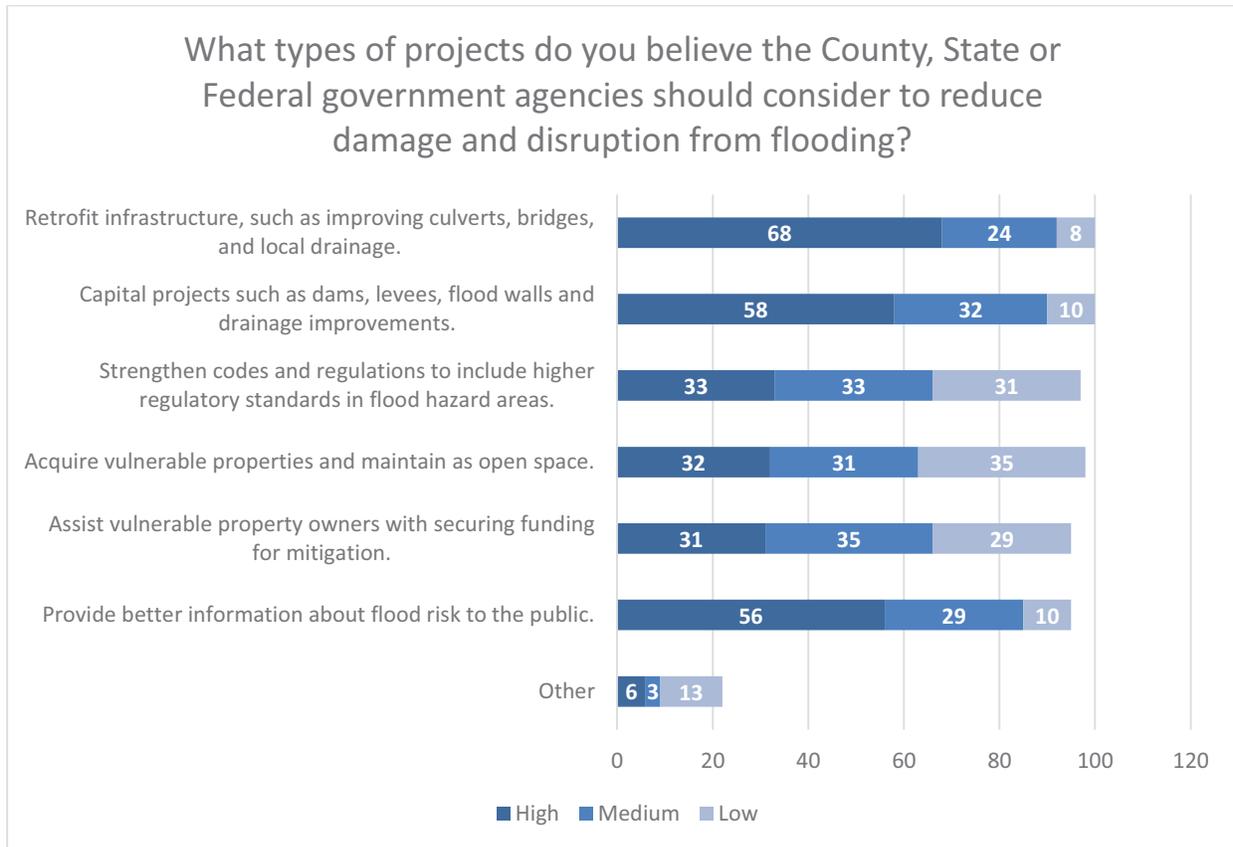
Question 20

Do you support the preservation of natural land that contains a flood hazard?		
Answer Options	Response Percent	Response Count
Do support	81.0%	81
Do not support	19.0%	19
answered question		100
skipped question		36



Question 21

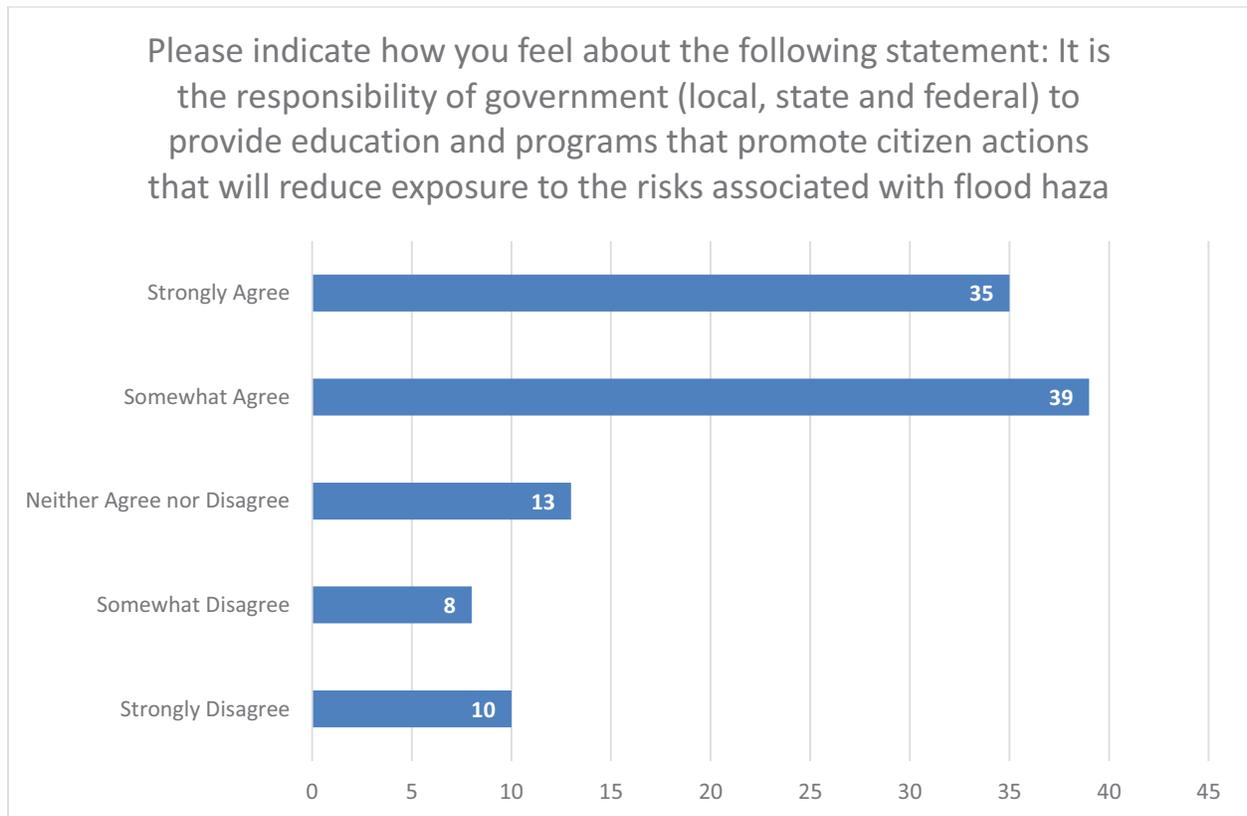
What types of projects do you believe the County, State or Federal government agencies should consider to reduce damage and disruption from flooding?					
Answer Options	High	Medium	Low	Rating Average	Response Count
Retrofit infrastructure, such as improving culverts, bridges, and local drainage.	68	24	8	1.40	100
Capital projects such as dams, levees, floodwalls and drainage improvements.	58	32	10	1.52	100
Strengthen codes and regulations to include higher regulatory standards in flood hazard areas.	33	33	31	1.98	97
Acquire vulnerable properties and maintain as open space.	32	31	35	2.03	98
Assist vulnerable property owners with securing funding for mitigation.	31	35	29	1.98	95
Provide better information about flood risk to the public.	56	29	10	1.52	95
Other (please specify)	6	3	13	2.32	22
					4
answered question					103
skipped question					33



Question 22

Please indicate how you feel about the following statement: It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks associated with flood hazards.

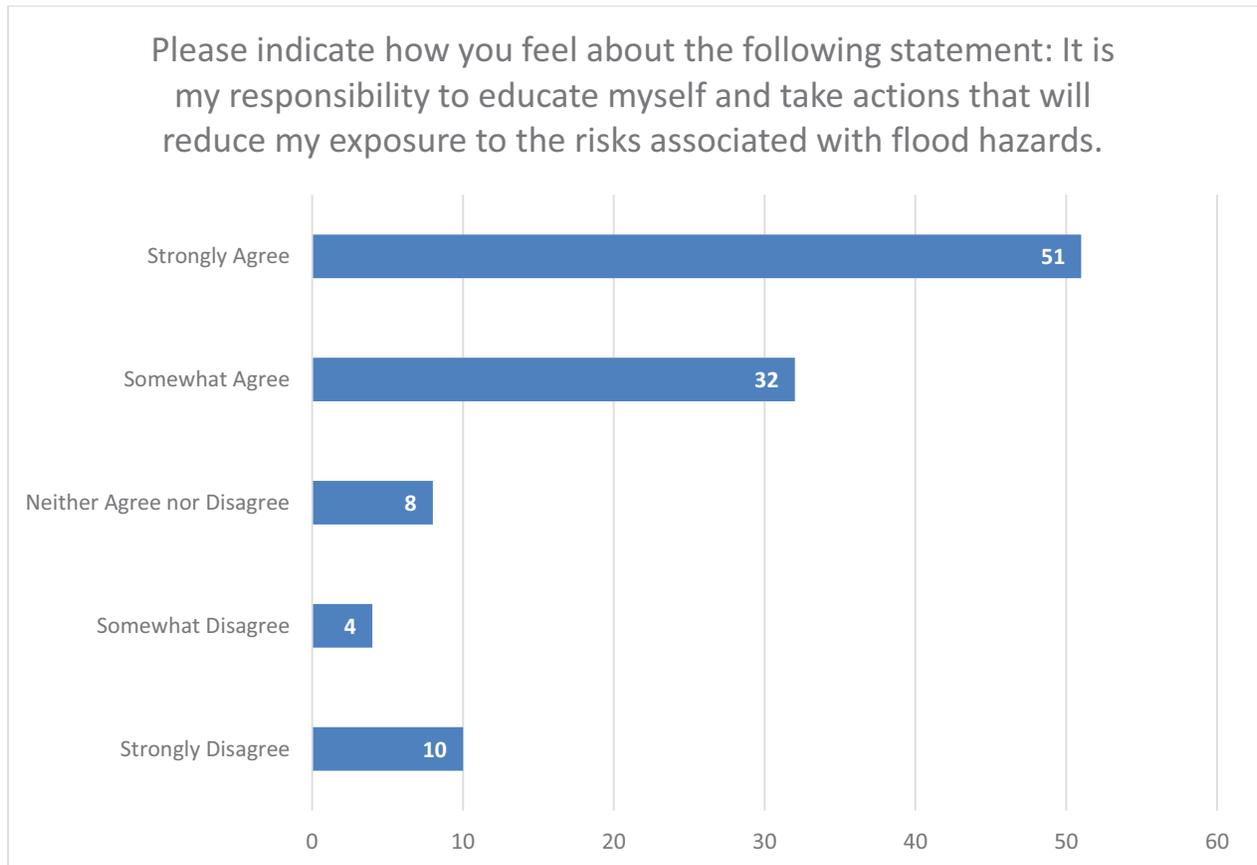
Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	10	8	13	39	35	3.77	105
						<i>answered question</i>	105
						<i>skipped question</i>	31



Question 23

Please indicate how you feel about the following statement: It is my responsibility to educate myself and take actions that will reduce my exposure to the risks associated with flood hazards.

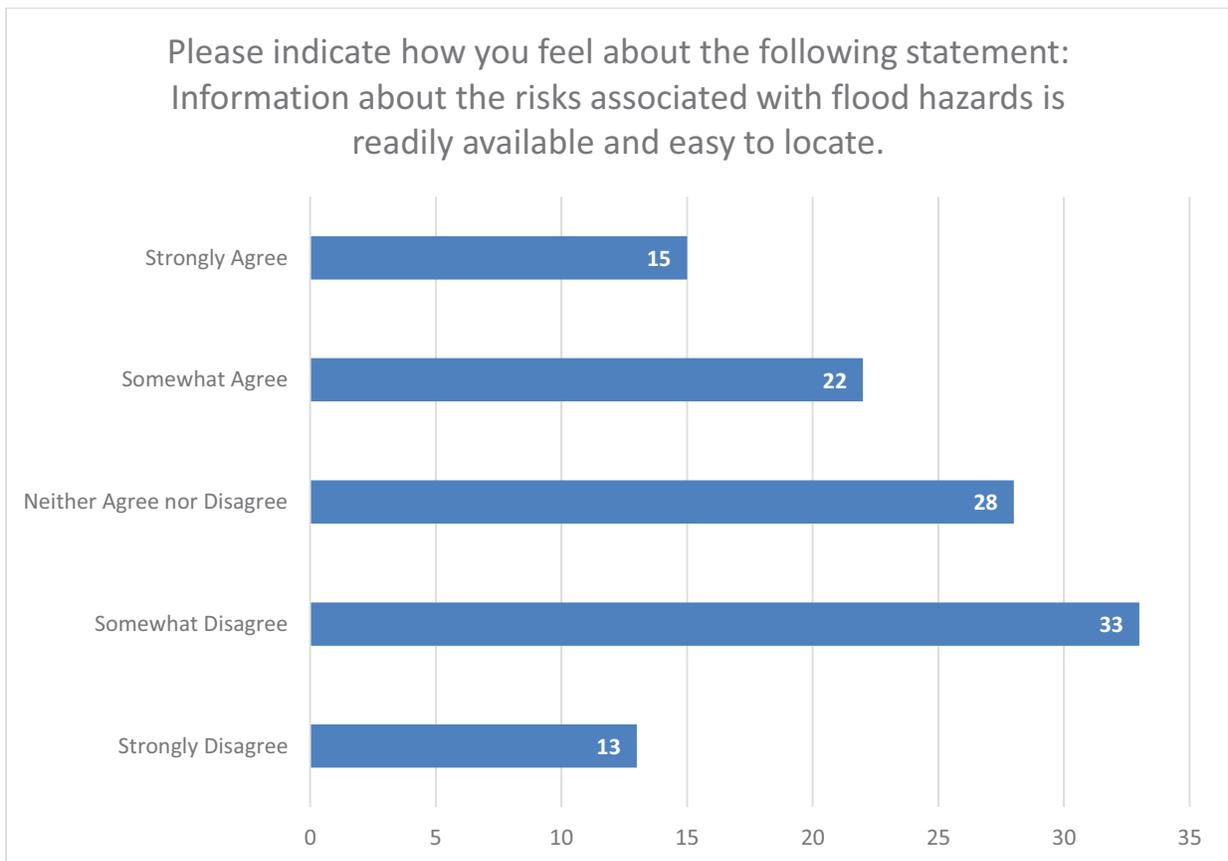
Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	10	4	8	32	51	4.05	105
	answered question						105
	skipped question						31



Question 24

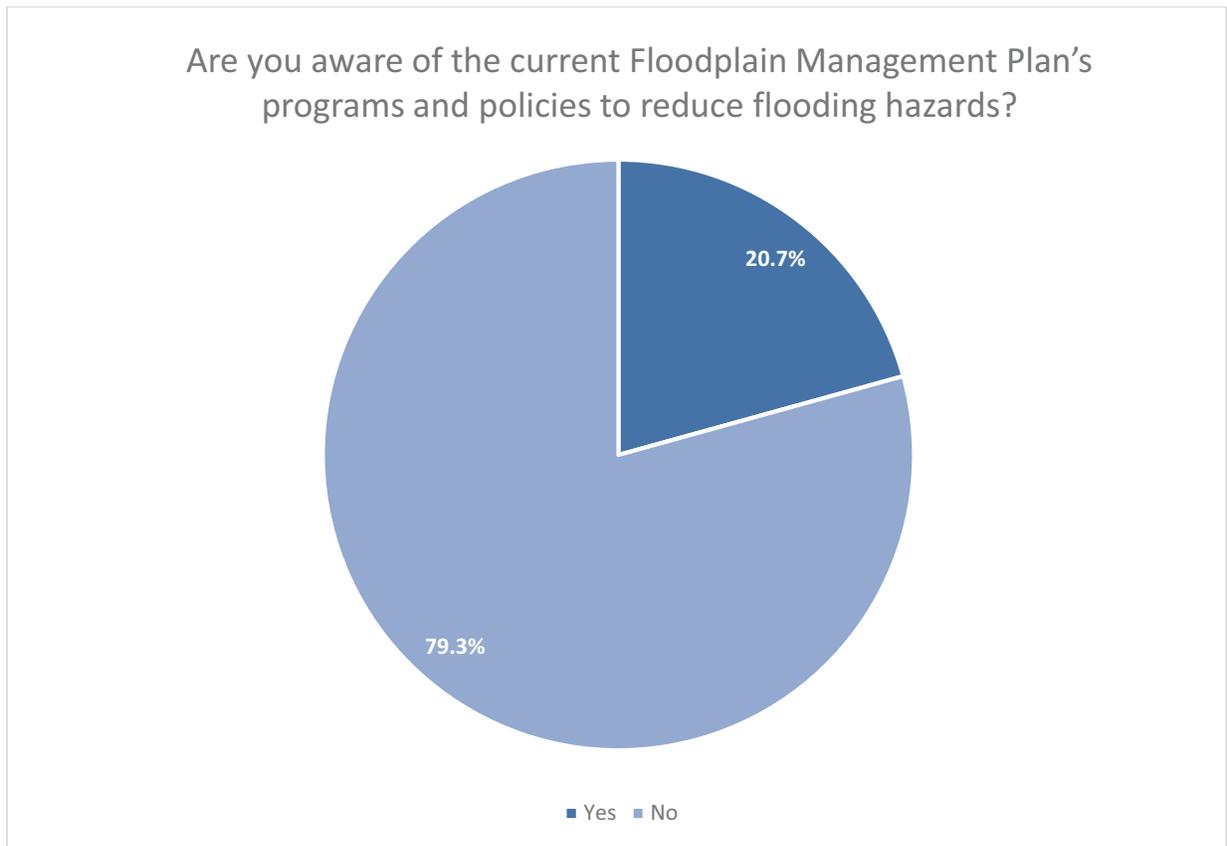
Please indicate how you feel about the following statement: Information about the risks associated with flood hazards is readily available and easy to locate.

Answer Options	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
Choose one:	13	33	28	22	15	2.94	111
						<i>answered question</i>	111
						<i>skipped question</i>	25



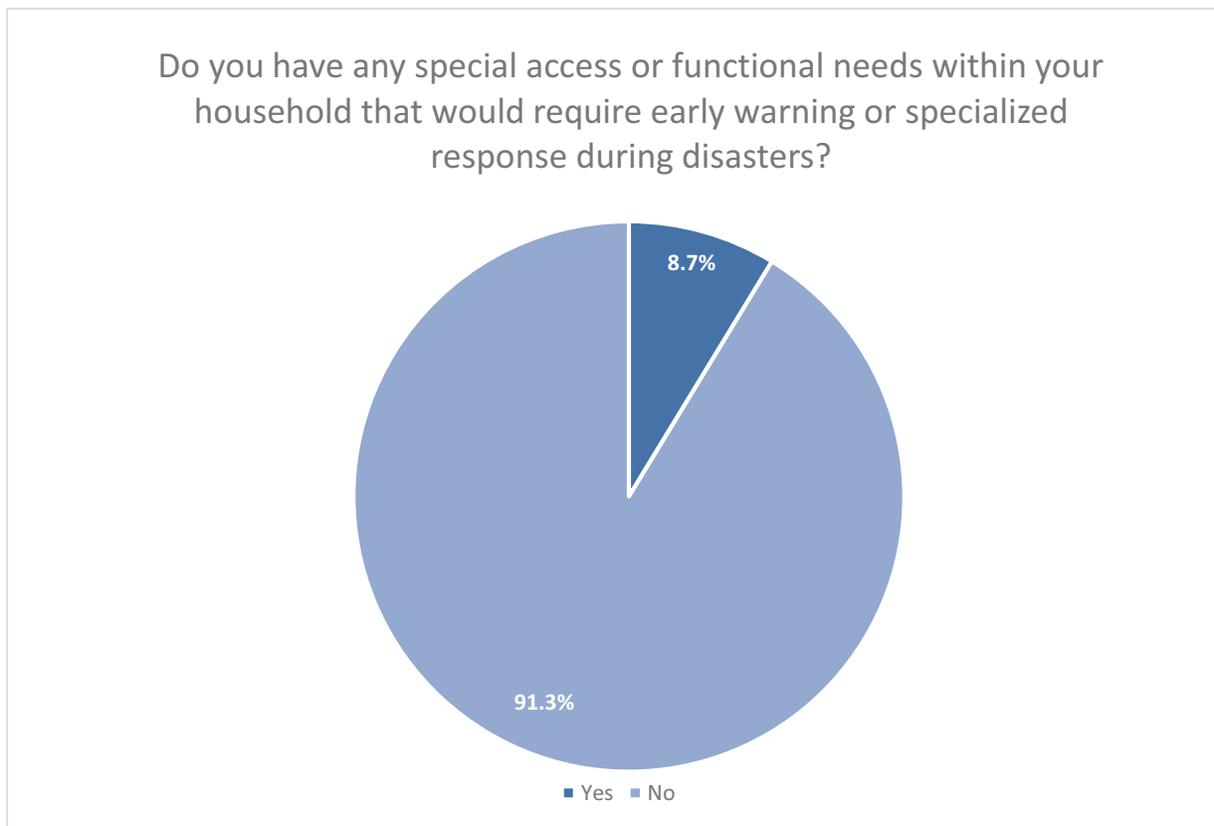
Question 25

Are you aware of the current floodplain management plan's programs and policies to reduce flooding hazards?		
Answer Options	Response Percent	Response Count
Yes	20.7%	23
No	79.3%	88
Please describe programs and policies of which you are aware		8
answered question		111
skipped question		25



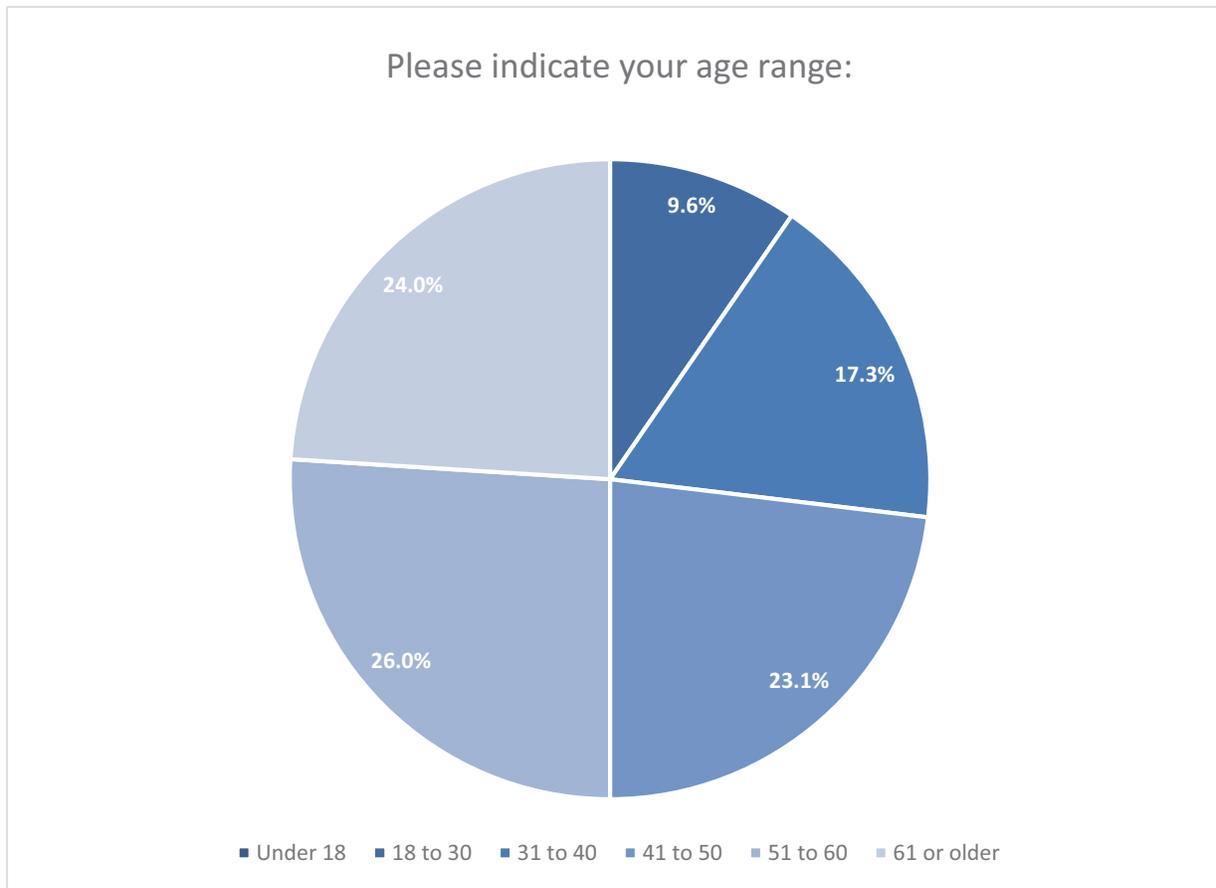
Question 26

Do you have any special access or functional needs within your household that would require early warning or specialized response during disasters?		
Answer Options	Response Percent	Response Count
Yes	8.7%	9
No	91.3%	95
answered question		104
skipped question		32



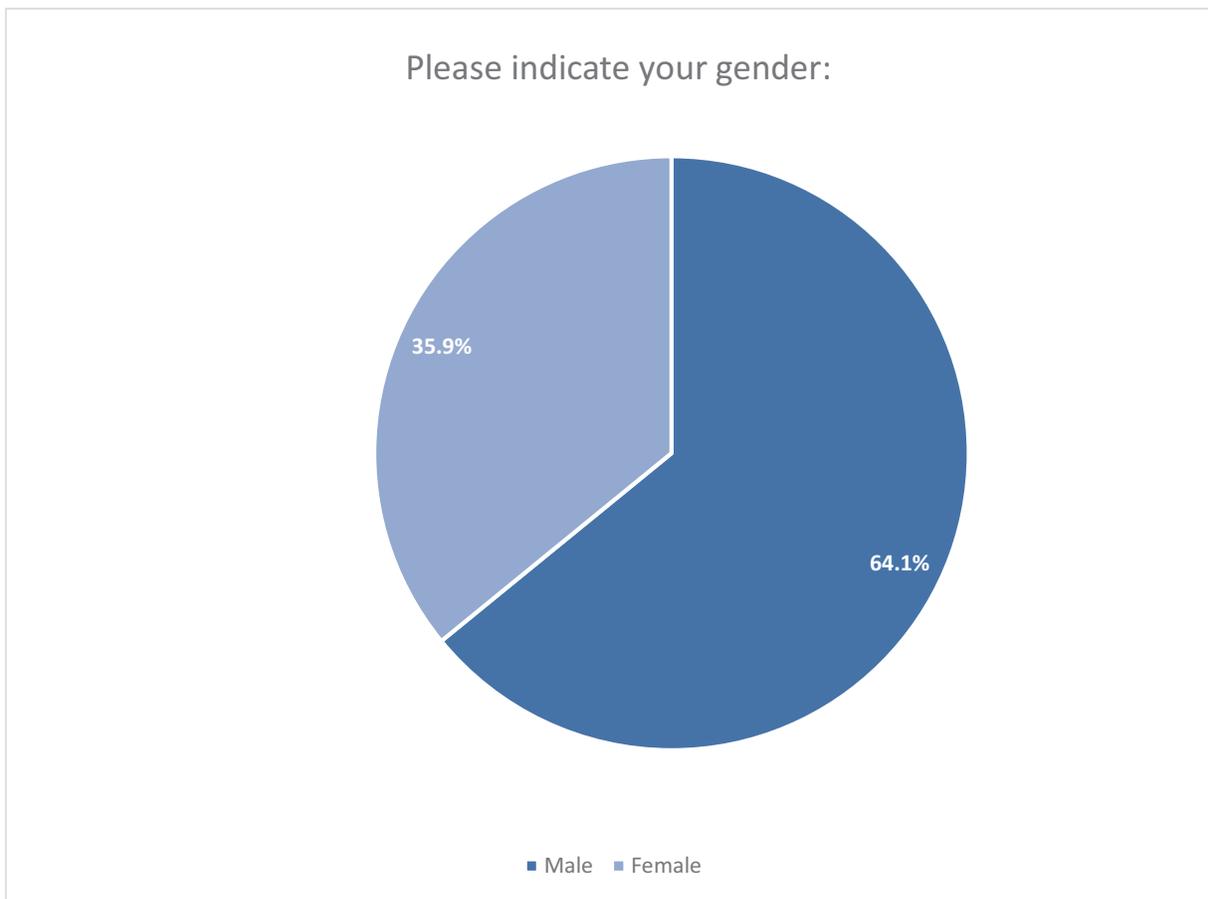
Question 27

Please indicate your age range:		
Answer Options	Response Percent	Response Count
Under 18	0.0%	0
18 to 30	9.6%	10
31 to 40	17.3%	18
41 to 50	23.1%	24
51 to 60	26.0%	27
61 or older	24.0%	25
answered question		104
skipped question		32



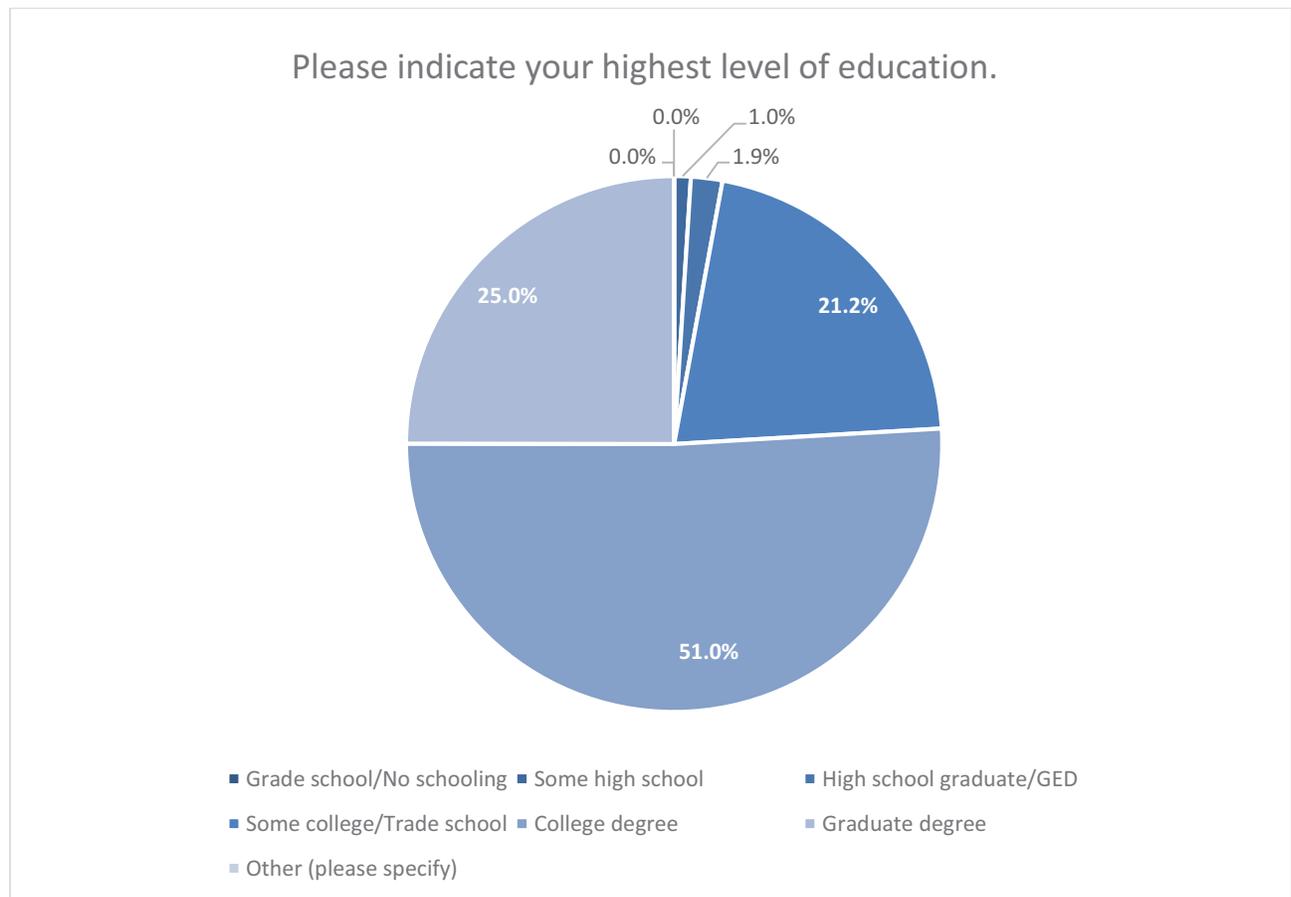
Question 28

Please indicate your gender:		
Answer Options	Response Percent	Response Count
Male	64.1%	66
Female	35.9%	37
answered question		103
skipped question		33



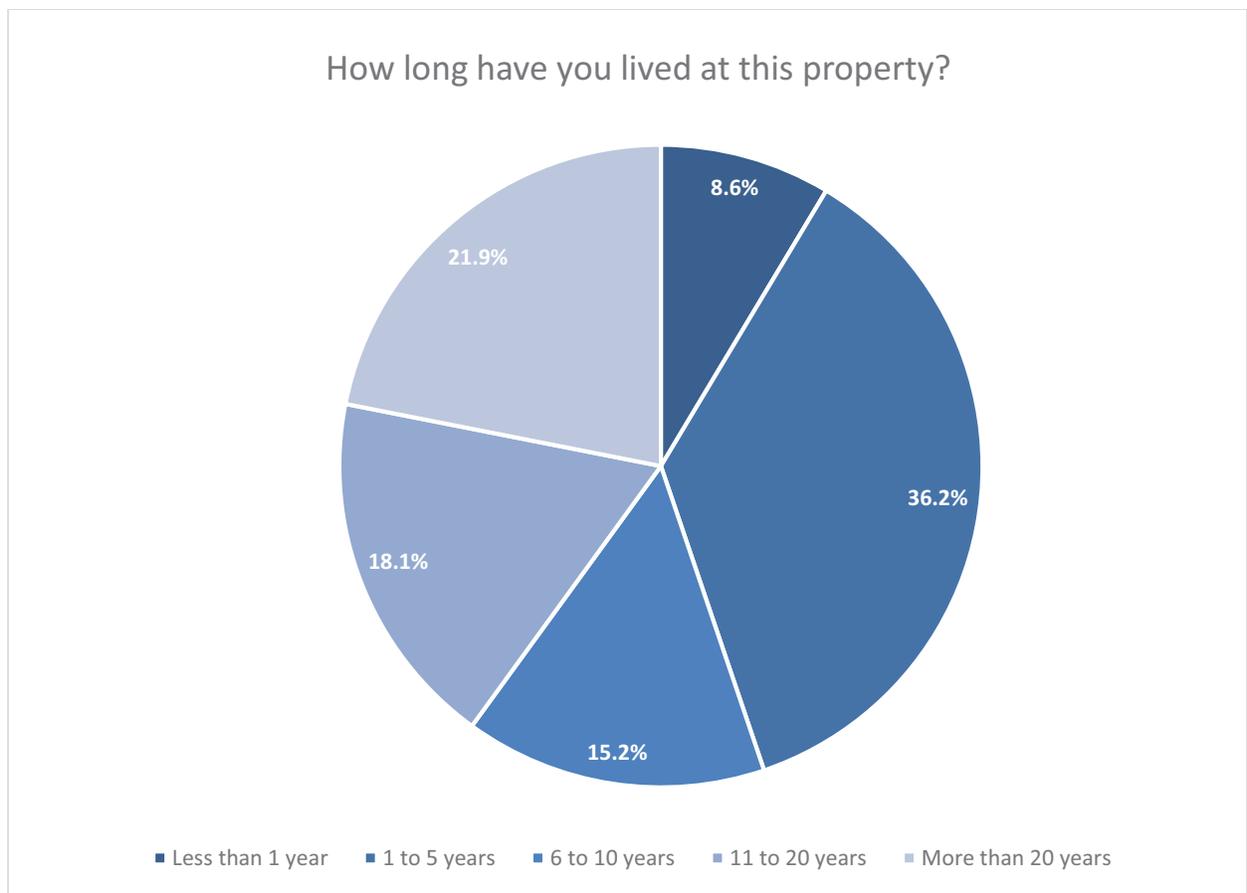
Question 29

Please indicate your highest level of education.		
Answer Options	Response Percent	Response Count
Grade school/No schooling	0.0%	0
Some high school	1.0%	1
High school graduate/GED	1.9%	2
Some college/Trade school	21.2%	22
College degree	51.0%	53
Graduate degree	25.0%	26
Other (please specify)	0.0%	0
answered question		104
skipped question		32



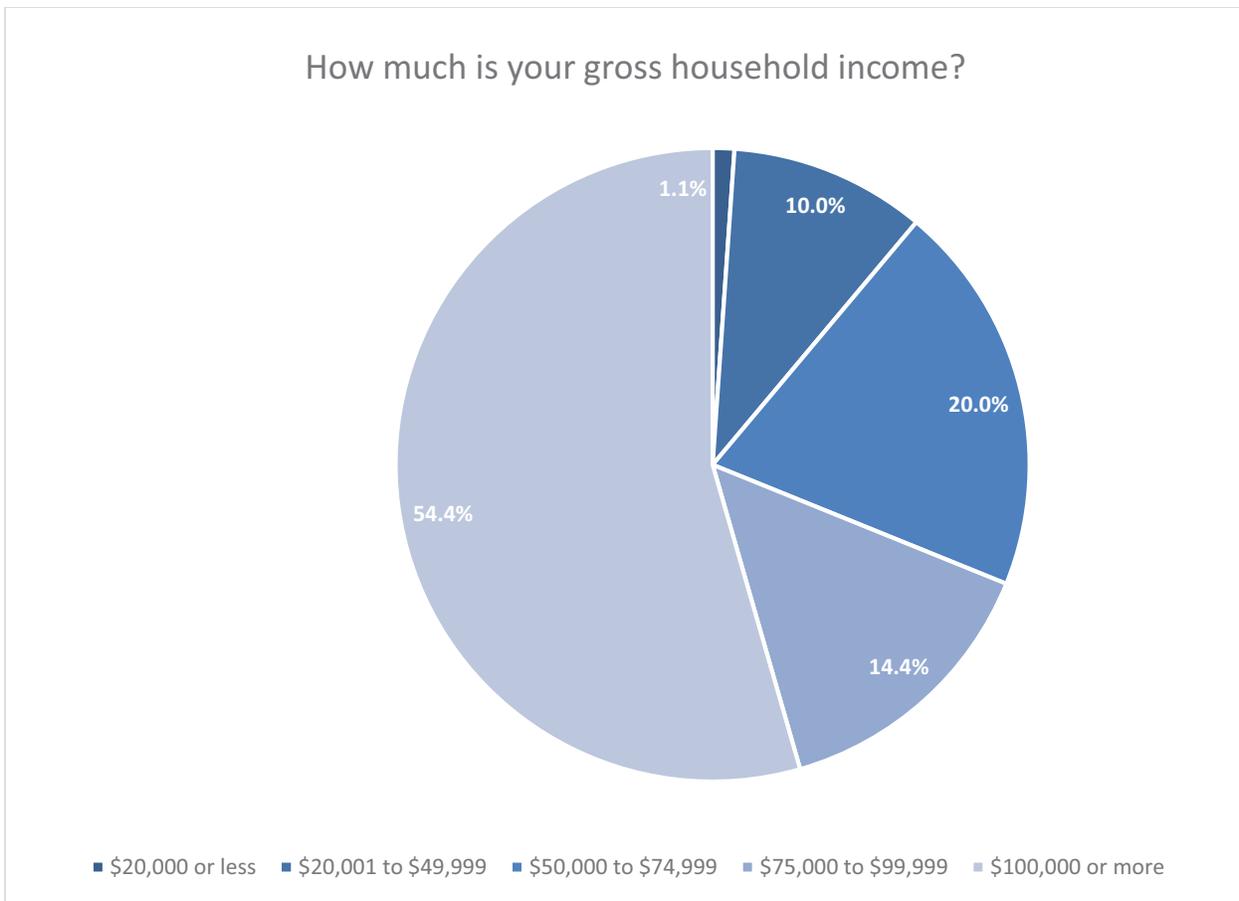
Question 30

How long have you lived at this property?		
Answer Options	Response Percent	Response Count
Less than 1 year	8.6%	9
1 to 5 years	36.2%	38
6 to 10 years	15.2%	16
11 to 20 years	18.1%	19
More than 20 years	21.9%	23
answered question		105
skipped question		31



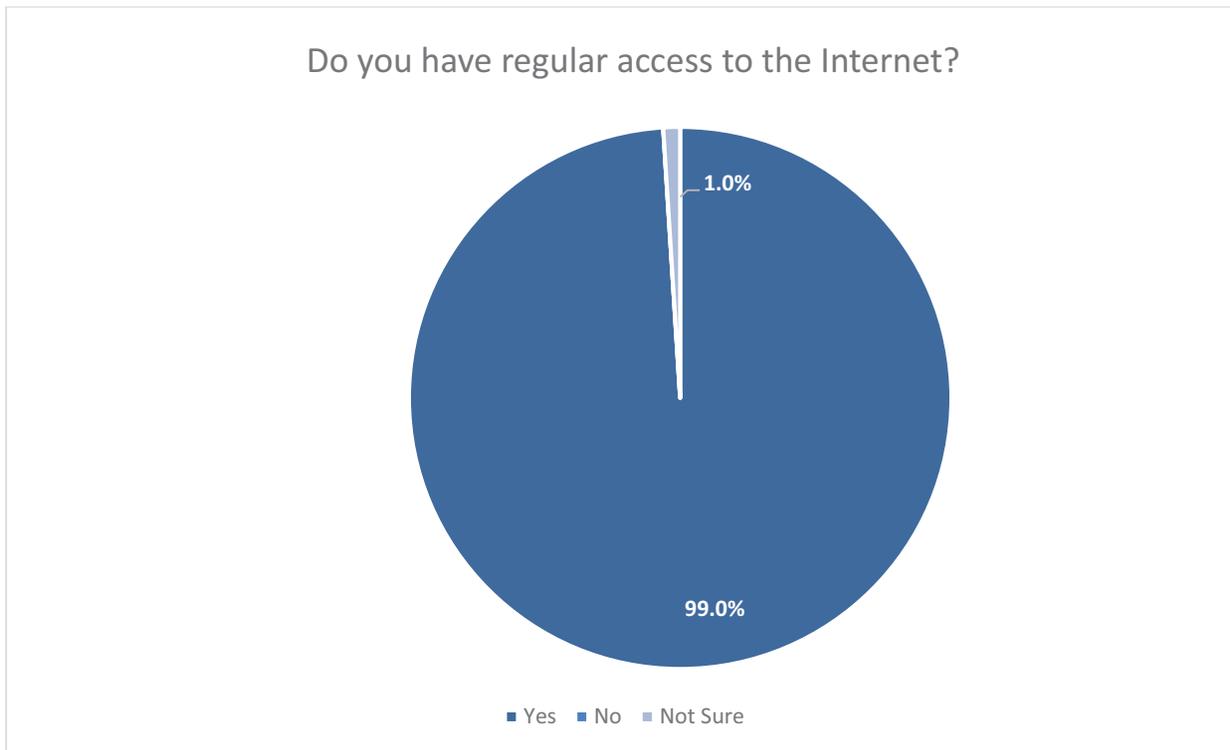
Question 31

How much is your gross household income?		
Answer Options	Response Percent	Response Count
\$20,000 or less	1.1%	1
\$20,001 to \$49,999	10.0%	9
\$50,000 to \$74,999	20.0%	18
\$75,000 to \$99,999	14.4%	13
\$100,000 or more	54.4%	49
answered question		90
skipped question		46



Question 32

Do you have regular access to the Internet?		
Answer Options	Response Percent	Response Count
Yes	99.0%	103
No	0.0%	0
Not Sure	1.0%	1
answered question		104
skipped question		32



Question 33

Comments	
Answer Options	Response Count
	17
answered question	17
skipped question	119