Las Virgenes Municipal Water District
Hazard Mitigation Plan

July 3, 2019

Version 1.0
7/03/2019

MLC & Associates, Inc.

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SECTION 1: INTRODUCTION

ACKNOWLEDGEMENTS

This Hazard Mitigation Plan (HMP) was a coordinated effort that involved multiple individuals within the Las Virgenes Municipal Water District (LVMWD). Participants in the process included the Planning Group and LVMWD Steering Committee that provided overall guidance and oversight. The Board of Directors was responsible for final approval of the HMP.

Planning Group Members

Angela Saccareccia	Finance
Douglas Anders	Facilities & Operations
Eric Schlageter	Technical Services / HMP Project Manager
James Korkosz	Facilities & Operations
Mercedes Acevedo	Facilities & Operations

Steering Committee Members

David W. Pedersen	General Manager
John Zhao	Facilities & Operations, Interim Director
Don Patterson	Finance & Administration, Director
Joe McDermott	Resource Conservation and Public Outreach, Director

Board of Directors

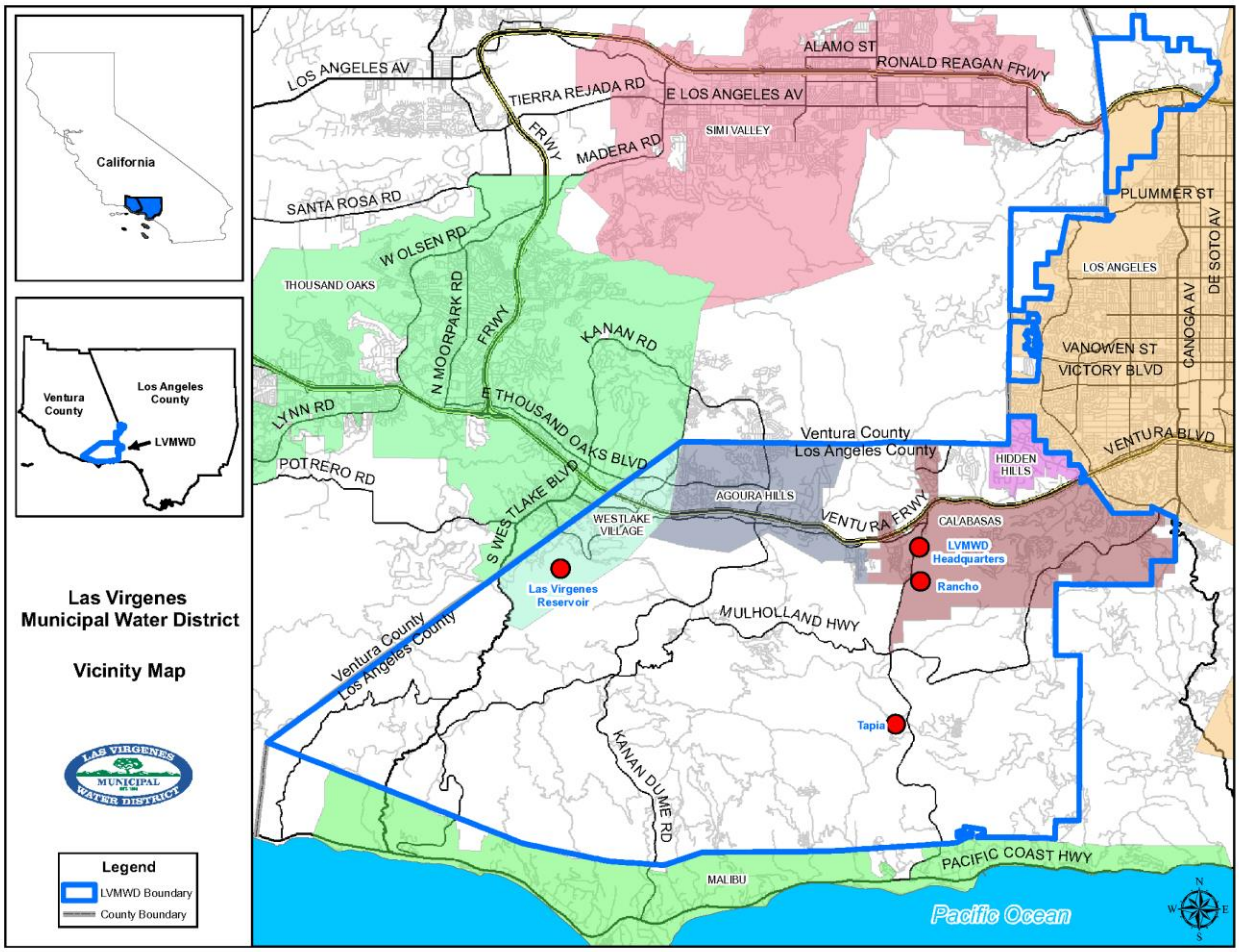
Charles Caspary	Division 1 Director, Secretary
Lynda Lo-Hill	Division 2 Director, Treasurer
Lee Renger	Division 3 Director
Leonard E. Polan	Division 4 Director, Vice President
Jay Lewitt	Division 5 Director, President
Glen Peterson	MWD Representative

EXECUTIVE SUMMARY

Las Virgenes Municipal Water District provides potable water, wastewater treatment, recycled water and biosolids composting to more than 75,000 residents in the cities of Agoura Hills, Calabasas, Hidden Hills, Westlake Village, and unincorporated areas of western Los Angeles County.

City	Population (2017 U.S. Census Estimate)
Agoura Hills	20,692
Calabasas	24,202
Hidden Hills	1,921
Westlake Village	8,440
Total	**55,255**

SOURCE: U.S. Census Bureau



Map 1: LVMWD Service Area Map

Joint Powers Authority

In 1964, the Las Virgenes – Triunfo Joint Powers Authority (JPA) was established between Las Virgenes and Triunfo Sanitation Districts to treat wastewater within the Malibu Creek watershed. The JPA owns and operates the Tapia Water Reclamation Facility (Tapia). Tapia began operating at 0.5 million gallons per day in 1965. In 1972, the district began the practice of applying recycled water from Tapia to local landscapes.

In light of burgeoning local population in the late 1980s and early 1990s, Tapia's capacity was again expanded to its ultimate build-out of 16 million gallons per day. In 1994, the JPA began operations at the Rancho Las Virgenes Composting Facility which transforms biosolids extracted from wastewater into market-ready soil amendment.

Calleguas-Las Virgenes Public Financing Authority

In 1993, the Calleguas-Las Virgenes Public Financing Authority (PFA) was formed under the Marks-Roos Local Bond Pooling Act of 1985 (Act) to provide Calleguas Municipal Water District and Las Virgenes Municipal Water District with greater flexibility to finance essential water and wastewater infrastructure. The Act allows local agencies to form a joint powers authority that may be used, among other purposes, to consolidate the financing of several capital projects to achieve lower overall borrowing costs. The PFA may issue bonds and loan the proceeds to one or both of its member agencies who are responsible for the debt service.

The PFA Board meets at least once annually alternating between Calleguas Municipal Water District, 2100 Olsen Road, Thousand Oaks, and Las Virgenes Municipal Water District, 4232 Las Virgenes Road, Calabasas. The PFA Board is comprised of 10 members: five Board Members from Calleguas Municipal Water District and five Board Members from Las Virgenes Municipal Water District.

LVMWD Ability to Support Mitigation

The LVMWD has incorporated the following capabilities into its ability to support hazard mitigation.

Type of Resource	Resource Group	Ability to Support Mitigation
Planning and Policy	General Manager	The LVMWD General Manager acts as the District's chief executive officer. The General Manager implements policies adopted by the elected Board of Directors and oversees the business of the District. The General Manager provides leadership in the administration of District programs including hazard mitigation planning; ensures that District services meet the needs of customers; coordinates the effective use of facilities, finances and personnel to achieve District goals and objectives in the Strategic Plan; and keeps the Board fully informed. The three departments that report directly to the General Manager are: • Facilities and Operation • Finance and Administration • Resource Conservation and Public Outreach
Administrative and Technical	Finance & Administration	The Finance and Administration Department is responsible for the management of the District's finances, investments, budgets, human resources and information technology systems. The department is also in charge of warehousing, purchasing, risk management and other administrative programs. All of these functions support hazard mitigation planning and implementation including financial controls, budgeting, personnel, technology, and procurement. The following groups are under Finance and Administration: • Finance • Human Resources • Information Systems • Purchasing

Type of Resource	Resource Group	Ability to Support Mitigation
Operations and Infrastructure Implementation of Capital Improvement Programs Sustaining Ongoing Operations	Facilities & Operations	The Facilities and Operations Department is responsible for the day-to-day operation, maintenance, regulatory compliance and replacement needs of the District's potable water, recycled water and sanitation facilities. The department is also responsible for the planning, engineering and construction of new facilities to serve current and future customers. As such, Facilities and Operations is the main group responsible for the planning and implementation of hazard mitigation programs for the District. The groups within Facilities and Operations are: • Potable Water • Recycled Water • Sanitation • Tapia Water Reclamation Facility • Rancho Las Virgenes Composting Facility • Technical Services (Planning/Engineering) • Pure Water Project - Las Virgenes - Triunfo
Public Information Training Public Outreach Environmental Affairs	Resource Conservation and Public Outreach	The Resource Conservation and Public Outreach Department is responsible for providing customer service, community outreach, legislative monitoring and public information functions. The Department implements the District's website, education, conservation and watershed stewardship programs. As such, hazard mitigation public outreach is managed and coordinated by this group.
Plans		
Plan Resource	Strategic Plan	General Plan outlines long-term direction for development and policy in the unincorporated areas of the county. There are opportunities to coordinate local hazard mitigation actions with policies for the unincorporated area as governed
Plan Resource	Hazard Mitigation Plan	The District's Hazard Mitigation Plan identifies the risks caused by natural hazards as well as other events that threaten the LVMWD the communities that the District serves. The Hazard Mitigation Plan also formalizes the District's hazard mitigation approach, provides a forum for public input, and describes the strategies and projects being implemented to reduce risk and better coordinate action with local communities – which will help foster a consistent and unified approach to hazard mitigation.

Hazard Mitigation Plan Purpose

The Robert T. Stafford Disaster Relief and Emergency Assistance Act provides the basis for federal assistance to state and local governments impacted by a disaster and outlines the requirements for mitigation planning. Hazard Mitigation is considered the first step in preparing for emergencies (rather than placing a reliance on recovery after an event).

The Federal Emergency Management Agency (FEMA) requires state and local governments to establish then update their hazard mitigation plans every 5 years. The HMP allows the Las Virgenes Municipal Water District (LVMWD) to be eligible for FEMA mitigation programs including the Hazard Mitigation Grant Program and Flood Mitigation Assistance Program.

The Disaster Mitigation Act of 2000 (DMA 2000), Section 322 (a-d) requires that local governments maintain mitigation plans that describe the process for identifying hazards, risks and vulnerabilities, identifies and prioritizes mitigation actions, encourages the development of local mitigation, and provides technical support for those efforts as a condition of receiving federal disaster mitigation funds. This Hazard Mitigation Plan serves to meet these requirements.

Furthermore, this plan assists the LVMWD in reducing risk from hazards by identifying resources, information, and strategies for risk reduction, while helping to guide and coordinate mitigation activities. Mitigation strategies for reducing the potential losses identified in the risk assessment are outlined in this HMP and are based on existing authorities, policies, programs, resources, and the ability to expand on and improve these existing tools. In summary, the information and mitigation strategies within the Hazard Mitigation Plan:

- Establishes a basis for coordination and collaboration between the LVMWD, its departments, and the public
- Identifies and prioritizes future mitigation projects
- Assists in meeting the requirements of federal assistance programs

REQUIREMENTS FOR MITIGATION PLANS

Federal and State Requirements

The following Federal requirements must be met for approval of a Hazard Mitigation Plan:

- The public must be afforded opportunities for involvement in: identifying and assessing risk, drafting a plan, and public involvement in approval stages of the plan
- Community cooperation, with opportunity for other local government agencies, the business community, educational institutions, and non-profits to participate in the process
- Incorporation existing programs and other pertinent documents

The following components must be part of the planning process:

- Complete documentation of the planning process
- A detailed risk assessment on hazard exposures in the community
- A comprehensive mitigation strategy, which describes the goals and objectives, including proposed strategies, programs & actions to avoid long-term vulnerabilities
- A plan maintenance process, which describes the method and schedule of monitoring, evaluating and updating the plan and integration of the Hazard Mitigation Plan into other planning mechanisms
- Formal adoption by the Board of Directors
- Plan Review by Cal-OES and FEMA

Plan Mission

The Mission of the Las Virgenes Municipal Water District Hazard Mitigation Plan is to promote sound public policy and programs designed to protect the public, critical facilities, infrastructure, private and public property, and the environment from natural and human generated hazards. This will be achieved by developing, implementing, and maintaining this plan to guide the LVMWD towards creating and maintaining a safer more sustainable community.

Plan Goals

The Plan Goals describe the overall direction that the LVMWD can take to minimize the impacts of hazards. The Plan Goals help to guide the direction of future activities aimed at reducing risk and preventing losses. The Plan Goals are the foundation for the broad direction of the Mission Statement and the specific recommendations that are outlined in the strategies. These goals are divided into 4 major categories:

To Protect Life, Property, Environment

- Implement activities that assist in protecting lives by improving infrastructure, critical facilities, and other property to be more resistant to hazards.
- Reduce losses and repetitive damages for chronic hazard events.
- Encourage preventative measures in areas vulnerable to hazards.

Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with hazards.
- Provide information on tools and other opportunities to assist in implementing mitigation activities.

Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.

Emergency Management

- Establish policies to ensure mitigation projects for critical facilities, services, and infrastructure.
- Enforce and update current practices to support mitigation.
- Strengthen emergency operations by increasing collaboration and coordination among departments, public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Whom Does the Mitigation Plan Affect?

This Hazard Mitigation Plan affects the entire LVMWD Service Area Region and provides a framework for pre-emptive planning for hazards. The resources and background information in the plan are applicable area-wide, and the goals and recommendations lay the groundwork for mitigation plans and partnerships with neighboring communities.

How is the Plan Used?

Each section of the Hazard Mitigation Plan provides information and resources to assist in understanding the region and the hazard-related issues facing citizens, businesses, and the environment. The sections of the HMP combine to create a document that guides the mission to reduce risk and prevent loss from future hazard events.

Plan Development and Update Process

The HMP is monitored on an ongoing basis and formal updates are scheduled every five (5) years. The development, monitoring, and update process is the responsibility of the Planning Group. The HMP Steering Committee is responsible for providing guidance to the process and approval of the HMP and mitigation strategies.

The workflow below depicts the basic process for future HMP updates.

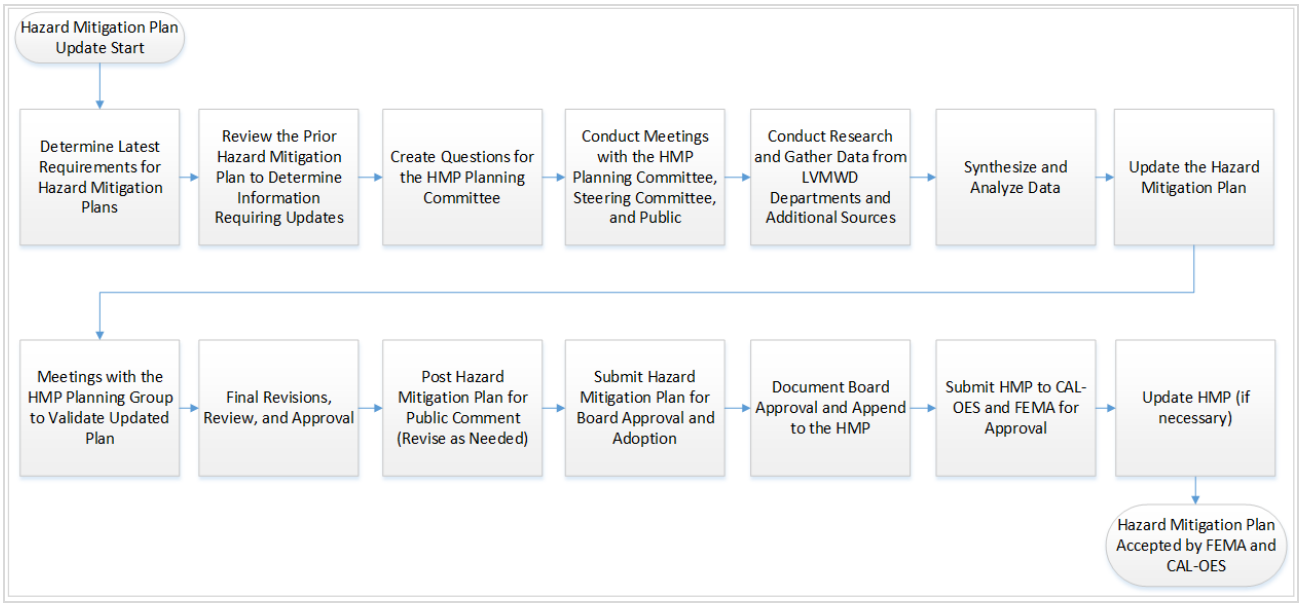


Figure 1: HMP Update Process Workflow

Plan Participants

The development of the Las Virgenes Municipal Water District Hazard Mitigation Plan has been a collaborative effort. The planning process was facilitated by a variety of departments along with a consulting agency, MLC & Associates, Inc. The LVMWD Steering Committee and Planning Group provided guidance in developing and updating the plan. Further, the LVMWD coordinates its disaster planning and mitigation efforts with the cities within its Service Area (Agoura Hills, Calabasas, Hidden Hills, and Westlake Village) and Los Angeles County.

The public was invited to participate in the development and update of the plan. In addition, ongoing disaster preparedness and mitigation information is routinely provided through public notices, the LVMWD website, LVMWD publications, and via public Board meeting.

The LVMWD HMP Steering Committee provided needed direction, guidance, and approval. The Planning Group provided key information, supporting documentation, and the prioritization of hazards within the LVMWD Service Area. The hazards were rated according to probability, magnitude/severity, warning time and duration.

Internal Input

The Steering Committee was composed of the Las Virgenes Municipal Water District General Manager and Directors and was established in order to provide guidance to facilitate the planning process, provide feedback, and approval.

The Hazard Mitigation Steering Committee along with Planning Group, and LVMWD staff were involved in developing the plan. This process involved meetings, discussion and individual reviews and input. The planning process included:

- Planning sessions with LVMWD representatives
- Reviews of historical disaster events in the local area that impacted the LVMWD
- A review of activities related to hazard mitigation from existing programs, Capital Improvement projects, and other projects

External Input

Existing mitigation plans, programs and activities from other agencies were reviewed as well as current FEMA hazard mitigation planning standards and the State of California Hazard Mitigation Plan Guidance document. In addition, geographic area and hazard specific data were generated to develop scenario-based hazard maps. These resources were valuable in developing the LVMWD Hazard Mitigation Plan (see **Annex A Resources** for source information).

Information from the sources noted above was evaluated and (when applicable) incorporated into the plan. In addition, the information gathered served as a basis for the strategy sessions that were conducted to document ongoing and future mitigation activities.

Hazard Mitigation Plan Organization

This Hazard Mitigation Plan contains background information on the purpose and methodology used to develop the mitigation plan, a profile of the Las Virgenes Municipal Water District Service Area Region, sections on the identified hazards that threaten the Region as well as the associated risks, a five-year mitigation strategy action plan matrix, and supporting information contained in the Appendices.

Strategy Organization

The data collection, research and the public participation process resulted in the development of the hazard mitigation strategies listed. The strategies outline activities in which each of the various cities and citizens can be engaged to reduce risk. They reflect future action to be taken in order to reduce the loss of property and life. Section 13 Hazard Mitigation Goals and Strategies provides brief descriptions of the projects and strategies developed.

Plan Implementation, Monitoring, and Evaluation

Section 12 Plan Maintenance and Monitoring details the formal process that describes how the Las Virgenes Municipal Water District Hazard Mitigation Plan is maintained. The plan maintenance process included a schedule for monitoring and evaluating the plan and producing a plan revision every five years. In addition, this section also describes how the LVMWD integrated public participation in the plan maintenance and update process.

Finally, the Plan Implementation, Monitoring, and Evaluation section includes an explanation of how the Las Virgenes Municipal Water District has incorporated the mitigation strategies outlined into existing planning mechanisms.

Plan Adoption

In 2019, the Las Virgenes Municipal Water District adopted this Hazard Mitigation Plan. The HMP Project Manager was responsible for submitting the plan to the State Hazard Mitigation Officer at the Governor's Office of Emergency Services (Cal OES). Cal OES then submitted the updated plan to the Federal Emergency Management Agency (FEMA) for review. This review addressed the federal criteria outlined in *Title 44 CFR Emergency Management and Assistance: Part 201 – Mitigation Planning*. Upon acceptance by FEMA, Las Virgenes Municipal Water District will maintain its eligibility for Hazard Mitigation Grant Program funds.

Coordinating Body

The Las Virgenes Municipal Water District Hazard Mitigation Planning Group was responsible for coordinating implementation of plan strategies and undertaking the formal review process. The Planning Group was also responsible for supporting the HMP Steering Committee who provided oversight for the project.

Coordination with Existing Programs

The LVMWD has incorporated its hazard mitigation goals, strategies, and implementation plans into existing and future efforts. Section 13 Hazard Mitigation Goals and Strategies provides a list of this coordination. Further, the LVMWD coordinates with the cities within its Service Area (Agoura Hills, Calabasas, Hidden Hills, and Westlake Village) which are part of the Las Virgenes-Malibu Council of Governments (LVMCOG). The LVMWD has incorporated key parts of the LVMCOG Multi-Jurisdictional Hazard Mitigation Plan into its HMP planning process.

Economic Analysis of Mitigation Projects

Determining the economic feasibility of mitigating hazards can provide decision makers with an understanding of the potential benefits and costs of an activity, as well as provide a basis upon which to compare alternative projects. The Federal Emergency Management Agency's approach to identify costs and benefits associated with hazard mitigation strategies or projects falls into two general categories: benefit-cost analysis and cost-effectiveness analysis.

Conducting a benefit-cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now in order to avoid disaster-related damages later. A cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. For the purposes of this HMP, an estimate of the benefit/cost ratio was used to evaluate the relative feasibility of the mitigation projects and strategies outlined in Section 13 Hazard Mitigation Goals and Strategies.

Formal Review Process

The LVMWD established a formal review process to evaluate this HMP and each mitigation strategy developed to ensure that the program will meet its goals and to provide the oversight required to ensure the soundness of the program. In addition, the Planning Group is responsible for monitoring and evaluating the progress of the mitigation strategies in the plan.

Continued Public Involvement

The LVMWD is dedicated to involving the public directly in the continual review and updating of the Hazard Mitigation Plan. Copies of the plan are made available on the LVMWD web site.

Mitigation Strategy Five-Year Action Plan

The Las Virgenes Municipal Water District Hazard Mitigation Action Plan includes resources and information to assist residents, public and private sector organizations, and others interested in participating in planning for hazards. The Mitigation Strategy Action Plan provides a list of activities designed to assist the LVMWD to reduce risk and prevent losses from future hazard events. The strategies address multi-hazard issues, as well as hazard specific activities such as for earthquakes, fires, flooding, landslide, windstorms, and terrorism.

HAZARD MITIGATION PLAN ORGANIZATION

The Hazard Mitigation Plan is organized as follows:

Section 1: Introduction
The Introduction provides an overview of the Hazard Mitigation Plan Mission, Goals, and Strategies. In addition, this section outlines the process used to develop the goals and strategies that cut across the hazards addressed in the Hazard Mitigation Plan. Finally, this section describes the background and purpose of developing the Hazard Mitigation Plan and the planning process.

Section 2: Service Area Region Profile
This section presents the history, geography, demographics, and socio-economics of Las Virgenes Municipal Water District Service Area Region. It serves as a tool to provide a historical perspective of hazards in the area, potential impacts, and identifies at risk populations.

Section 3: Risk Assessment
The Risk Assessment section provides information on hazard identification, vulnerability, and risk associated with hazards in Las Virgenes Municipal Water District Service Area Region.

HAZARD SPECIFIC INFORMATION

The following hazard specific sections are addressed in the HMP. Continuing hazards occur on an ongoing and/or seasonal basis and may be predicted through historic evidence and scientific methods. Each of the hazard-specific sections includes information on the history, hazard causes and characteristics, hazard assessment, mitigation goals and strategies. Continuing hazards addressed in the plan include:

Section 4: Earthquake	Section 8: Landslide and Debris Flow
Section 5: Wildfire	Section 9: Windstorm
Section 6: Climate Change	Section 10: Flood and Severe Winter Storm
Section 7: Energy Disruption	Section 11: Terrorism

Section 12: Plan Maintenance and Monitoring
The Plan Maintenance section provides information on plan implementation, monitoring and evaluation.

Section 13: Multi-Hazard Goals and Strategies
The Multi-Hazard Goals and Strategies section describes the mitigation strategies developed for the HMP. The strategies address multi-hazard issues, as well as hazard-specific activities that can be implemented to reduce risk and prevent loss from future events.

ANNEXES

The Annexes includes references to the information used to gather data and conduct analytical research to assemble the LVMWD Hazard Mitigation Plan. The Resources section also includes a description of the tools used to develop the plan as well as documentation of the meetings, discussions and events that were involved in the planning process.

Annex A: Resources

This section provides a list of resources for Regional, County, State, and Federal agencies and organizations that may be referenced directly and indirectly within the LVMWD Hazard Mitigation Plan.

Annex B: Meeting Agendas and Attendees

This section provides key meeting agendas related to mitigation planning and the LVMWD Hazard Mitigation Plan.

Annex C: Planning and Public Involvement

This section provides a description of public involvement activities including meetings and other public outreach efforts related to the Hazards Mitigation Plan update. This section also provides

Annex D: Plan Approval Documentation

This section provides a copy of Plan Approval documents related to the LVMWD Hazard Mitigation Plan.

Annex E: Local Hazard Mitigation Plan Review Tool

This section includes the Local Hazard Mitigation Plan Review Tool. The tool provides a quick reference to key sections of the plan.

SECTION 2: LVMWD SERVICE AREA REGION PROFILE

Identifying population groups and the risks posed by hazards provides the basis for implementing strategies to reduce potential impacts; thereby protecting the lives and property of citizens and communities. The result is the development and implementation of strategies, coordination of resources, and increased public awareness that will reduce risk and prevent loss from future hazard events.

This section of the Hazard Mitigation Plan provides an overview of the cities within the Las Virgenes Municipal Water District Service Area Region. City specific profiles contained within this section provide brief summaries of the vulnerable populations, structures, and economic base of each community.

POPULATION

According to 2017 Census data, the population of the four cities in the Las Virgenes Municipal Water District Service Area Region totaled 55,255. Within the region, Calabasas represents the largest population closely followed by Agoura Hills. Calabasas also represented the fasted growth area (5.0%) outpacing Los Angeles County (3.5%) through the period from 2010 to 2017. The population levels of the other cities within the area also grew since 2010. Due to terrain restrictions, designated parks and reserves, and local planning/zoning requirements, local populations are centered along the Ventura 101 Freeway.

Las Virgenes Municipal Water District Service Area Population Data				
Location	**2017 Estimated Population**	**% of Los Angeles County**	**2010 Population**	**% Change from 2010 to 2017**
Agoura Hills	20,692	0.20%	20,330	1.8%
Calabasas	24,202	0.24%	23,058	5.0%
Hidden Hills	1,921	0.02%	1,856	3.5%
Westlake Village	8,440	0.08%	8,270	2.1%
LVMWD Cities	**55,255**	**0.54%**	**53,514**	**3.3%**
Los Angeles County	10,163,507	100.00%	9,818,605	3.5%

GEOGRAPHY AND THE ENVIRONMENT

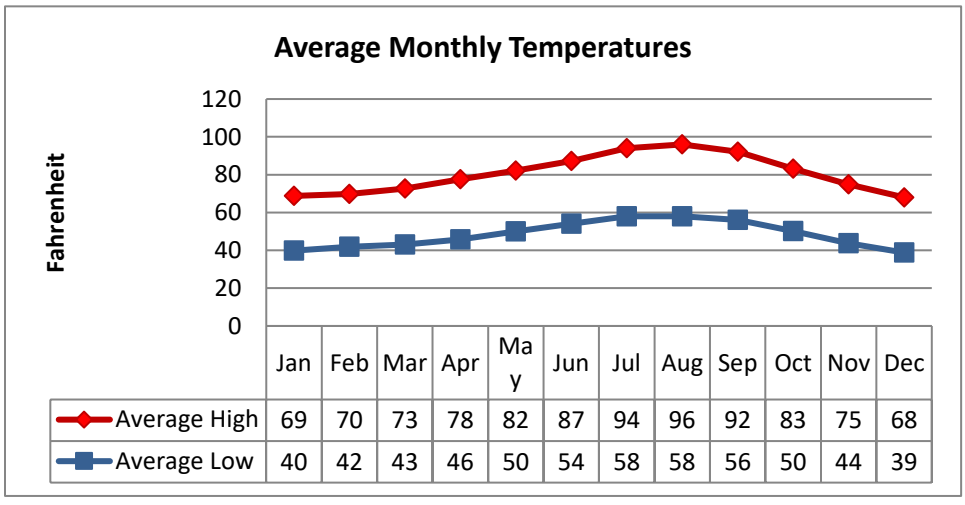
The geography includes mountainous terrain as well as small rivers and seasonal waterways (depending on rainfall). The climate is Mediterranean characterized by warm to hot, dry summers and mild to cool, wet winters. Summer temperatures in the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village can reach into the high 90's. (see **CLIMATE** section for additional details).

Map 2: LVMWD Region Map

CLIMATE

Temperature

The region is characterized by warm to hot dry summers and mild to cool wet winters typical of a Mediterranean climate.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High	69	70	73	78	82	87	94	96	92	83	75	68
Average Low	40	42	43	46	50	54	58	58	56	50	44	39

Figure 2: : Average Temperature by Month

The average high in the summer ranges from the mid to upper 90 degrees Fahrenheit. Average lows in the winter months range from the upper 30 to low 40 degrees Fahrenheit.

August tends to be the hottest month and December tends to be the coldest month. However, it should be noted that temperatures can vary over a wide range.

For example, Santa Ana winds typically occur in late fall and early winter. The Santa Ana winds are characterized by strong dry offshore winds originating from the Great Basin and Upper Mojave Desert.

Wind temperatures can range from extremely hot to cold. Damage can occur directly from the high wind speeds generated or from the secondary effects of very low humidity – which increases the threat of wildfires.

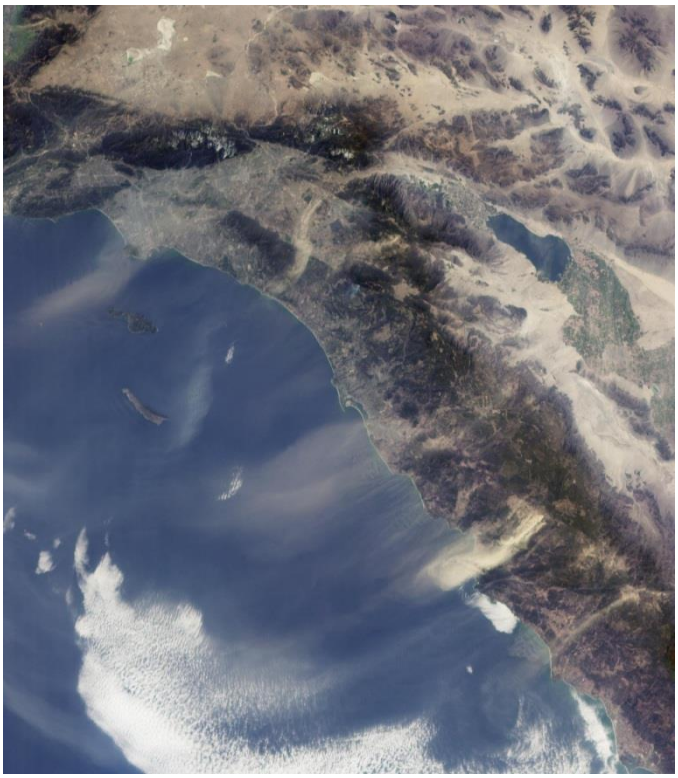


Figure 3: Santa Ana Winds (Feb 2002)

SOURCE: NASA/JPL-Caltech)

Rainfall

Rainfall in the LVMWD region averages approximately 19 inches per year. However, the term "average rainfall" is misleading because over the recorded history of rainfall in the region, rainfall amounts have ranged from no rain at all in some years to well over normal averages in very wet years. Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than in consistent amounts throughout the year.

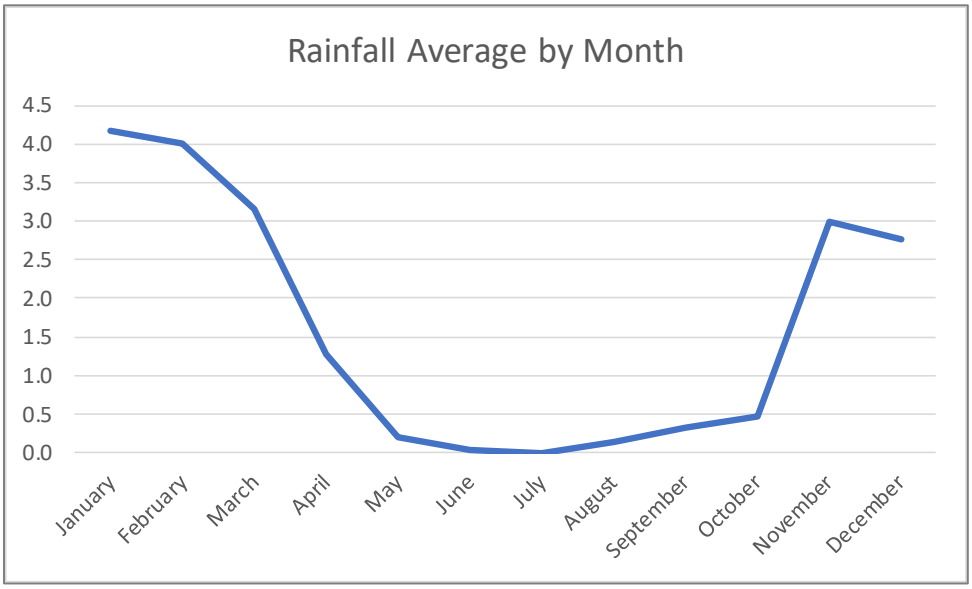


Figure 4: Average Rainfall by Month

El Niño and La Niña

Periodically, Southern California and the LVMWD region are subject to the effects of El Niño or La Niña conditions:

- El Niño is characterized by unusually warm ocean temperatures in the Equatorial Pacific resulting in increased rainfall in the southern tier of the U.S. El Niño conditions can result in flooding, mudslides, and traffic disruptions in the LVMWD region.
- La Niña is characterized by unusually cold ocean temperatures in the Equatorial Pacific resulting in decreased rainfall in the southern tier of the U.S. La Niña conditions can result in drought and increased danger from wildfires.

SECTION 3: RISK ASSESSMENT

The goal of mitigation is to reduce the future impacts of hazards. Hazards can result in injuries and the loss of life, cause property damage, disrupt the local economy, and force the expenditure of large amounts of public and private funds to assist with recovery. In order to focus efforts on the most likely and highest impact scenarios, mitigation must be based on a comprehensive Risk Assessment.

A Risk Assessment measures the potential loss from a hazard event by evaluating the vulnerability of buildings, infrastructure and people. It identifies the characteristics and potential consequences of hazards, how much of the community could be affected by a hazard, and the impact on community assets. Risk Assessments consist of:

- Hazard Identification and Risk Analysis
- Vulnerability Analysis / Loss Estimates

Note: This Risk Assessment presents loss estimates and provides a foundation for evaluating mitigation measures should a real hazard event occur. The loss estimates are intended to support the decision-making process for mitigation efforts.

It is important to note that the loss estimates calculated for this Risk Assessment used available data and methodologies and are approximate. These estimates should be used to understand the relative risk from hazards and potential losses and are not intended to be predictive of precise results.

Uncertainties are inherent in any loss estimation methodology arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary in developing vulnerability estimates (e.g., risk of loss projections and relative likelihood of occurrence). These factors can result in a range of uncertainty in loss estimates produced by this analysis.

DISASTER HISTORY

Emergencies and disasters can cause damage to the Las Virgenes Municipal Water District and the cities within the LVMWD Service Area Region. Natural disasters have occurred in the past and continue to have the potential for future events. While the risk of disasters cannot be eliminated, the effects can be reduced through a well-organized public education and awareness effort, preparedness and mitigation. In addition, the LVMWD must be prepared to provide efficient and effective response and recovery. Furthermore, careful planning and collaboration among public agencies, private sector organizations, and citizens within the community can minimize the losses that result from disasters.

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To illustrate the potential hazards to the region, a review of historical events can provide indicators for future threats to the area. The table below provides a summary of FEMA declared disasters occurring in Los Angeles County since 1995.

Disaster Number	IH Program Declared	IA Program Declared	PA Program Declared	HM Program Declared	Disaster Type	Incident Type	Title	Incident Begin Date	Incident End Date
4353	Yes	No	Yes	Yes	DR	Fire	WILDFIRES, FLOODING, MUDFLOWS, AND DEBRIS FLOWS	12/4/2017	
3396	No	No	Yes	No	EM	Fire	WILDFIRES	12/4/2017	12/29/2017
4305	No	No	Yes	Yes	DR	Flood	SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES	1/18/2017	1/23/2017
2851	No	No	Yes	No	FM	Fire	CROWN FIRE	7/29/2010	8/3/2010
1884	No	No	Yes	Yes	DR	Severe Storm(s)	SEVERE WINTER STORMS, FLOODING, AND DEBRIS AND MUD FLOWS	1/17/2010	2/6/2010
2830	No	No	Yes	No	FM	Fire	STATION FIRE	8/27/2009	9/25/2009
2828	No	No	Yes	No	FM	Fire	PV FIRE	8/27/2009	8/29/2009
1810	Yes	No	Yes	Yes	DR	Fire	WILDFIRES	11/13/2008	11/28/2008
2792	No	No	Yes	No	FM	Fire	FREEWAY FIRE COMPLEX	11/15/2008	11/20/2008
2791	No	No	Yes	No	FM	Fire	SAYRE FIRE	11/14/2008	
2789	No	No	Yes	No	FM	Fire	SESNON FIRE	10/13/2008	10/19/2008
2788	No	No	Yes	No	FM	Fire	MAREK FIRE	10/12/2008	10/17/2008
2763	No	No	Yes	No	FM	Fire	SANTA ANITA FIRE	4/26/2008	5/2/2008
1731	Yes	Yes	Yes	Yes	DR	Fire	WILDFIRES, FLOODING, MUD FLOWS, AND DEBRIS FLOWS	10/21/2007	3/31/2008
3279	No	No	Yes	No	EM	Fire	WILDFIRES	10/21/2007	3/31/2008
2736	No	No	Yes	No	FM	Fire	RANCH FIRE	10/20/2007	
2733	No	No	Yes	No	FM	Fire	BUCKWEED FIRE	10/21/2007	
2732	No	No	Yes	No	FM	Fire	CANYON FIRE	10/21/2007	
2708	No	No	Yes	No	FM	Fire	CANYON FIRE	7/7/2007	7/10/2007
2694	No	No	Yes	No	FM	Fire	ISLAND FIRE	5/10/2007	5/15/2007
2691	No	No	Yes	No	FM	Fire	GRIFFITH PARK FIRE	5/8/2007	5/11/2007
1689	No	Yes	No	Yes	DR	Freezing	SEVERE FREEZE	1/11/2007	1/17/2007
2583	No	No	Yes	No	FM	Fire	TOPANGA FIRE	9/28/2005	10/10/2005
3248	No	No	Yes	No	EM	Hurricane	HURRICANE KATRINA EVACUATION	8/29/2005	10/1/2005
1585	No	No	Yes	Yes	DR	Severe Storm(s)	SEVERE STORMS, FLOODING, LANDSLIDES, AND MUD AND DEBRIS FLOWS	2/16/2005	2/23/2005
1577	Yes	Yes	Yes	Yes	DR	Severe Storm(s)	SEVERE STORMS, FLOODING, DEBRIS FLOWS, AND MUDSLIDES	12/27/2004	1/11/2005
2535	No	No	Yes	No	FM	Fire	CA-CROWN WILDFIRE-07-21-2004	7/20/2004	7/23/2004
2534	No	No	Yes	No	FM	Fire	CA-FOOTHILL WILDFIRE-07-18-2004	7/17/2004	7/23/2004
2528	No	No	Yes	No	FM	Fire	CA - PINE FIRE - 7-13-2004	7/12/2004	7/21/2004

Disaster Number	IH Program Declared	IA Program Declared	PA Program Declared	HM Program Declared	Disaster Type	Incident Type	Title	Incident Begin Date	Incident End Date
1498	Yes	Yes	Yes	Yes	DR	Fire	WILDFIRES, FLOODING, MUDFLOW AND DEBRIS FLOW DIRECTLY RELATED T	10/21/2003	3/31/2004
2502	No	No	Yes	No	FM	Fire	CA-VERDALE FIRE 10-25-2003	10/24/2003	10/29/2003
2466	No	No	Yes	No	FM	Fire	CA - WILDFIRE (PACIFIC FIRE) - 01-06-2003	1/6/2003	1/10/2003
2464	No	No	Yes	No	FS	Fire	WILLIAMS FIRE	9/22/2002	9/29/2002
2462	No	No	Yes	No	FS	Fire	LEONA FIRE	9/3/2002	9/12/2002
2417	No	No	Yes	No	FS	Fire	CA - COPPER FIRE - 06-06-2002	6/5/2002	6/14/2002
1203	No	Yes	Yes	No	DR	Severe Storm(s)	SEVERE WINTER STORMS AND FLOODING	2/2/1998	4/30/1998
3120	No	Yes	Yes	Yes	EM	Fire	SEVERE FIRESTORMS	10/21/1996	10/31/1996
1046	No	Yes	Yes	Yes	DR	Severe Storm(s)	SEVERE WINTER STORMS, FLOODING LANDSLIDES, MUD FLOW	2/13/1995	4/19/1995
1044	No	Yes	Yes	Yes	DR	Severe Storm(s)	SEVERE WINTER STORMS, FLOODING, LANDSLIDES, MUD FLOWS	1/3/1995	2/10/1995

Source: FEMA

FEMA Disaster Declaration Key

Disaster Number Sequentially assigned number used to designate an event or incident declared as a disaster.
IH Denotes whether the Individuals and Households program was declared for this disaster
IA Denotes whether the Individual Assistance program was declared for this disaster.
PA Denotes whether the Public Assistance program was declared for this disaster.
HM Denotes whether the Hazard Mitigation program was declared for this disaster.
Disaster Type Two-character code that defines if this is a major disaster, fire management or emergency declaration.
Incident Type Type of incident such as fire or flood. The incident type affects the types of assistance available.

FEDERAL REQUIREMENTS FOR RISK ASSESSMENTS

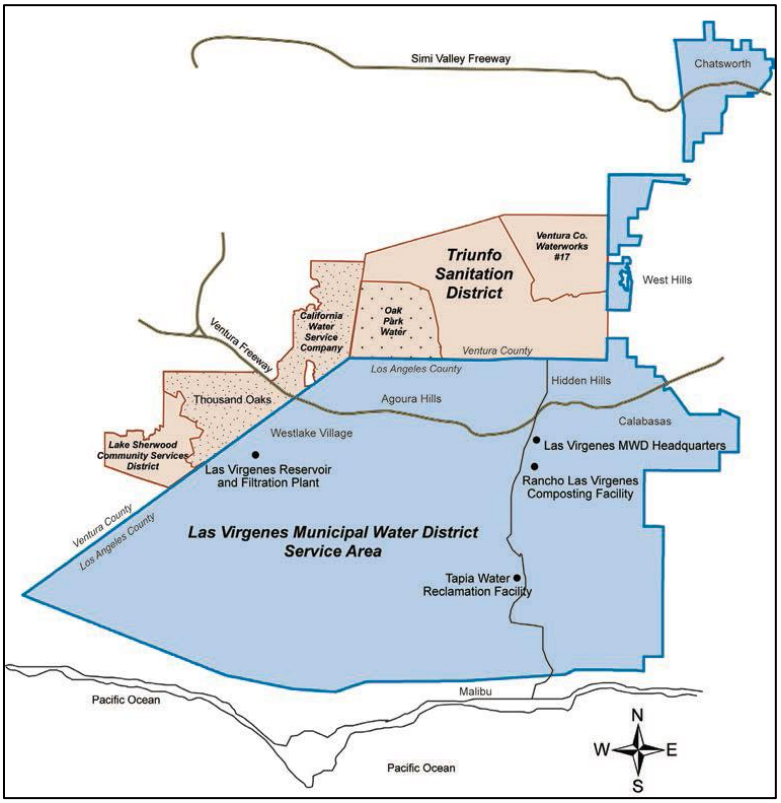
Federal regulations for hazard mitigation plans outlined in 44 CFR Part 201 include a requirement for conducting a Risk Assessment. This Risk Assessment requirement is intended to provide information that will help communities identify and prioritize mitigation activities that will reduce losses from the identified hazards. The hazards profiled in this mitigation plan, include: earthquakes, earth movement (including landslide), flooding, fires (including wildland and structural), windstorms and terrorism.

The Federal criteria for conducting Risk Assessments under 44 CFR Part 201 (Section 322 of the Stafford Act, 42 U.S.C. 5165) and information on how the Las Virgenes Municipal Water District Hazard Mitigation Plan meets those criteria are outlined below.

Section 322 Plan Requirement	How is this addressed?
Identifying Hazards	Each hazard section includes an inventory of selected available data sources that identify hazard areas. Maps identifying the locations of hazards in the LVMWD Region are provided in this Risk Assessment and in each individual hazard section, i.e., Earthquake, Wildfire, Wind, Landslide, Flood, and Terrorism.
Profiling Hazard Events	Each hazard section includes documentation of the history and causes and characteristics of the hazard in the Region.
Assessing Vulnerability: Identifying Assets	The “hazard identification” and “risk assessment” provide a summary of the vulnerability assessment from each hazard and (where data is available) the assets at risk.
Assessing Vulnerability: Estimating Potential Losses	The calculations of the impact of the hazard (if data was available), the economic exposure, and physical losses, are discussed in this Risk Assessment and under each hazard of this Hazard Mitigation Plan. Vulnerability assessments were completed for the hazards addressed in the plan, and quantitative estimates were made (when data was available) for each hazard.
Assessing Vulnerability: Analyzing Development Trends	The LVMWD Service Area Region Profile Section of this plan provides a description of the development trends in the Region including the geography, environment, and populations.

HAZARD IDENTIFICATION AND RISK ANALYSIS

Hazard identification consists of (1) defining the study area in terms of scale and coverage; and (2) collecting and compiling a list of prevalent hazards in the study area to help narrow the focus of the analysis. The figure below depicts the study area.



Map 3: LVMWD HMP Study Area

Identified Hazards

Based on the local area history and assessment of local risks, the following hazards are included in this Hazard Mitigation Plan:

- Earthquake
- Wildfire
- Climate Change (including Drought and Extreme Heat)
- Energy Disruption / Power Outage
- Landslide (including Earth Movement/Debris Flow)
- Windstorm
- Flood and Severe Winter Storm
- Terrorism

Each of these disasters can have widespread effects that include loss of life and property, disruption to critical infrastructure (utilities, communications, transportation, etc.), and economic impact to the area. Although terrorism is a threat, it is viewed as unlikely, however the lack of warning time and potential impact warrants inclusion into this HMP.

VULNERABILITY AND LOSS ESTIMATES

Assessing vulnerability is a three-step process. The first step is to identify existing structures and critical facilities that are located within the hazard area. Critical facilities are of particular concern because these facilities and infrastructure provide essential products and services to the general public that are necessary to preserve the welfare and quality of life in the Region and fulfill important public safety, emergency response, and/or disaster recovery functions.

Once existing structures are identified, the next step is to include an estimate of losses for the identified asset. Estimating potential loss involves assessing the damage, injuries, and financial costs likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models.

The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. The last step in assessing the Region's vulnerability to hazards is to analyze development trends in the Region.

The following loss exposures have been developed using HAZUS-MH base data in terms of the residential, commercial, and industrial properties at risk. For example if a major wildfire occurred and spread due to a lack of water resources.

NOTE: HAZUS-MH utilizes data at the block level from diverse sources such as the U.S. Census. Due to the data compilation process, estimates based on city boundaries are difficult to generate. Consequently, the HAZUS-MH data presented in this Risk Assessment groups some areas as indicated. Neighboring cities are included for reference purposes.

City Name	Total Exposure [$B]	Residential [$B]	Commercial [$B]	Industrial [$B]
Agoura Hills (including Agoura)	3.892	3.291	0.508	0.093
Calabasas / Hidden Hills	2.132	1.826	0.271	0.035
Westlake Village Area	2.25	1.661	0.522	0.067
Totals	**8.274**	**6.778**	**1.301**	**0.195**

Future Development Trends

The summaries below provide brief descriptions of development trends in the Las Virgenes Municipal Water District Service Area Region. Development trends provide an indication of future risk – either from urban area growth in previously undeveloped land (resulting in increased risk from wildfire, landslide, flood, etc.), changes in the building inventory, or increased population densities.

Agoura Hills Development Trends

Residential neighborhoods are fully developed and there are limited opportunities for infill development. From 2012 to 2016, the total number of residential housing units increased slightly by approximately 0.6% however there was a significant increase in the number of large units (3 or more units) and mobile homes.

Agoura Hills also contains multiple commercial zones and established business centers. The table below provides a summary of Commercial and Mixed-Use development and Residential projects in Agoura Hills (Source: City of Agoura Hills Development Summary, Department of Planning and Community Development, June 2018 2nd Quarter Report).

Commercial and Mixed-Use Projects

Status	Category	Acres	Use Square Feet	No. of Units / Lots / Projects
In Review	Commercial - New	64.85	360,103	6
	Commercial - Additions	9.72	15,740	2
	Commercial – Rebuild	17.57	3,600	213
	Commercial – Remodel	3.7	2,800	2
	Residential - New	N/A	162,681	N/A
	Subdivision	N/A	N/A	N/A
	Outdoor Use	N/A	5,800	1
Approved	Commercial - New	30.54	549,926	7
	Commercial - Additions	1.33	744	1
	Commercial – Rebuild	0	0	N/A
	Commercial – Remodel	12.75	134,098	3
	Residential	N/A	118,878	110
	Subdivision	4.22	N/A	3
	Outdoor Use	6.79	19,995	1
Completed	Commercial - New	1.93	21,782	1
	Commercial - Additions	0	0	N/A
	Commercial – Rebuild	0	0	N/A
	Commercial – Remodel	1.86	3,400	1
	Residential - New	0	0	N/A
	Subdivision	0	0	N/A
	Outdoor Use	0	0	N/A

Residential Projects

Status	Category	Acres	Square Feet	No. of Units / Lots
In Review	New Construction	10.12	16,563	3
	Room Additions	3.08	5,324	3
	Subdivision	0	0	0
	Other	0	0	0
Approved	New Construction	62.34	53,096	9
	Room Additions	1.52	27,295	4
	Subdivision	0	N/A	0
	Other	0	0	0
Completed	New Construction	1.52	8,805	2
	Room Additions	0.48	938	1
	Subdivision	0	0	0
	Other	0	0	0

Calabasas Development Trends

Most developable areas within the City are already built out and the majority of undeveloped land will remain undeveloped due to environmental constraints and terrain limitations. From 2012 to 2016, the total number of residential housing units increased by approximately 4% with the greatest growth in structures in 1-unit attached and multi-unit structures. Although the City is mainly residential, there are a number of established commercial business parks and shopping centers. The table below provides a summary of pending and current development projects in Calabasas (Source: City of Calabasas Projects, Plans & Reports in the City of Calabasas as of 9/25/2018 http://www.cityofcalabasas.com/projects.html).

Name	Location	Description	Number of Units	Size
Audi Calabasas	24650 Calabasas Road	Remodel and Addition to an Existing Audi Calabasas auto dealership	Auto Dealership Expansion	Approximately 111,608 square feet to the existing 35,058 square foot site
Avanti	23500 Park Sorrento	Mixed use development including 80 condominium units (two-and three-bedroom units) and 8 one-and two-bedroom affordable rent units. On-site amenities including: pool, club house, outdoor recreation, etc.	88 Residential Units	212,400 square-feet 10,700 square-feet of commercial use space with 294 parking spaces

Name	Location	Description	Number of Units	Size
Calabasas Hilton Garden Inn Expansion	4150 Park Sorrento	Proposed expansion to be built behind an existing three-story, 141-room hotel (Calabasas Hilton Garden Inn	Detached three-story, 51-room structure	28,787 square feet
Las Virgenes Road / Thousand Oaks Blvd. Commercial Center	5741 Las Virgenes Road	Commercial Center	Two-One Story Buildings	45,040 square-feet
The Paxton Calabasas Project	4240 Las Virgenes Road	Residential development on 5 acres of a 21-acre site (16 acres will remain open space)	78-unit townhome	21-acre site
Raznick Mixed Use	23480 Park Sorrento	Commercial Mixed Use (CMU), Age Restricted (55 years old or over) Apartment Complex and Retail	42 Residential Units 1,620 Retail square feet	0.92 acres
Rondell Oasis Site	26300 Rondell Street	3-story self-storage facility and associated office	Storage Facility	67,177 square-feet
West Village Calabasas	4790 Las Virgenes Road at the eastern terminus of Agoura Road (APNs: 2069078009; and 011)	The proposed project involves the development of residential, commercial, and public open space/trail uses on an undeveloped site. The residential component includes 15 three-story multifamily housing buildings. Each building would provide 12 dwelling units for a total of 180 units. The commercial component consists of a 5,867 square-foot retail center.	180 Residential Units 5,867 Retail square feet	77.22 acres 66.1 acres preserved as open space

Hidden Hills Development Trends

Hidden Hills is a fully developed master planned residential community with a small restricted commercial zone (a single real estate office). Any further development or home modifications must be approved by the Hidden Hills Community Association Architectural Committee. As a result, minimal or no new development is anticipated.

Westlake Village

Westlake Village is a master-planned community with an array of housing types including: townhomes, condominiums, mobile homes, single-family and lakefront residences, and view-oriented estates. From 2012 to 2016, the total number of residential housing units increased by approximately 5.5% with 5 to 9 unit structures exhibiting the greatest increase followed by 20 or more unit structures while mobile home, 3 to 4 unit, and 10 to 19 unit structures decreased. Within Westlake Village, there are approximately 866 commercial and light industrial businesses (Source: U.S. Census Bureau 2012 Economic Census of the U.S.). Future growth is controlled by the City Planning Department and City Council who work with active and organized homeowner's associations to maintain the high quality of development within the City.

Currently there are three current or proposed significant development projects in Westlake Village (Source: Westlake Village Planning Department, List of Current Projects as of 9/25/2018 https://www.wlv.org/212/Current-Projects).

Street Address	Occupant	Zone	Description
Westlake Village Inn 31943 Agoura Road, Westlake Village, CA 91361	Westlake Village Inn	CPD	Westlake Village Inn Spa Addition The City has approved an expansion to the Westlake Village Inn to include 16 new hotel rooms and a spa complex. As part of the project, the Planning Department conducted an Initial Study and determined that the appropriate document to comply with the California Environmental Quality Act is a Mitigated Negative Declaration. The original document has been revised and is being recirculated. It can be viewed by accessing the link below, in addition to plans for the approved project.
Thousand Oaks Blvd. and Lindero Canyon Road	TBD	CPD BP PI	Westlake Village Business Park Approximately 183 net acres (54 parcels) In May of 2011, the Ad-hoc Committee recommended a preferred development alternative to the City Council, at which time the City Council directed staff and The Arroyo Group to proceed with preparation of a Specific Plan utilizing the preferred development concept.
Calvary Community Church 5495 Via Rocas Westlake Village, CA 91362	Calvary Community Church	PI	Calvary Community Church Addition Calvary Community Church has submitted an application to construct 13,000 square feet of multipurpose space, 1,140 square feet of storage space, and a variety of landscaping and hardscape improvements to provide age specific playgrounds and recreational space.

Profiling Hazards

The Las Virgenes Municipal Water District serves the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village. Key infrastructure includes 24 major water tanks and 24 pumping stations, 10,000 acre-foot Las Virgenes Reservoir, and the Westlake Village Filtration Plant.

- The Las Virgenes Reservoir dam is located at 2860 Three Springs Drive, Westlake Village. The water filtration plant is located at 32601 Torchwood Place, Westlake Village. Water is also purchased from the Metropolitan Water District of Southern California (MWD).
- The LVMWD takes precautions to secure their facilities including fencing sites and securing facilities with alarms. Major facilities have security access gates locked 24/7 and a security company monitors and responds to alarms.
- The district has operating and response procedures to ensure that any potential interruption of services will be as short as possible. Further, the district has completed a Vulnerability Assessment as required by federal law to assess and mitigate any potential security issues.

The profiling hazards process describes the causes and characteristics of each hazard, how the selected hazard has affected the Las Virgenes Municipal Water District Service Area Region in the past, and what part of the population, infrastructure, and environment has historically been vulnerable to each specific hazard. A careful examination of hazard event profiles within the study area provides a reference point for understanding the potential impacts from future events.

Detailed profiles are provided in each of the individual hazard sections included in this plan:

- Section 6 Earthquake
- Section 7 Wildfire
- Section 8 Climate Change
- Section 9 Energy Disruption
- Section 10 Landslide
- Section 11 Severe Wind
- Section 12 Flood
- Section 13 Terrorism

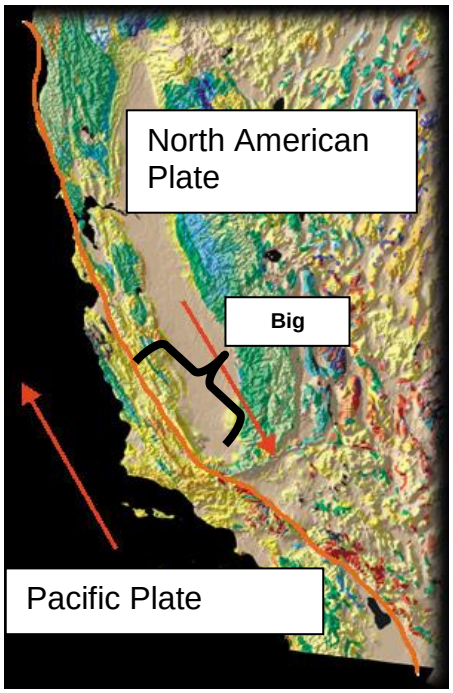
SECTION 4: EARTHQUAKE

THE NATURE OF THE EARTHQUAKE THREAT

Earthquakes occur at the boundaries of the Earth's tectonic plates as they move relative to one another. The tectonic boundary between the Pacific Plate and the North American Plate in California is along the San Andreas Fault. The fault is a transform boundary where the plates are sliding horizontally past one another.

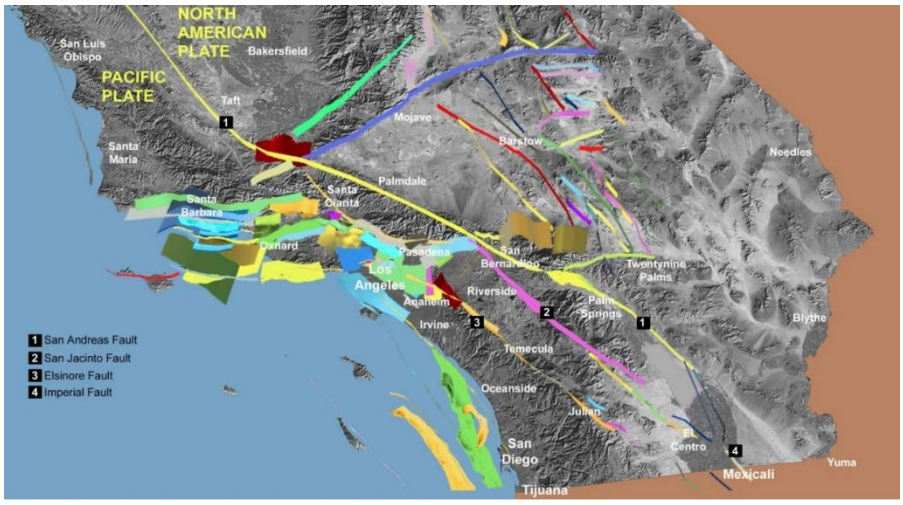
The risk of earthquakes in southern California is exacerbated by the fact that the two plates are inhibited in their motion by what is known as the "Big Bend". In this section of the San Andreas the fault curves to the west then curves back to the north. This creates a barrier to simple lateral motion. This bend is a convergent (restraining) bend, creating a localized collision of tectonic plates, generating a tremendous amount of compression stress.

To release this stress, additional faults have formed over time. The "Big Bend" of the San Andreas Fault is thought to be responsible for much of the complexity of faulting in Southern California



Map 4: San Andreas Fault "Big Bend"

The following map depicts several parallel faults to the San Andreas Fault. These four faults are considered to be responsible for approximately half of the significant earthquakes in the region (SOURCE: Southern California Earthquake Center - SCEC).



Map 5: Parallel Faults to the San Andreas Fault

HISTORICAL RECORD OF EARTHQUAKES IN SOUTHERN CALIFORNIA

Earthquakes occur *every* day in Southern California. Most are small with a magnitude less than M1. The table below provides examples of significant earthquakes in Southern California since 1857.

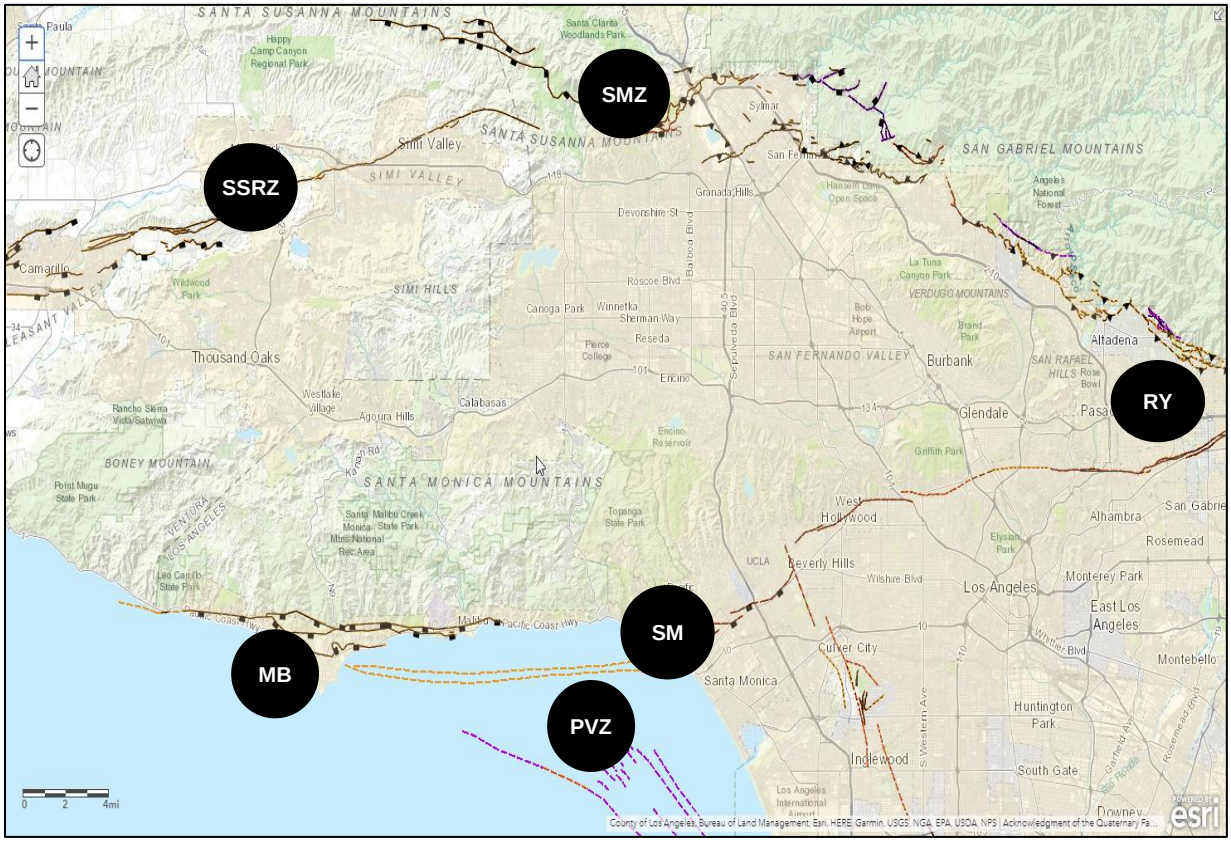
Date	Time	Location	Magnitude
01.09.1857	8:24 am	Fort Tejon	7.9
02.24.1892	11:20 pm	Laguna Salada	7.3
12.25.1899	4:25 am	San Jacinto/Hemet	6.7
04.21.1918	2:31 pm	San Jacinto	6.8
06.29.1925	7:42 am	Santa Barbara	6.8
11.04.1927	5:51 pm	Offshore Lompoc	7.1
03.10.1933	5:54 pm	Long Beach	6.4
05.18.1940	8:37 pm	Imperial Valley	6.9
04.10.1947	7:58 am	Manix	6.5
07.21.1952	3:52 am	Kern County	7.5
04.09.1968	6:29 pm	Borrego Mountain	6.6
02.09.1971	6:01 am	San Fernando	6.6
10.15.1979	4:16 pm	Imperial Valley	6.4
07.08.1986	2:21 am	North Palm Springs	5.7
10.01.1987	7:42 am	Whittier Narrows	5.9
11.24.1987	5:15 am	Superstition Hills	6.6
06.28.1991	7:43 am	Sierra Madre	5.8
04.22.1992	9:50 pm	Joshua Tree	6.1
06.28.1992	4:57 am	Landers	7.3
06.28.1992	8:05 am	Big Bear	6.3
01.17.1994	4:30 am	Northridge	6.7
10.16.1999	2:46 am	Hector Mine	7.1
12.22.2003	11:15 am	San Simeon	6.5
07.29.2008	11:42 am	Chino Hills	5.4
03.21.2009	1:12 pm	Salton Sea Bombay Beach	4.8
05.17.2009	8:39 pm	Inglewood	4.7
12.30.2009	10:48 am	Northern Baja	5.8
10.03.2010	4:04 am	Pico Rivera	4.4

SOURCE: Southern California Earthquake Center (SCEC) and Southern California Seismic Network

CAUSES AND CHARACTERISTICS OF EARTHQUAKES

Earthquake Faults In or Near the LVMWD Service Area Region

There are multiple fault zones in proximity to the LVMWD Service Area.



Map 6: Earthquake Faults in the LVMWD Region

Fault Map Code	Fault Name	Probable Magnitude	Length
MB	Malibu Coast Fault	6.0 – 7.0 M_w	21.1 miles
SM	Santa Monica Fault	6.0 – 7.0 M_w	15.0 miles
PVZ	Palos Verdes Fault Zone	6.0 – 7.0 M_w	49.7 miles
SSRZ	Simi-Santa Rosa Fault Zone	6.5 – 7.0 M_w	24.9 miles
SMFZ	Sierra Madre Fault Zone	6.0 – 7.0 M_w	46.6 miles
RY	Raymond Fault	6.0 – 7.0 M_w	16.2 miles

SOURCE: U.S. Geological Survey and California Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed 1/7/2010, from USGS web site: http//earthquakes.usgs.gov/regional/qfaults/

Although the San Andreas Fault is capable of producing an earthquake with a magnitude greater than 8, there are multiple “lesser” faults that are in closer proximity and have the potential to inflict greater damage to the LVMWD Service Area Region. For example, 6.5 M_W earthquake along the Malibu Coast Fault could result in more death and destruction than a “Great” quake on the San Andreas which is 40 miles away.

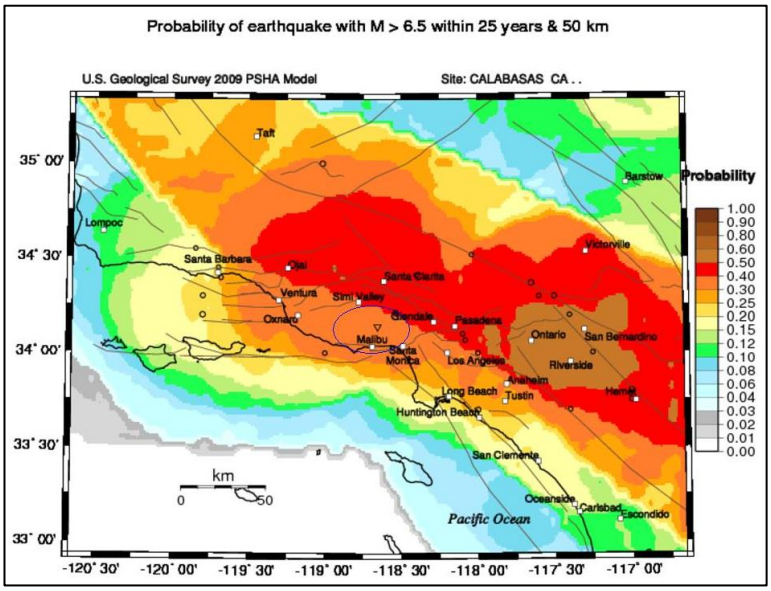
Earthquake Probability

According to the U.S. Geological Survey the probability within the next 30 years for the Los Angeles Region is:

- 60% that an earthquake measuring magnitude 6.7
- 46% that an earthquake measuring magnitude 7
- 31% that an earthquake measuring magnitude 7.5

In addition, according to the Earthquake Probabilistic Seismic Hazard Assessment (PSHA) model, there is a 30 to 40% chance that the region will experience an earthquake of magnitude 6.5 or greater within the next 25 years.

An earthquake of M6.5 or larger could cause a considerable number of casualties, as well as extensive damage to buildings, infrastructure, and critical facilities. The effects would be aggravated by aftershocks and secondary effects such as fire and landslides.



Map 7: Southern California PHSA Model (USGS)

In the event of a catastrophic earthquake, the capacity of the region to respond on its own would quickly become overwhelmed and assistance from surrounding municipalities, as well as the state and federal governments would be needed.

Following a major earthquake:

- Extensive search and rescue operations would be required
- The demand for emergency medical care would increase
- Food and temporary shelter would have to be provided for displaced people
- Infrastructure damage to dams, pipelines, storage facilities (potable and waste), and safe water supplies will be significantly impacted

Furthermore, it is likely emergency operations would be hampered by the loss of critical infrastructure and roads, damage to critical facilities, disruption of utilities, and communications disruptions. During the recovery period, extensive efforts would be required to remove debris, clear roadways, demolish unsafe structures, restore public utilities (including water supplies), and provide continuing care for the affected population including temporary shelters for displaced people. Finally, secondary issues such as hazardous materials releases and civil unrest could further strain resources.

EARTHQUAKE LVMWD HAZARD IDENTIFICATION

A major earthquake impacting the LVMWD Service Area will likely result in damage to structures and disruptions to critical infrastructure (roads, bridges, lifelines, etc.). The examples listed below provide brief descriptions of the types of damage that can be anticipated.

Lifelines

Lifelines include water, waste water, natural gas, electric power generation and distribution systems, fuel pipelines, and telecommunications systems. Ground shaking and amplification can cause pipes to break, power and telephone lines to fall, and damage cell phone and radio towers. A disruption to lifelines will hamper rescue, recovery, and rebuilding efforts as well as interrupt the distribution of important information to the public. Examples include:

- Ground shaking and ground deformation can damage pipelines and may rip many apart. Further, if soils liquefy pipelines may float or move laterally with the blocks of soil displaced by lateral spreading.
- Water pumping stations and wells are dependent on electrical power that may be unavailable in the days following an event.
- Damage to sewage pipelines can result in waste spills and failures.
- Power used by the LVMWD is transported via a system of high-voltage transmission lines. Electrical transmission lines (overhead lines, power poles, and underground utility conduits) and distribution facilities (substations) can be disrupted or damaged. Ground failures such as landslides could damage lines and may take months to repair depending on accessibility. In addition, large porcelain insulators, bushings, and transformers are vulnerable to moderate ground motions and damaged transformers may take months to replace. Redundancies built into the electrical grid should mitigate some of the impact; however, a major earthquake will almost certainly disrupt the local electrical grid.
- Communications systems are vulnerable to overload in the minutes and hours following a major event. The communications infrastructure is comprised in part of hard-wired telephone and cable TV systems, microwave transmission stations, cellular telephone systems, and radio systems. Cellular systems are dependent on the hardwired connections between cell towers and land-based telephone systems. Hardwired systems and the cell phone infrastructure are owned and operated by private companies such as AT&T, Verizon, and Charter.
- Damage to natural gas lines can result in fires or explosions as well as service disruptions.

Fire

Downed power lines or broken gas pipelines can trigger fires which can impact LVMWD facilities. Furthermore, multiple fire emergencies may occur simultaneously. Major incidents will demand a larger share of resources and smaller fires may receive little or insufficient resources. Also, it may be more difficult for fire departments to respond to fire emergencies if fire stations suffer building damage. Finally, loss of electricity may cause pump failures resulting in a loss of water pressure in some communities, further hampering firefighting efforts.

Economic Impact

The economic impact to the LVMWD includes direct property damage, lost business output and productivity, and loss of revenue (including long term loss of the local economic base).

Estimated Impact of an Event

If major wildfire were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure (pump stations)
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 50% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 50% Loss Occurs
Population	20,692	24,202	1,921	8,440	27,628
Total City Employment	11,200	11,900	-	13,886*	11,550
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$2,160,297,500
Total Housing Units	5,562	6,097	510	2,934	7,552

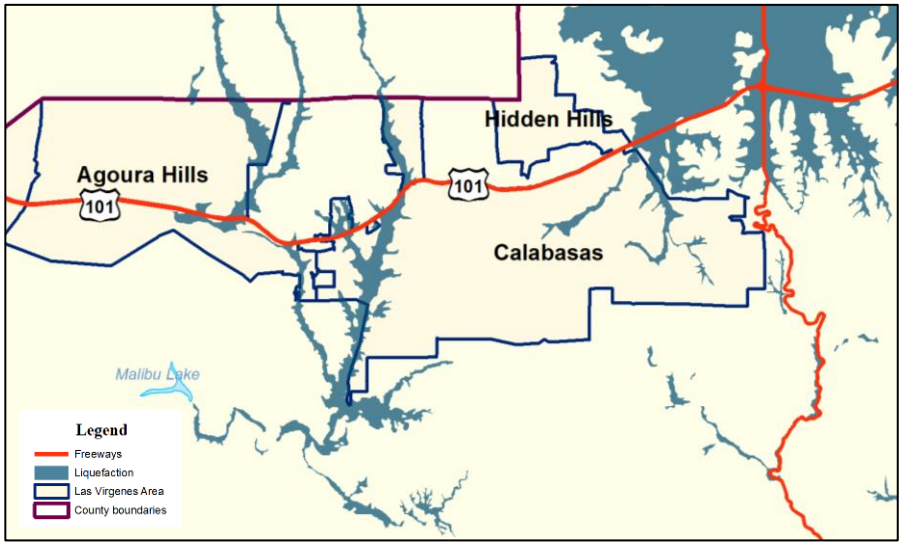
*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

EARTHQUAKE VULNERABILITIES

Liquefaction

Buildings above liquefiable soils may settle or tip due to a loss of bearing capacity of the soil. Liquefaction occurs when soil grains in loose, saturated silty, sandy, or gravel soils attempt to rearrange themselves in a denser configuration when subjected to strong earthquake ground motions. The resulting increase in pressure of the water in the voids of the soil temporarily transforms the soil into a fluid, causing the soil to lose much of its strength. As the pore-water pressure builds, ground water and liquefied soil may find their way to the surface, creating sand boils on the ground surface. Several types of damaging ground failures can occur due to liquefaction including lateral spreading, ground settlement and sink holes.

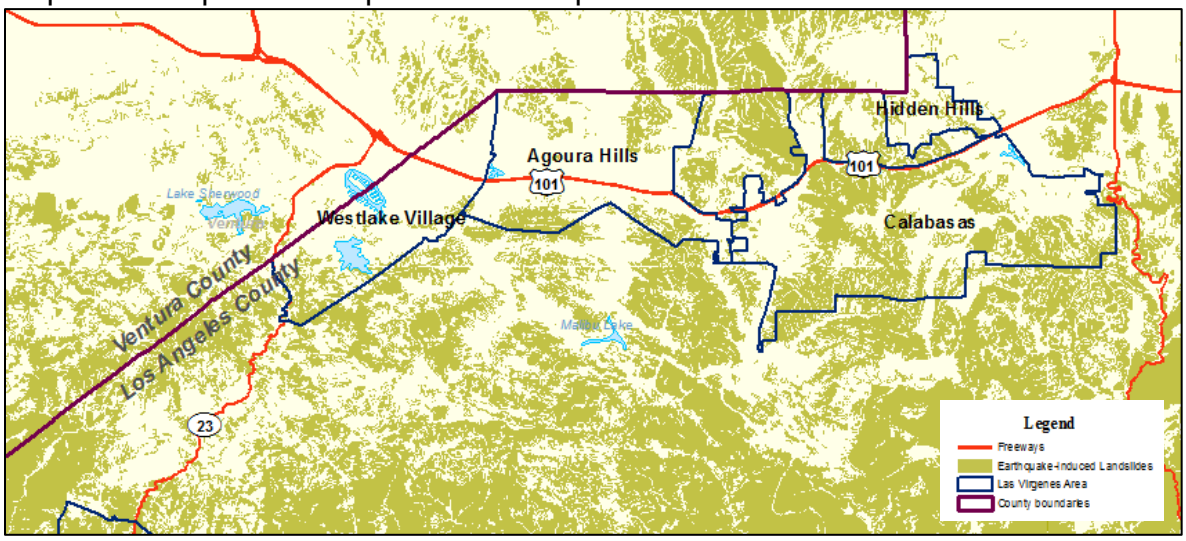
Lateral spreading occurs when the subsurface soil liquefies. Gravity and inertial forces from the earthquake cause the mass to move downslope. Lateral spreading can occur on very shallow slopes (nearly flat ground) and they can cause ground displacements ranging from inches to tens of feet. This type of movement can damage utilities, pipelines, and structures supported by shallow or deep foundations. In the LVMWD Service Area, portions of Calabasas and Agoura Hills are in liquefaction zones.



Map 8: Liquefaction Zones

Landslide

The severity of seismically induced landslides and related damage is dependent on the level of ground shaking and groundwater conditions at the time of the earthquake. The map below depicts areas prone to earthquake induced landslides.



Map 9: Potential Earthquake Induced Landslide Areas

EARTHQUAKE MITIGATION STRATEGIES

LVMWD Mitigation Activities

The LVMWD complies with the Los Angeles Region Uniform Code Program (LARUCP) Seismic Zone 4 requirements. These are more restrictive standards than required by the State of California Building Code. In addition, the LVMWD continues to evaluate and monitor its infrastructure for seismic safety and potential areas for improvement. Areas of focus include:

- Dams and Drainage
- Pipelines
- Pump Stations
- Waste and Reclamation Facilities
- Other Critical Infrastructure and Facilities

SECTION 5: WILDFIRE

THE NATURE OF THE WILDFIRE THREAT

Fire is a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities such as those that the LVMWD supports are built within or adjacent to hillsides and mountainous areas. Consequently, there is a significant potential for losses due to fire in the region (including wildland and urban fires). Furthermore, some of the LVMWD key infrastructure are located within wildfire zones.

HISTORICAL RECORD OF SIGNIFICANT FIRES

The table below provides a summary of the Top 20 Most Destructive Wildfires in California according to the California Division of Forestry and Fire Protection (CAL FIRE) as of September 2018 (not including the Woolsey Fire)

Top 20 Largest California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	*ACRES*	STRUCTURES	DEATHS
1	**MENDOCINO COMPLEX*** *(Under Investigation)*	July 2018	Colusa County, Lake County, Mendocino County & Glenn County	**459,123**	280	1
2	**THOMAS** *(Under Investigation)*	December 2017	Ventura & Santa Barbara	**281,893**	1,063	2
3	**CEDAR** *(Human Related)*	October 2003	San Diego	**273,246**	2,820	15
4	**RUSH** *(Lightning)*	August 2012	Lassen	**271,911 CA / 43,666 NV**	0	0
5	**RIM** *(Human Related)*	August 2013	Tuolumne	**257,314**	112	0
6	**ZACA** *(Human Related)*	July 2007	Santa Barbara	**240,207**	1	0
7	**CARR** *(Human Related)*	July 2018	Shasta County, Trinity County	**229,651**	1,604	7
8	**MATILIJA** *(Undetermined)*	September 1932	Ventura	**220,000**	0	0
9	**WITCH** *(Powerlines)*	October 2007	San Diego	**197,990**	1,650	2
10	**KLAMATH THEATER COMPLEX** *(Lightning)*	June 2008	Siskiyou	**192,038**	0	2
11	**MARBLE CONE** *(Lightning)*	July 1977	Monterey	**177,866**	0	0
12	**LAGUNA (POWERLINES)**	September 1970	San Diego	**175,425**	382	5
13	**BASIN COMPLEX** *(Lightning)*	June 2008	Monterey	**162,818**	58	0
14	**DAY FIRE** *(Human Related)*	September 2006	Ventura	**162,702**	11	0
15	**STATION** *(Human Related)*	August 2009	Los Angeles	**160,557**	209	2
16	**ROUGH** *(Lightning)*	July 2015	Fresno	**151,623**	4	0
17	**McNALLY** *(Human Related)*	July 2002	Tulare	**150,696**	17	0
18	**STANISLAUS COMPLEX** *(Lightning)*	August 1987	Tuolumne	**145,980**	28	1
19	**BIG BAR COMPLEX** *(Lightning)*	August 1999	Trinity	**140,948**	0	0
20	**HAPPY CAMP COMPLEX** *(Lightning)*	August 2014	Siskiyou	**134,056**	6	0

*** Fires uncontained and totals are likely to change.**

*There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.
**This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.

9/5/2018

History of Fire Events in the LVMWD Service Area Region

The LVMWD Service Area has a long history of wildland fires. In fact, over the past 110 years nearly the entire region has been impacted by fire. Major fires since 2003 include the following events:

Name	Year	Estimated Acres	Structure Loss
Woolsey Fire	2018	96,949	1,643
Lost Fire	2008	167	0
Corral Fire	2007	4,901	53
Malibu Canyon Fire	2007	4,565	22
Sherwood Fire	2006	168	0
Topanga Fire	2005	24,175	323
Pacific Fire	2003	806	0

CAUSES AND CHARACTERISTICS OF WILDFIRES

Southern California has two distinct areas of risk for wildland fire. First, the foothills and lower mountainous areas which are often covered with scrub brush or chaparral. Second, the higher elevation mountains which are contain large forest areas. In fact, the magnitude of the 2003 fires that struck Southern California were the result of three primary factors: (1) severe drought, accompanied by a series of storms that produced thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that led to a build-up of brush and small diameter trees in the forests.

WILDFIRE HAZARD IDENTIFICATION

Urban/Wildland Interface Fires

The LVMWD Service Area is challenged by the increasing number of houses being built on the urban/wildland interface. The National Wildland Coordinating Group defines urban/wildland interface as “the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.

In terms of urban/wildland interface fires, there are three categories of concern:

- The classic urban/wildland interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas;
- The mixed urban/wildland interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings;
- Occluded urban/wildland interfaces exist where islands of wildland vegetation occur inside a largely urbanized area.

Very High Fire Hazard Severity Zones

For the purposes of describing the severity of fire hazard areas, the Los Angeles County Fire Department classifies areas according to criteria established in the State legislation commonly referred to as the "Bates Bill". The Bates Bill Process determines **V**ery **H**igh **F**ire **H**azard **S**everity **Z**ones (VHFHSZs) including Local Responsibility Areas (LRAs).

Very High Local Responsibility Areas (LRA)	Government Code 51175-89 directs the California Department of Forestry and Fire Protection (CAL FIRE) to identify areas of very high fire hazard severity zones within Local Responsibility Areas (LRA). Mapping of the areas, referred to as Very High Fire Hazard Severity Zones (VHFHSZ), is based on data and models of, potential fuels over a 30-50 year time horizon and their associated expected fire behavior, and expected burn probabilities to quantify the likelihood and nature of vegetation fire exposure (including firebrands) to buildings. Local Responsibility Area VHFHSZ maps were initially developed in the mid-1990s and are now being updated based on improved science, mapping techniques, and data. In late 2005 to be effective in 2008, the California Building Commission adopted California Building Code Chapter 7A requiring new buildings in VHFHSZs to use ignition resistant construction methods and materials. These new codes include provisions to improve the ignition resistance of buildings, especially from firebrands. The updated very high fire hazard severity zones will be used by building officials for new building permits in LRA. The updated zones will also be used to identify property whose owners must comply with natural hazards disclosure requirements at time of property sale and 100 foot defensible space clearance. It is likely that the fire hazard severity zones will be used for updates to the safety element of general plans.
Very High State Responsibility Areas (SRA)	The State Board of Forestry and Fire Protection classify areas in which the primary financial responsibility for preventing and suppressing fires is that of the state. These include: lands covered wholly or in part by timber, brush, undergrowth or grass, whether of commercial value or not; lands which protect the soil from erosion, retard run-off of water or accelerated percolation; lands used principally for range or forage purposes; lands not owned by the Federal government; and lands not incorporated. By Board regulations, unless specific circumstances dictate otherwise, lands are removed from SRA when housing densities average more than 3 units per acre over an area of 250 acres.
Very High Federal Responsibility Areas (FRA)	The State and Federal Agencies jointly develop and review the Annual Operating Plan for the protection of Federal Responsibility Areas (FRA) located within State DPAs. As identified in the Annual Operating Plan, the State provides wildland fire protection at a level, which is most nearly equivalent to the wildland fire protection that would be provided directly by the Federal Agencies on FRA of equal hazard, risk, and value. Federal Agencies retain all land management responsibilities except for wildland fire protection on FRA within the area where the State has direct protection responsibility. This does not preclude the Federal Agencies from conducting fire prevention activities on these lands.

An assessment of the overall probabilities of wildfire in the LVMWD Service Area is provided in the Wildfire Probabilities section.

Per the Bates Bill, the following factors are used to determine the Very High Wildland Fire Hazard Severity Zones in the area.

- Fuel
- Topography
- Dwelling density
- Weather
- Infrastructure
- Fire codes and ordinances as they relate to brush issues

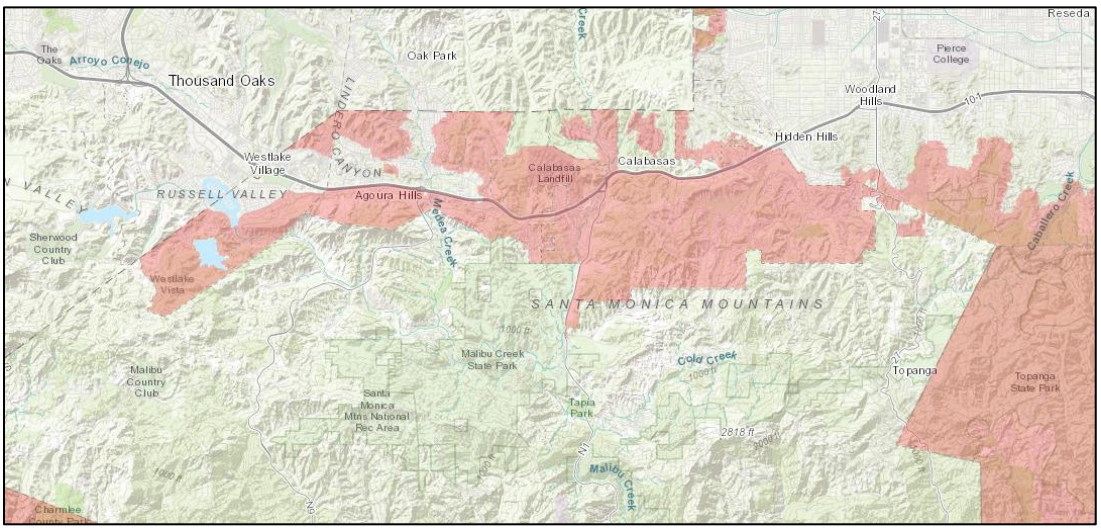
Each factor was given a value of 1-4 with a 4 being the highest danger rating. Any total score over 10 qualified the area as being one of VHFHSZ. Each of the three areas evaluated rated 10 or above with the highest area receiving a 12.

All five cities within the LVMWD Service Area have been designated as VHFHSZs. Fire zone areas are rated on a scale of I – IV, with IV representing the most severe fire hazard zone. The Region contains both Zone III and Zone IV areas.

Identifying the hazard area as set forth above is the first step in assessing each city's vulnerability to wildland fires. Other key factors in assessing wildfire risk include:

- Ignition sources
- Building materials and design
- Community design
- Structural density
- Slope
- Vegetative fuel
- Fire occurrence
- Weather, as well as occurrences of drought

The map below depicts the Very High Fire Hazard Severity Zones Local Responsibility Areas (LRA).



Map 10: VHFHSZ LRA

Estimated Impact of an Event

If major wildfire were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure (pump stations)
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 20% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 20% Loss Occurs
Population	20,692	24,202	1,921	8,440	11,051
Total City Employment	11,200	11,900	-	13,886*	4,620
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$864,119,000
Total Housing Units	5,562	6,097	510	2,934	3,021

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

WILDFIRE VULNERABILITIES

Base Hazard Factors

In order to determine the "base hazard factor" of specific wildfire hazard sites and interface areas, several factors must be considered. Categories used to assess the base hazard factor include:

- Topography (location, characteristics and geography)
- Fuels
- Development (site/building construction and design, landscaping, defensible space, accessibility, etc.)
- Weather

Topography

Topography influences the movement of air, thereby directing a fire's course. In general, if the percentage of uphill slope doubles the rate of fire spread doubles. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Unfortunately, hillsides with hazardous topographic characteristics are also desirable, residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

Numerous canyons, saddles, and ridges in the VHFHSZ will also contribute to erratic fire behavior due to the funnel and subsequent acceleration effect it will have on wind traveling through the area.

Fuels

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression "dog-hair" thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

In addition, fuel is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading," or the amount of available vegetative fuel. In the region, there are several types of fuel including a large amount of chaparral and woodland vegetation that is a catalyst for fire activity.

Like much of Southern California, chaparral is a primary fuel prevalent in the region along with grasses, non-native vegetation and large trees such as junipers, palm, eucalyptus, pines, and locally prevalent oaks.

Added to this is the fact that a large percentage of the fuel beds in the Santa Monica Mountains contain dead and downed vegetation. This "die back" condition is due largely to drought conditions. These fuel beds are extremely receptive to ignition and spread of wildfires more quickly than live vegetation. This type of fuel mode is of particular concern when fires are wind driven, which can lead to short and long-range spotting - which can affect the entire region.

Development

Growth and development in scrubland and forested areas is increasing the number of structures in region. Wildfire has an effect on development, yet development can also influence wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation and use natural materials. There are many types of these homes within the Region that use vegetation as privacy barriers. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions make evacuation and firefighting difficult. Similarly, narrow and winding roads in these developed areas tend to make evacuation of civilians slow and difficult especially when fire resources are trying to gain access to the area utilizing the same roads.

Wildfire hazard areas are commonly identified in Regions of the urban/wildland interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control such as the surrounding fuel load, weather, topography, and property characteristics. Generally, hazard identification rating systems are based on weighted factors of fuels, weather and topography.

Within the cities in the LVMWD Service Area, increased development in and adjacent to naturally vegetated areas exposes additional structures to potential wildland fires. With sound construction practices, sufficient water flows, brush clearance and provision of adequate access the risk can be reduced.

Weather

Drought

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. Recent concerns about the effects of climate change (particularly drought) have contributed to concerns about wildfire vulnerability (see **Climate Change** section for additional details).

Drought also leads to less frequent irrigation which can contribute to wildfires. From 2007 to 2009 and again from 2012 to 2016 Southern California experienced severe drought conditions. This corresponds to the most recent years when significant wildfires have occurred.

Wind

High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The “Santa Ana” winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

The Southern California Region experiences Santa Ana Wind conditions typically in the fall months. This poses a threat in two ways. A fire starting in the LVMWD Service Area will spread rapidly and has the potential of overwhelming initial attack forces and destroying structures within minutes of ignition. A fire starting adjacent to the LVMWD Service Area could quickly burn into the area either by direct flame contact or by fire brands being carried by the winds and spotting onto structures or combustible vegetation.

Wind bends the flames to pre-heat the fuel ahead and can carry fire brands up to a quarter mile or more ahead of the flame front. The majority of catastrophic fires that Southern California has experienced have occurred in the months of September, October, and November when Santa Ana Winds typically occur. Wind is considered to be the primary factor that influences fire spread. Furthermore, severe wind gusts can

occur through local canyons and valleys, propelling and increasing the intensity of wildfires.

SCE Public Safety Power Shutoffs

High winds combined with severe wildfire risk increase the threat of power line related fires. Trees can fall onto power lines sparking a fire and wind-blown debris can cause sparks and ignite. In response, Southern California Edison (SCE) has issued public notices that it may de-energize selected power lines during these high risk periods. The SCE website states, "In alignment with its operational safety practices, we may proactively shut off power in high fire risk areas when extreme weather conditions present a clear and imminent danger to public safety. We take pride in service reliability; de-energizing customers is not something we take lightly and is only sparingly used in the most extreme conditions. This will only occur after exhausting a number of other operational practices."

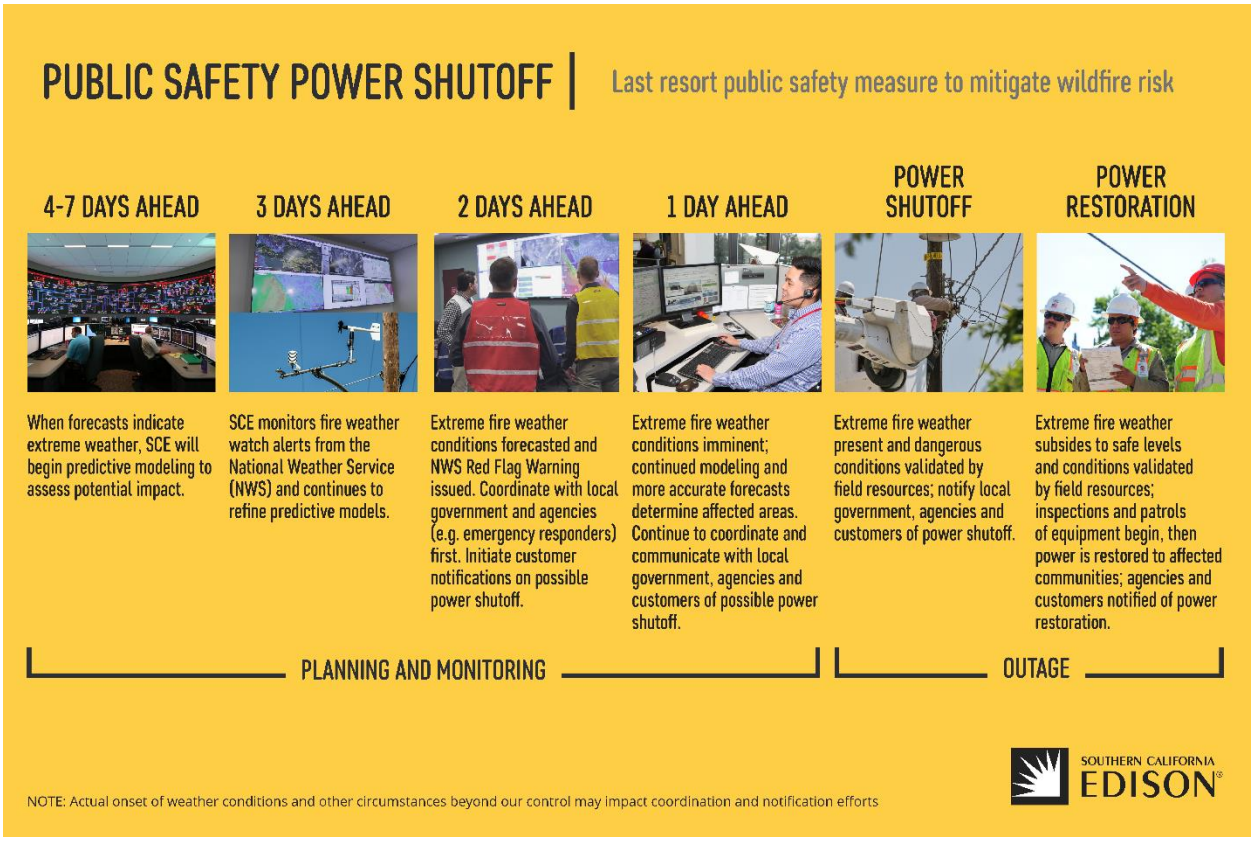


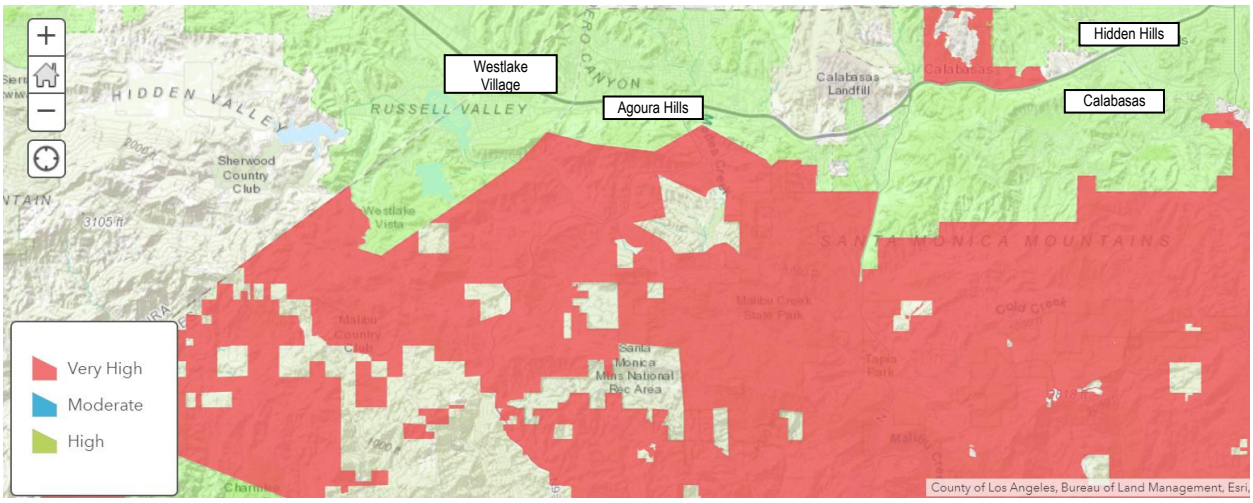
Figure 5: SCE Public Safety Power Shutoff Process

The Threat of Urban Conflagration

An urban conflagration could start either as a result of a lightning strike, arson, human error, earthquake or other phenomenon. Possible scenarios include a fire in planned community that quickly spreads to nearby homes due to a combination of high winds and high temperatures.

Wildfire Probabilities

Southern California and the cities within the Las Virgenes Municipal Water District Service Area are perennially under threat of wildfire. This situation will worsen as the impacts of climate change continue (see Climate Change section for additional details). Further, the National Interagency Coordination Center lists the potential outlook of fire for the Southern California region as "Above Normal" as of October 2018. The map below provides an overall view of the probabilities for wildfire in the water district in terms of **Very High**, **High**, and **Moderate** risk. The probability of wildfire for all cities within the LVMWD Service Area are classified as either High or Very High.

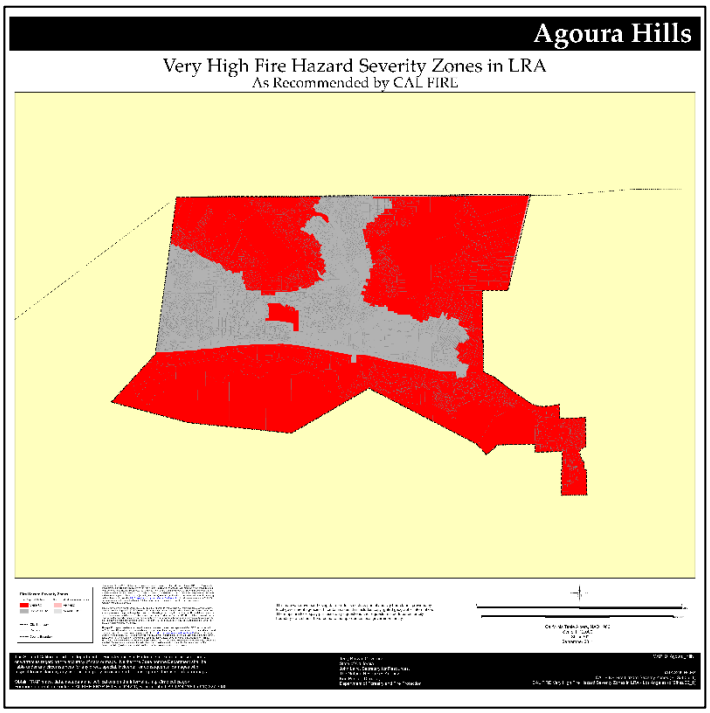


Source: Los Angeles County Fire Department (2018)

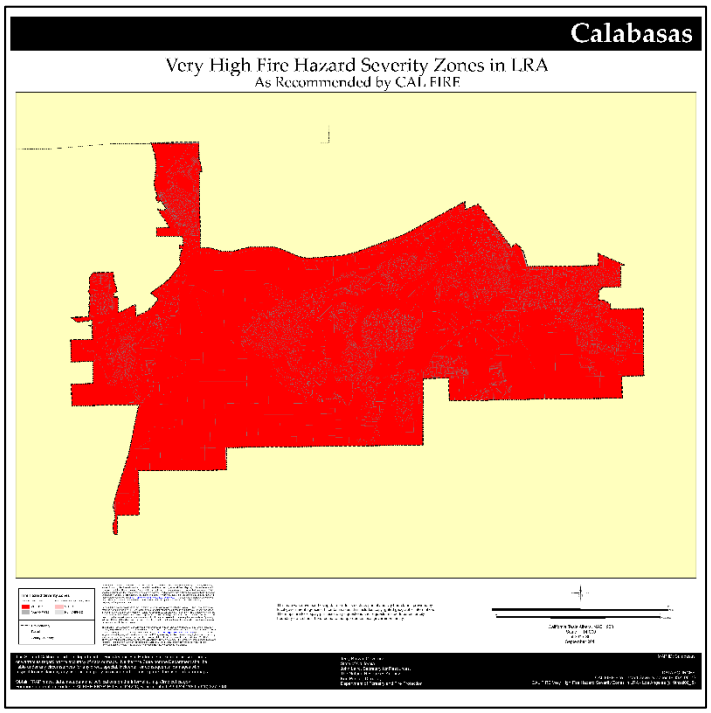
The Very High Fire Hazard Severity Zone section and maps on the following page (city VHFHSZ maps) provide a detailed assessment of the probable locations for wildfire within the LVMWD Service Area.

Map 11: Fire Hazard Severity Zones

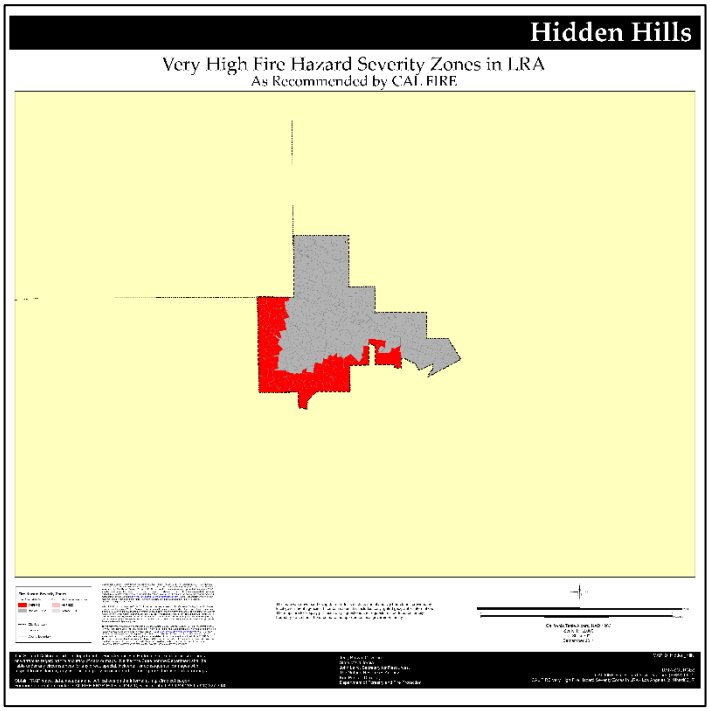
City VHFHZ Maps



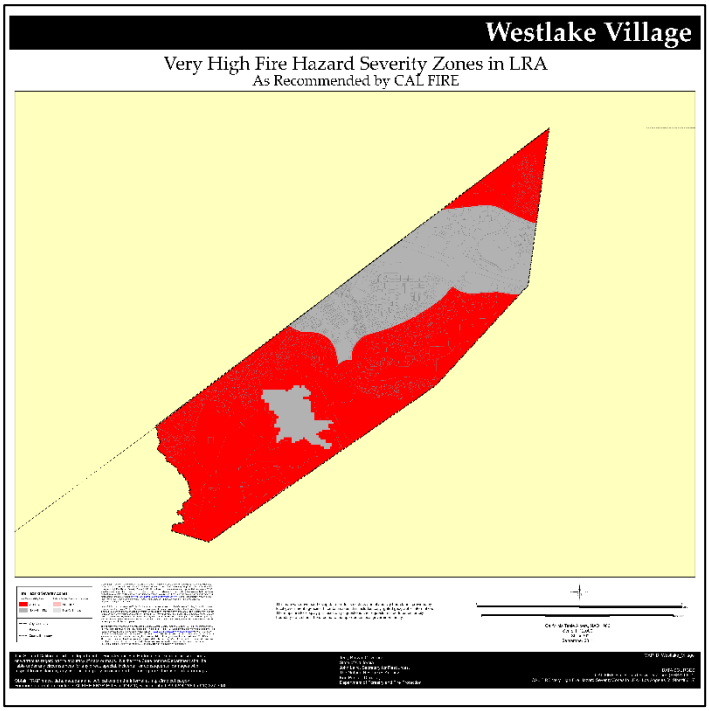
Map 12: City of Agoura Hills VHFHSZ LRA



Map 13: City of Calabasas VHFHSZ LRA



Map 14: City of Hidden Hills VHFHSZ LRA



Map 15: City of Westlake Village VFHSZ LRA

WILDFIRE MITIGATION STRATEGIES

Federal Programs

The role of the federal land managing agencies in the wildland /urban interface is to reduce fuel hazards on the lands they administer; cooperate in prevention and education programs; provide technical and financial assistance; and develop agreements, partnerships and relationships with property owners, local protection agencies, states and other stakeholders. These relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence.

Federal Emergency Management Agency (FEMA) Programs

FEMA is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland /urban interface is to encourage comprehensive disaster preparedness plans and programs, increase the capability of state and local governments and provide for a greater understanding of FEMA programs at the federal, state and local levels.

Fire Suppression Assistance Grants

Fire Suppression Assistance Grants may be provided to a state with an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property as well as encourage the development and implementation of viable multi-hazard mitigation measures. The grant may include funds for equipment, supplies and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for fires. The grants are cost-shared with states. FEMA's Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues and the USFA's National Fire Academy provides training programs.

Hazard Mitigation Grant Program

Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities to reduce the possibility of damages from all future fire hazards and to reduce the costs to the nation for responding to and recovering from the disaster.

National Wildland/Urban Interface Fire Protection Program

Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The Western Governors' Association (WGA) can act as a catalyst to involve state agencies, as well as local and private stakeholders, with the objective of developing an implementation plan to achieve a uniform, integrated national approach to hazard and risk assessment and fire prevention and protection in the wildland/urban interface. The

program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

U.S. Forest Service

The U.S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on forest lands. The USFS is a cooperating agency and, while it has little to no jurisdiction in the lower valleys, it has an interest in preventing fires in the interface, as fires often burn up the hills and into the higher elevation US forest lands.

Los Angeles County Fire Department

First Responders

The LVMWD is located in the Central Region, Division of the Los Angeles County Department (LACoFD). Battalion 5 of the LACoFD serves the Las Virgenes Region.

Operating 9 divisions and 22 battalions, LACoFD answers approximately 300,000 emergency calls annually. The Department currently has 169 fire stations, 68 paramedic squads, 9 wildland fire suppression camps, 10 bulldozers, 9 helicopters, 23 Prevention Offices, 12 Forestry Units and numerous other response vehicles and facilities. It serves 58 incorporated cities, as well as the unincorporated areas of the County. Additionally, the Department has Planning, Information Management, Lifeguard, and Health Hazardous Materials Divisions which provide valuable services to the more than 4.1 million people who reside in the 1.2 million housing units located throughout the Department's 2,305 square mile area. The LACoFD is one of six Contract Counties that maintain a contractual relationship with California Department of Forestry and utilizes the California Fire Plan within Los Angeles County as the primary wildland fire protection plan.

Fire Prevention Division

Fire prevention and code enforcement in this area historically requires concentrated efforts related to water supplies for fire protection and vehicular access for fire apparatus. Geographic and terrain limitations as well as the lack of water supply in mountainous terrain present challenges that LACoFD Inspectors review and inspect, often times providing alternative solutions for the owners/occupants to consider.

Special Operations Bureau

The Special Operations Bureau provides highly technical operational functions to County residents including Emergency Medical Services, Urban Search and Rescue, Hazardous Materials, Air Operations, Fire Camps for wildland firefighting, Heavy Equipment and central Dispatch.

Fire Prevention Programs

The Los Angeles County Fire Department manages an active effort in order to prevent the possibility of a wildfire occurring within region. The following list provides a sample of the programs, activities and practices.

Prescribed Burning
The health and condition of brush will determine the magnitude of wildfire. The LACoFD does practice prescribed burning. If fuels (slash, dry or dead vegetation, fallen limbs and branches) are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The results are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to remove these fuels.

Pre-Fire Management Plan
As a preventative measure, the LACoFD also implements a Pre-Fire Management Plan whose overall goal is to reduce the total cost and losses from wildland fires in California by protecting assets at risk through focused pre-fire management prescriptions and increased initial attacks.

Fuel Modification Plan
The Fuel Modification Plan is part of the Forestry Division of the LACoFD. This publication was prepared to establish a set of guidelines and landscape criteria for all new construction relating to fuel modification planning that will reduce the threat of fire in high hazard areas.

Vegetation Management Program
The Vegetation Management Program (VMP) is a cost-sharing program that focuses on the use of prescribed fire, mechanical, biological and chemical means for addressing wildland fire fuel hazards and other resource management issues on State Responsibility Area (SRA) and Local Responsibility Area (LRA) lands. The use of prescribed fire mimics natural processes, restores fire to its historic role in wildland ecosystems, and provides significant fire hazard reduction benefits that enhance public and firefighter safety.

The Los Angeles County Fire Department created the Vegetation Management Program in 1979 to develop strategies for responding to the growing fire hazard problem. These include:

- An ongoing effort to analyze the history of wildland fires in Los Angeles County
- Experimentation with different methods of reducing and removing fuels in fire prone areas
- Evaluation of the environmental impacts and effects of these practices

Brush Clearance Inspection Program

Mandated by the LA County Fire Code, all property owners in the region are presently required to maintain a firebreak around and adjacent to all buildings and structures by removing all flammable vegetation or other combustible growth for a minimum distance of 200 feet from the structure or to the property line, whichever is closer.

The Brush Clearance Program is a joint effort between the Los Angeles County Fire Department and the County of Los Angeles Department of Agricultural Commissioner/Weights and Measures, Weed Hazard and Pest Abatement Bureau (Weed Abatement Division). This unified enforcement legally declares both improved and unimproved properties a public nuisance, and where necessary, requires the clearance of hazardous vegetation. These measures create “Defensible Space” for effective fire protection of property, life and the environment. The Department’s Brush Clearance Unit enforces the Fire Codes as it relates to brush clearance on improved parcels, coordinates inspections and compliance efforts with fire station personnel, and provides annual brush clearance training to fire station personnel.

Fire Retardant Foam

All the Los Angeles County Fire Department fire engines are equipped with fire retardant foam capability. This type of program demonstrates the value of pre-suppression and prevention efforts when combined with property owner support to mitigate hazards within the wildland/urban interface.

Fire Codes

Fire codes have been amended throughout the years to assist fire department personnel with wildland firefighting in the rural/urban interface zones. Building construction in these areas may have additional requirements for non-combustible construction components and water supplies. Inspectors assigned to these regional offices provide developers and homeowners with information for fire safe construction and fire protection systems.

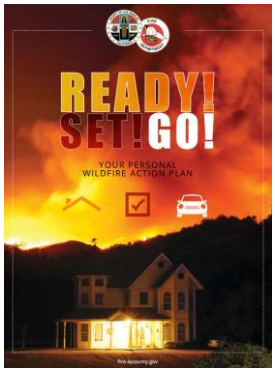
Building Codes

All cities in the LVMWD Service Area are located within the Very High Fire Hazard Severity zone (VHFHSZ). Class A roofing material and one-hour rated exterior construction of structures is required by Fire and Building Codes.

Public Education and Involvement

The Fire Prevention Division within the Los Angeles County Fire Department (LACoFD) focuses on educating the community about the benefits of proper safety practices and identifying and eliminating all types of hazardous conditions, which pose a threat to life, the environment and property.

Ready Set Go!



The Los Angeles County Fire Department promotes wildfire prevention, loss mitigation, and preparedness via its website, through public information campaigns, and neighborhood inspections. As part of this effort, the LACoFD has published a personal wildfire action plan for residents living in the interface region called Ready Set Go! The plan describes the actions and tools necessary to successfully prepare for a wildfire. It gives guidance on retrofitting houses with fire-resistive features and describes how to create the necessary defensible space around the home. This publication also helps families prepare well ahead of time so that they are ready to quickly evacuate from an area endangered by a fast-approaching wildfire.

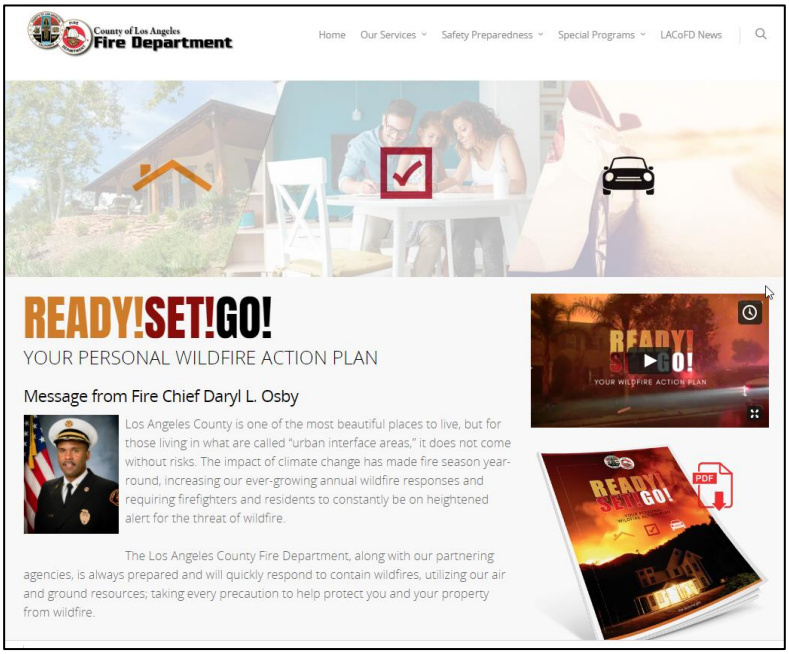


Figure 6: LACoFD Ready Set Go Web Page

BAER (Burned Area Emergency Rehabilitation)

The Los Angeles County Fire Department working in cooperation with the U.S. Forest Service, surveys burned areas after wildfires in order to determine what mitigation efforts are necessary to avoid mudslides in the event of a large rainfall (ex. strategically placing K-rails to deter mudslides) and to begin re-vegetation.

LVMWD Mitigation Activities

The LVMWD continues to focus on wildfire mitigation planning to support its operations and the local communities it serves. Key activities include:

- Brush Clearance and Tree Trimming Around LVMWD Facilities and Critical Infrastructure
- Emergency Power Generation to Support Key Pump Stations
- Ongoing Inspections and Assessments of All LVMWD Facilities and Infrastructure

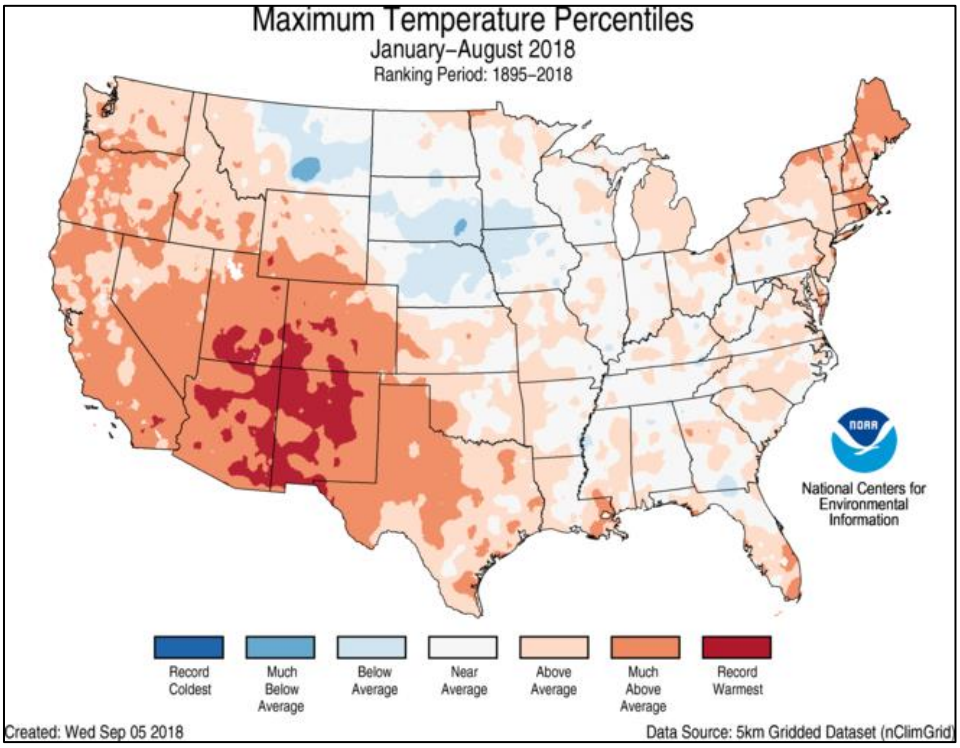
SECTION 6: CLIMATE CHANGE

THE NATURE OF THE CLIMATE CHANGE THREAT

According to "California's Fourth Climate Change Assessment" developed by the State of California, continued climate change will have a severe impact on California. Increased temperatures, drought, wildfires, and sea level rise are several of the main concerns related to climate change in the Southwest.

Temperature Rise

By the year 2100, the average annual maximum daily temperature is expected to increase 5.6° to 8.8° Fahrenheit. The resulting rise in temperature can result in power outages (from increased demands combined with limited supplies) as well as agriculture and livestock losses.



Map 16: Maximum Temperature Percentiles (1895-2018)

Water and Drought

By 2050, the water supply from the California snowpack is projected to decline by two-thirds. This will lead to water shortages of up to 16 percent in certain regions causing losses in agriculture as well as community water consumption restrictions.

Wildfire

By 2100, the frequency of severe wildfires is expected to increase, with a projected 77 percent rise in the average area burned statewide. In the areas that have the highest fire risk, wildfire insurance is estimated to see costs rise by 18 percent by 2055 (see **Wildfire** section for additional area specific information).

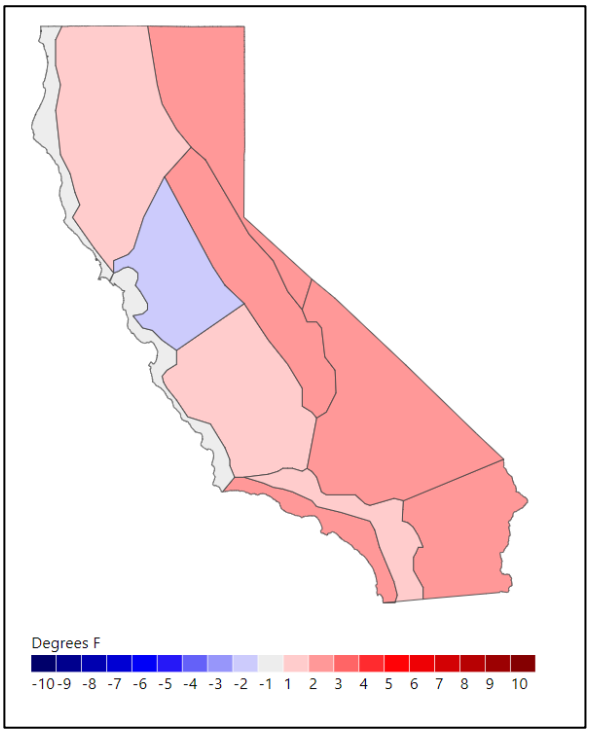
CLIMATE CHANGE AND DROUGHT HISTORY

Temperature

Overall, temperatures in the South Coast Region of California have fluctuated year-to-year but have shown a consistent increase since 2012. Furthermore, as of August 2018, the average temperature in the South Coast Region rose 2 degrees from the 1981-2010 average (CNAP California Climate Tracker). The table below provides a summary of the annual deviation from the average temperature from 1990 to 2017.

Year	Annual Mean Temperature (Fahrenheit)	Average (1895-2017)	Change
1990	63.77	63.44	0.33
1991	63.09	63.44	-0.35
1992	64.69	63.44	1.25
1993	63.71	63.44	0.27
1994	63.19	63.44	-0.25
1995	64.05	63.44	0.61
1996	64.67	63.44	1.23
1997	64.83	63.44	1.39
1998	62.14	63.44	-1.30
1999	62.48	63.44	-0.96
2000	63.40	63.44	-0.04
2001	62.37	63.44	-1.07
2002	62.54	63.44	-0.90
2003	63.89	63.44	0.45
2004	63.33	63.44	-0.11
2005	63.39	63.44	-0.05
2006	63.80	63.44	0.36
2007	63.37	63.44	-0.07
2008	64.19	63.44	0.75
2009	63.75	63.44	0.31
2010	62.15	63.44	-1.29
2011	62.13	63.44	-1.31
2012	64.14	63.44	0.70
2013	63.99	63.44	0.55
2014	66.42	63.44	2.98
2015	65.83	63.44	2.39
2016	64.91	63.44	1.47
2017	65.20	63.44	1.76

Source: Western Regional Climate Center



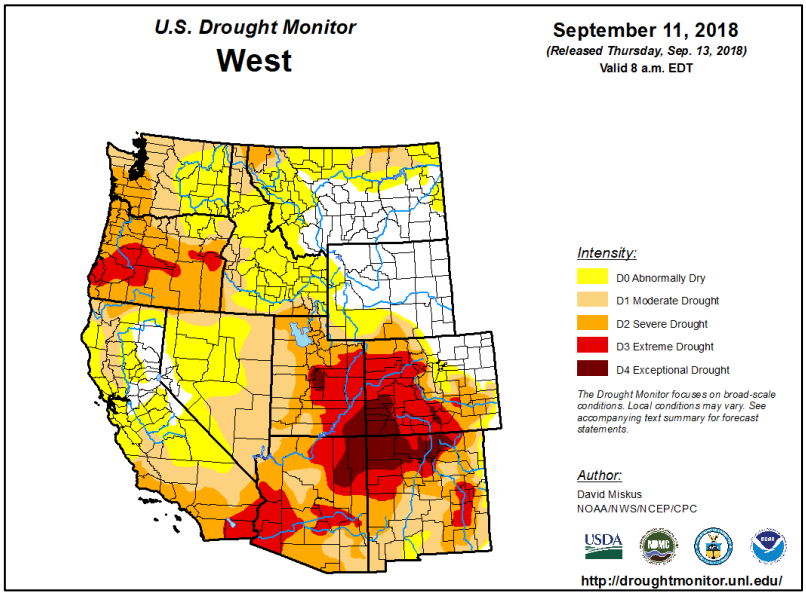
Map 17: CNAP Mean Temperature Departures from 1981-2010 Average

Source: The National Drought Mitigation Center, University of Nebraska-Lincoln

Drought

California is currently recovering from the last prolonged period of drought that lasted from 2012 to 2017 and again in the 2018-2019 season. Despite these periods of heavy rains, California and the Western U.S. remain in risk of severe drought.

In addition, historically since rainfall in the South Coast of California and the State in general has varied widely from year to year.



Map 18: Current Drought Western U.S. Status (2018)

The table below provides a summary of the rainfall variations from 1980 to 2017. Since 2011, average rainfalls have fallen short of the historical average (the annual average from 1895 to 2017 was 17.61).

Year	Precipitation (inches)	Percent of Average		Year	Precipitation (inches)	Percent of Average
1980	27.58	156.61		1999	8.14	46.21
1981	13.46	76.43		2000	14.80	84.04
1982	21.72	123.32		2001	21.16	120.15
1983	36.66	208.18		2002	9.00	51.08
1984	9.62	54.62		2003	15.39	87.37
1985	10.35	58.77		2004	19.77	112.25
1986	18.02	102.31		2005	27.77	157.68
1987	13.29	75.48		2006	14.97	85.03
1988	13.40	76.11		2007	7.40	42.03
1989	5.44	30.89		2008	16.77	95.23
1990	8.56	48.59		2009	11.03	62.62
1991	19.26	109.35		2010	28.06	159.31
1992	23.78	135.01		2011	14.21	80.71
1993	28.93	164.25		2012	11.44	64.93
1994	12.75	72.42		2013	5.39	30.60
1995	31.70	180.01		2014	10.86	61.68
1996	20.19	114.64		2015	7.77	44.11
1997	14.40	81.77		2016	13.46	76.44
1998	32.56	184.86		2017	14.91	84.66

Source: Western Regional Climate Center

CLIMATE CHANGE HAZARD IDENTIFICATION

LVMWD Service Area climate change hazards involve multiple threats including:

- Loss and/or Disruption to Water Supplies
- Increased Wildfires
- Extreme Heat (resulting in higher water demands)
- Power Outages (impacting facilities and pump stations)
- Increased Flood, Landslide, and Debris Flow Threats

Estimated Impact of an Event

Climate change has multiple consequences to local populations. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure from Wildfires, Subsidence/Sink Holes, Landslides, and Flood Inundation
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 10% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 10% Loss Occurs
Population	20,692	24,202	1,921	8,440	5,526
Total City Employment	11,200	11,900	-	13,886*	2,310
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$432,059,500
Total Housing Units	5,562	6,097	510	2,934	1,510

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

CLIMATE CHANGE VULNERABILITIES

In terms of vulnerabilities, the main concerns involve the impact of:

- Excessive Heat leading to:
  - Power outages
  - Heat-related health issues
- Drought and Limited water supplies causing:
  - Reduced water availability to the local community and residents
  - Livestock (including horses) and domesticated animal losses
  - Damage to local natural habitats
- Wildfire (see **Wildfire** section)

Climate Change Probabilities

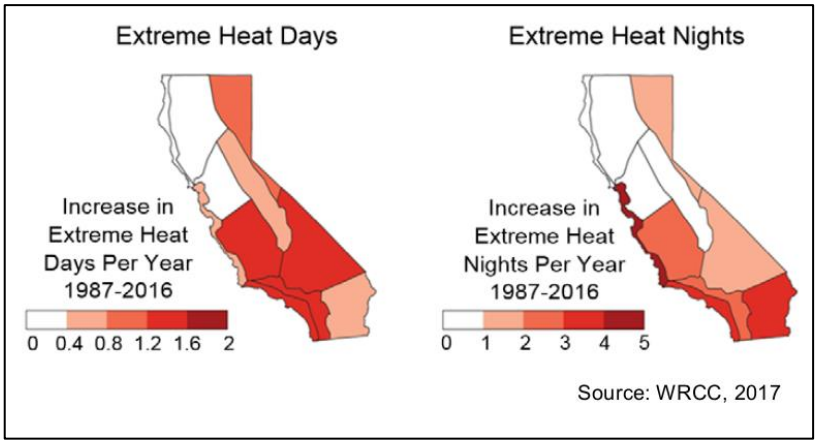
According to the Environmental Protection Agency (EPA), continued emissions of greenhouse gases will lead to further climate changes. Future changes are expected to include a warmer atmosphere, a warmer and more acidic ocean, higher sea levels, and larger changes in precipitation patterns. The extent of future climate change depends on what we do now to reduce greenhouse gas emissions. The more emitted, the larger future changes will be (Environmental Protection Center, 2015).

Temperature Rise

California can expect an increase in temperature in the future. A recent presentation by the California Public Utilities Commission, Policy & Planning Division [1] stated that extreme heat days in some cities in California are likely triple by 2030.

The Indicators of Climate Change in California report summarized trends in extreme heat conditions for the state.[2] The report indicated that the number of daytime heat waves varied year-to-year without a clear trend. However, nighttime heat waves increased in frequency over the past 40 years.

Regional Trends in Extreme Heat Days and Nights



Map 19: Regional Trends in Extreme Heat Days and Nights

[1] Douglas, Kristin, California in 2050: Some Sizzling Predictions, California Public Utilities Commission, Policy & Planning Division, 2017
[2] Milanes, et.al., Indicators of Climate Change in California, 2018.

Further, regional trends showed that the rate of increase in the number of extreme heat nights was twice that of the rate of increase in extreme heat days for most of Southern California. The graph on the following page depicts the number of Extreme Heat days by year from 1950 through 2005 with predictions to 2099.

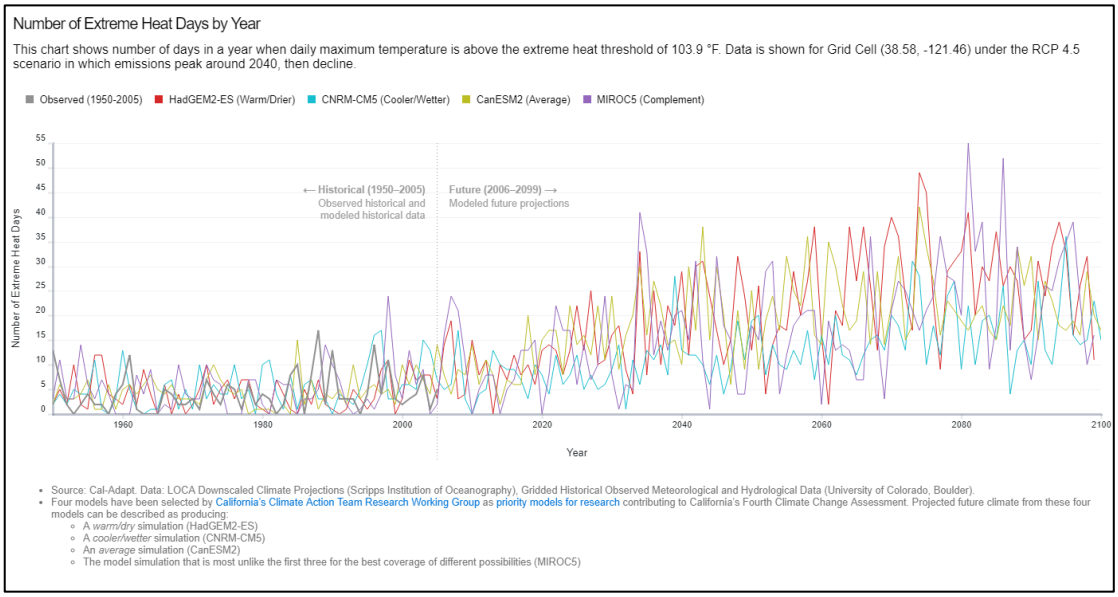


Figure 7: Number of Extreme Heat Days by Year

Source: Cal-adapt.org

Drought

Over the long-term, drought conditions in the Western U.S. are likely to continue for the foreseeable future as exemplified by the 2012 – 2016 drought (see previous Drought History section for additional details). Short-term, the region remains in Severe Drought status. Long-term, the region can expect lower than historical precipitation in the future. The chart below provides a predictive model of accumulated rainfall for the area from 2046 to 2047.

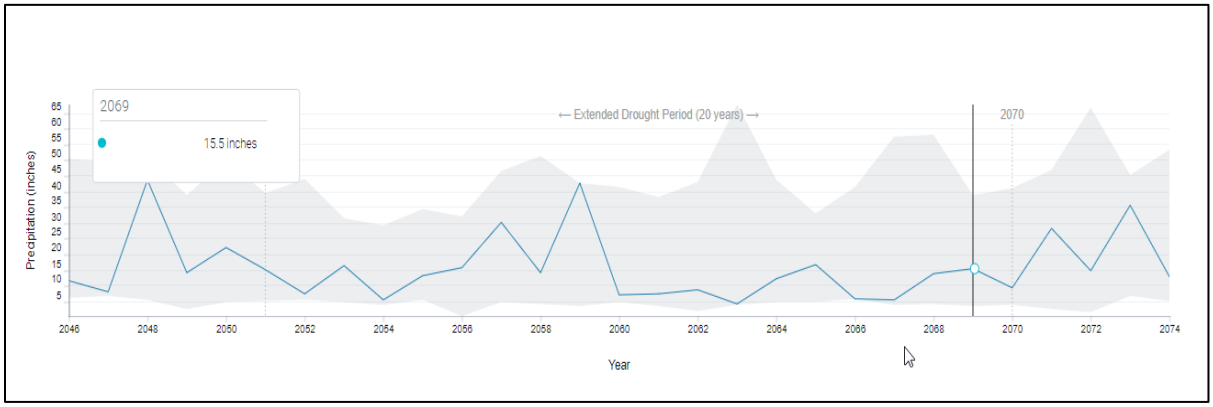


Figure 8: Extended Drought Scenario (2051 - 2070)

CLIMATE CHANGE MITIGATION STRATEGIES

State and Federal Water Management Operations

On January 17, 2014, Governor Jerry Brown Jr. declared a state-wide drought State of Emergency. Under the requirements issued by the Governor, specific water use restrictions were put into place and goals were established for communities to decrease water use (State of California, California Department of Water Resources, 2015). Key measures in the proclamation include:

- Asking all Californians to reduce water consumption by 20 percent and referring residents and water agencies to the Save Our Water campaign - www.saveourh2o.org - for practical advice on how to do so
- Directing local water suppliers to immediately implement local water shortage contingency plans
- Ordering the State Water Resources Control Board (state water board) to consider petitions for consolidation of places of use for the State Water Project and Central Valley Project, which could streamline water transfers and exchanges between water users
- Directing the California Department of Water Resources and the state board to accelerate funding for projects that could break ground this year and enhance water supplies
- Ordering the state water board to put water rights holders across the state on notice that they may be directed to cease or reduce water diversions based on water shortages
- Asking the state water board to consider modifying requirements for releases of water from reservoirs or diversion limitations so that water may be conserved in reservoirs to protect cold water supplies for salmon, maintain water supplies and improve water quality

As part of the State's drought response, a public website has been established to provide guidance and information on ways to save water http://saveourwater.com/. According to the State of California Drought Management Website (May 1, 2014) (http://ca.gov/drought/managementactions.html):

> *"the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) joined with the State Water Resources Control Board (State Water Board) to form a Real-Time Drought Operations Management Team. This multi-agency team has exercised flexibility to conserve and store water since late January and continues exercising flexibility in a manner consistent with State Water Project and federal Central Valley Project operations protocols and provisions for water contract shortages. The California Department of Fish and Wildlife (CDFW), the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) have coordinated closely with the Team and they have collectively worked to ensure that water management decisions do not unreasonably affect threatened and endangered species"* (State of California, 2014).

LVMWD Mitigation Activities

The LVMWD continues to promote climate change related mitigation planning to support its operations and the local communities it serves. Key activities include:

- Brush Clearance and Tree Trimming Around LVMWD Facilities and Critical Infrastructure to Reduce the Threat of Wildfires
- Leak Detection and Prevention to Reduce Water Loss to Maximize Water Resources (during drought conditions)
- Emergency Power Generation to Support Key Pump Stations

SECTION 7: ENERGY DISRUPTION

THE NATURE OF THE ENERGY THREAT

Energy is a critical dependency throughout the LVMWD Service Area Region. Sources of energy include electric power, natural gas, oil and fuel supplies. The focus of this section is on electric power disruptions.

The electric power system of North America is comprised of four major sections: the Quebec Interconnection, Eastern Interconnection, Western Interconnection and the ERCOT Interconnection. California is part of the Western Interconnection. Within each Interconnection there are interdependent power generators and transmission lines. As such, a failure in any part of an Interconnection can cause a widespread disruption to all or a major section of the electrical grid.

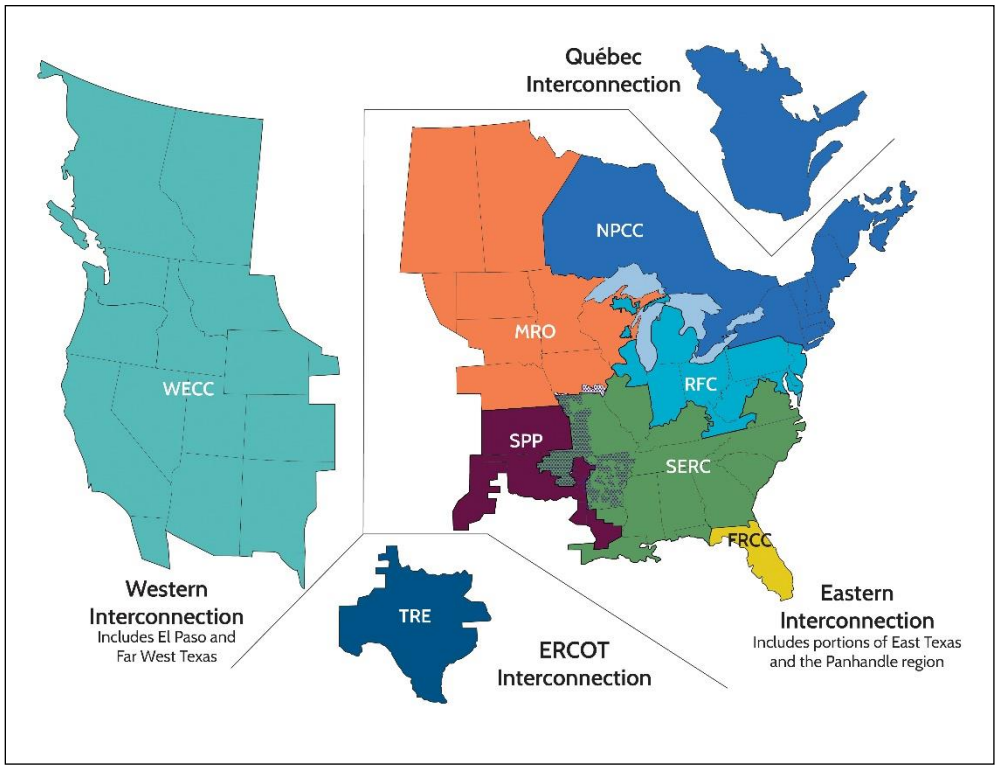


Figure 9: NERC Interconnections

Energy disruptions have a major impact on the public, businesses, and critical infrastructure. Such disruptions result from natural or human-generated disasters or be a result of other issues such as spikes in demand during peak energy use, unanticipated power plant shutdowns, transmission system congestion, and equipment or system failures.

HISTORICAL RECORD OF POWER OUTAGES

Energy disruptions have a major impact on the public, businesses, and critical infrastructure. Within Southern California and Los Angeles County, there have been incidents of major power outages in the past. The table below lists examples of major and minor power failures in the area since 1996 to depict the variety of causes and impacts from natural events, technology failures, and man-made incidents.

Event Year	Event	Affected Areas	Cause
1996	Western North American Blackouts	Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington and Wyoming, Alberta, British Columbia, and Baja California Norte in Mexico.	Man-made: trees too close to power lines caused systemic failures.
2000 – 2001	California Electricity Crisis	The State of California	Man-made: energy shortages caused by market manipulation, regulation and deregulation, price caps, supply and demand.
2004	Rolling Blackouts	Forced blackouts in local communities from Calabasas to Simi Valley.	Technology: Power company equipment failure.
2005	Los Angeles Blackout	The City of Los Angeles, West Los Angeles, San Fernando Valley, Hollywood	Man-made: human error
2011	Southwest Blackout	California – San Diego, Orange, Riverside, and Imperial Counties. Also affected states in Northern Mexico, as well as counties in Arizona.	Man-made: human error.
2011	Southern California Windstorm	More than 340,000 homes were without power in Los Angeles County including the San Gabriel Valley, Westchester, Highland Park, South Los Angeles, and the San Fernando Valley.	Natural: Downed trees caused by high winds brought down power lines resulting in major power outages in the region.
2013	Malibu Power Outage	More than 3,000 customers along Pacific Coast Highway lost power in a local outage.	Natural: Bird striking power lines.
2013	Los Angeles County Power Outage	Power outage impacting more than 69,000 homes in Los Angeles County including parts of Calabasas and Westlake Village.	Undetermined: Downed power lines.
2014	Pasadena Power Outage	Several thousand home and businesses in Pasadena experienced a prolonged blackout.	Man-made: Mylar balloon tangled in power lines.
2014	Los Angeles County Blackouts	More than 50,000 homes were without power in Los Angeles County.	Natural: Winter storms.

POWER OUTAGE HAZARD IDENTIFICATION

Electrical power is supplied to the LVMWD by Southern California Edison (SCE). Power outages can occur whenever there is a severe disruption to power generation facilities or the electric distribution network (for instance during a severe storm, earthquake, or wildfire).

In addition, human error is a potential risk. For example, on September 8, 2011 an Arizona Public Service (APS) employee is believed to have caused a major power outage that included Arizona and portions of Southern California including San Diego, Orange, and Imperial Counties. The outage impacted more than 5 million people. While the LVMWD was not impacted, this event demonstrates the potential for widespread power disruptions.

Furthermore, there is an ongoing risk of cyber-attack to the nation's critical infrastructure. On August 14, 2003, the MSBLAST worm (Blaster) and SoBig worms were suspected of causing a massive blackout in the Northeastern Interconnect impacting 50 million customers from the mid-west to the east coast.

CAUSES AND CHARACTERISTICS OF ENERGY EVENTS

Energy threats can be categorized into four types of events:[3]

- Natural disasters caused by nature (e.g., floods, wind, earthquakes)
- Accidental events caused by technological failure (e.g., pipeline rupture, chemical spills, nuclear system failure)
- Systemic threats caused by the physical inability of the energy delivery system (generation and distribution) to meet demand
- Deliberate attacks caused by people – (e.g. terrorists, criminals, hackers, delinquents, employees)

[3] The National Association of State Energy Officials (NASEO) *State Energy Assurance Guidelines*

Natural Disasters

Natural hazard events have the potential to cause disruptions in the energy supply. In the LVMWD Service Area, the following types of events can cause outages or other energy events:

- Drought
- Earthquakes
- Flooding
- Severe storms
- Subsidence
- Wildfires
- Windstorms

Accidental Events

Accidental events that cause energy disruptions can be due to technological failure, hazardous materials releases, pipeline rupture, nuclear system failure, accidental actions or inaction. Accidents can be a localized event such as a car crashing into a power pole or a local transformer incident or can be more widespread such as the Southwest Blackout of 2011 that was caused by an employee making repairs at an electrical substation. As the energy infrastructure ages, there is the possibility of equipment failure that can cause intermittent power or pipeline failures.

Systemic Threats

Systemic threats affect the entire energy distribution and production network, including production plants and distribution infrastructure. Systemic events occur when energy delivery systems are physically unable to meet demand. Examples of systemic threats include insufficient power generation capabilities during peak demand such as such as during a prolonged heat wave.

Deliberate Attacks

Deliberate attacks are intentional, malicious acts caused by people that are aimed at personnel, equipment, infrastructure, or computer systems (cyber-attacks). Many power plants and other infrastructure are remotely controlled by supervisory control and data acquisition (SCADA) systems. SCADA systems are vulnerable to attack by hackers who can access the system and perform acts of sabotage against a target, and an attack against SCADA can shut down an energy provider's operations. A deliberate attack such as a Denial of Service attack can slow or shut down a provider's Web site and make it difficult for customers to access personal or billing information.
In addition, physical attacks can target distribution points, transmission lines, and pipelines.

POWER OUTAGE HAZARD IDENTIFICATION

A large power outage in the region that happens during the hottest part of summer or the coldest part of winter will likely result in injury and in extreme cases – fatalities as well as disrupt key lifelines such as water supplies. An outage at any time will disrupt roads, highways, lifelines, public services, and the general health of local populations.

Lifelines

Many lifelines are dependent on power, including water pumping stations and sewage systems. A power outage will prevent these systems from running normally as they are reliant on electricity for operations. Examples include:

- Water pumping stations, wells, and sewage treatment plants are dependent on electrical power. While the pumping stations have backup generators in case of power outages, an extended outage may affect the ability of these stations to provide or preserve the safety of water.
- The telecommunications infrastructure is comprised in part of hard-wired telephone and cable systems, microwave transmission stations, cellular telephone systems, and radio systems. Industries dependent on the telecommunications sector include oil and gas, electric power, transportation, emergency services, government services, water, and banking and finance. Most telecommunications providers have backup power plans and agreements to procure the fuel needed to run during a power outage, although an extended outage may impede the ability of telecommunications providers to continue to deliver service to the dependent industries.
- Some gas and fuel pipelines may be dependent on electricity at pumping and filtering stations. Utility offices and command centers may be reliant on natural gas or other fuels to maintain continuity of operations.

Estimated Impact of an Event

If major power disruption were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Equipment (from power fluctuations)
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 20% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 20% Loss Occurs
Population	20,692	24,202	1,921	8,440	11,051
Total City Employment	11,200	11,900	-	13,886*	4,620
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$864,119,000
Total Housing Units	5,562	6,097	510	2,934	3,021

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

POWER OUTAGE VULNERABILITIES

The major concern regarding the impact on communities from power outage events is the failure of critical infrastructure and the danger to public health. Critical infrastructure failures may require days or weeks to repair. In addition, the impact to business and industry can result in immediate and long term economic loss.

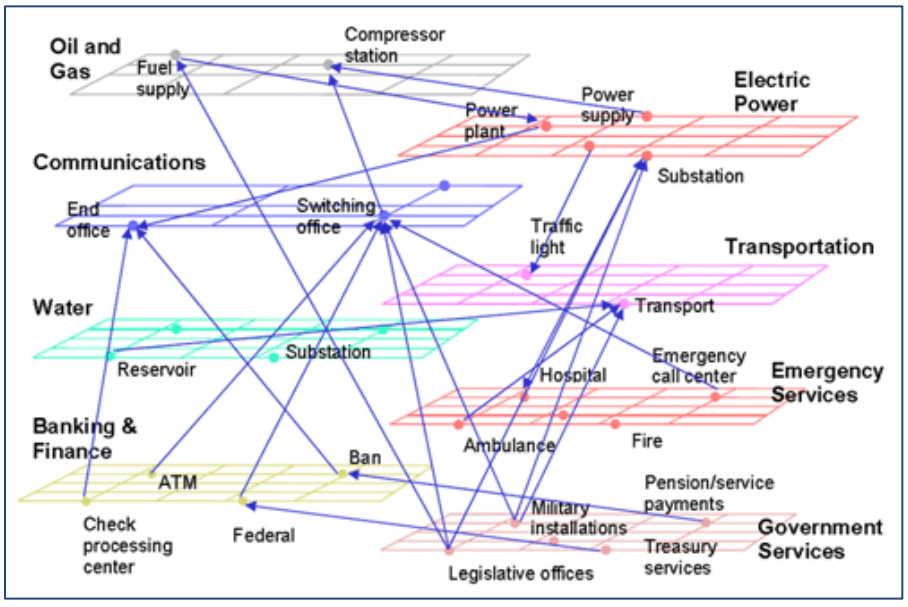


Figure 10: Infrastructure Interdependencies

Source: FCC Public Safety and Homeland Security Bureau

Critical Infrastructure

Critical infrastructure can fail during a power outage, especially if the event lasts longer than a few days. Outages will affect water and sewer systems, pipelines, transportation networks, emergency facilities, telecommunications systems, hospitals, and other essential sites. Power outages that last a few hours may only be an inconvenience as most critical infrastructure component have generators or backup power capabilities, but prolonged outages will affect the usability of generators and depend heavily on access to fuel sources. Finally, the failure of services such as the sewage system may pose a hazard to the health of the local community.

Many infrastructure components are dependent on each other. For example, pipelines depend on electricity, and while fuel can be used to run generators, once existing fuel supplies are depleted, it is difficult to procure new supplies without electricity. If gasoline is unavailable, transportation systems become unreliable. As a result, these "infrastructure interdependencies" can create larger issues the longer a power outage lasts.

ENERGY DISRUPTION MITIGATION STRATEGIES

SCE provides power to all cities within the LVMWD Service Area and is responsible for managing the power supply. To mitigate the threat of power outages, SCE has an emergency preparedness program in place to address pre- and post-disaster planning needs.

Additionally, SCE has included in their plans the need to communicate with the public during an outage. SCE also continually assesses the vulnerability of their system to hazards and takes steps to mitigate the risk. This includes contingency plans for shutting down parts of the electric distribution network in high risk wildfire conditions such as during periods of extreme wind.

LVMWD Mitigation Activities

The LVMWD continues to pursue mitigation actions to respond to the potential for energy disruptions. Such action is required to support its operations and the local communities that the LVMWD serves. Key activities include:

- Emergency Power Generation to Support Key Pump Stations
- Solar Power Implementation

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SECTION 8: LANDSLIDE AND DEBRIS FLOWS

THE NATURE OF THE LANDSLIDE THREAT

A landslide is defined as, the movement of a mass of rock, debris, or earth flow down a slope. Landslides are a type of "mass wasting" which denotes any down slope movement of soil and rock under the direct influence of gravity (FEMA). The term "landslide" encompasses events such as rock falls, topples, slides, spreads, and flows. Landslides can be initiated by rainfall, earthquakes, changes in groundwater, disturbance and change of a slope by man-made construction activities, or any combination of these factors. Underwater landslides can also occur causing tidal waves and damage to coastal areas.

The size of a landslide normally depends on the geology and the initial cause of the landslide. Landslides vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure and their composition and characteristics.

Landslides can be described as either: (1) rapidly moving (generally known as debris flows), and (2) slow moving. Rapidly moving landslides or debris flows present the greatest risk to human life. People living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Slow moving landslides can cause significant property damage but are less likely to result in serious human injuries (USGS).

Nationally, landslides (including mudslide and debris flows) cause 25 to 50 deaths each year. The best estimate of direct and indirect costs of landslide damage in the United States range between $1 billion and $2 billion annually (FEMA)[4]. As a seismically active region, California has had a significant number of locations impacted by landslides.

In addition to the potential loss of life, landslides can result in pipeline and critical infrastructure damage as well as private property losses, impact transportation corridors, break fuel and energy conduits, and disrupt communication facilities. Within the LVMWD Service Area there are areas that are susceptible to landslides and debris flows due to slope instability, fire activity, rainfall and the geologic make-up of the area.

[4] FEMA, Landslide Loss Reduction, A Guide for State and Local Government Planning, 1989

Debris Flow

A debris or mud flow is a river of rock, earth and other materials, including vegetation that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Debris flows can have speeds on the order of 20 mile per hour and can often move much faster (California Department of Conservation). This high rate of speed makes debris flows extremely dangerous to people and property in its path. In the event of a major landslide, debris flow can destroy roadway pavement and fill the storm drain catch basins. Any significant surface movement along streets will isolate residents and disrupt utilities in those areas. Although no significant debris flow resulting from landslide activity has been recorded in the LVMWD Service Area, it remains a possibility.

HISTORICAL RECORD OF LANDSLIDE EVENTS

History of Landslides, Debris Flows, and Mudflows in Southern California

The National Weather Service has documented the following significant flood triggered landslide, debris flows, and mud slide events in Southern California since 2010 (additional flood events are documented in the **Flood and Severe Winter Storm** section).

Date(s)	Weather	Adverse Impacts
12/17/2010 - 12/22/2010	A very wet period developed as strong westerly flow across the Pacific tapped a pool of deep subtropical moisture near Hawaii, resulting in days of moderate to heavy rainfall. Four to 12 inches of rain fell in the coastal and valley areas over six days, 12 to 28 inches in the mountains, up to 9 inches in the high desert and less than 4 inches in the lower desert.	Major landslides and flash flooding impacted the communities of Laguna Beach, Apple Valley, along the Whitewater Channel in the Coachella Valley near Palm Springs, Highland, Corona, Loma Linda, La Jolla, and the city of San Diego from 12.21 to this day. Qualcomm Stadium was flooded but was miraculously drained and prepared for the Poinsettia Bowl held there on 12.23.
8/17/2012	A massive thunderstorm dropped 5.36" of rain on Yucaipa Ridge.	Runoff caused several mudslides down the hill in Forest Falls, one was 5 feet deep.
8/30/2012	Thunderstorms erupted in the mountains above Cathedral City. A thunderstorm produced 1.53" in one hour at March AFB in Riverside.	Major flash flooding in Cathedral City included 1 to 2 feet of rapidly moving water, closing several roads. Water forced mud and debris into several businesses in town, causing significant damage. Flash flooding in Moreno Valley went into a few homes. A rescue was needed to save a stranded motorist. Several roads and freeways were closed because of water and/or mud.
12/13/2012	Heavy rain from a winter storm spread rainfall across the San Diego metro area of 1.25 to 2 inches.	The rain triggered an eight-ton, six-foot diameter boulder to roll into a Poway home. There were also numerous flood related issues on the roadways, including a few that required swift water rescues. High tide and flooding runoff combined to flood PCH in Seal Beach and Sunset Beach. Some garages were inundated.

Date(s)	Weather	Adverse Impacts
7/21/2013	Thunderstorms erupted across the mountains and deserts. Radar estimated two to four inches of rainfall in one hour for some of the storms.	The newly vulnerable burn scar of the Mountain fire got brief heavy rain on the 21st that produced a flash flood and a debris flow called an "ash flow." One of these flowed into a pond, displaced the water, and killed the resident fish. Several other desert roads near Sky Valley, Mecca, and Borrego Springs were rendered impassable from the water and debris. In Big Bear City, some of these floodwaters entered a few homes. In remote Anza Borrego Desert State Park, three vehicles were washed downstream.
8/23/2013	Heavy thunderstorms on the San Jacinto Mountains.	Debris and water came down from the Mountain Fire burn into Palm Springs.
9/6/2013 - 9/7/2013	Thunderstorms developed in the mountains and deserts and Inland Empire each day. Pea to dime sized hail and damaging winds also accompanied these storms.	On 9.6, mud and water covered the highway near Warner Springs, stranding multiple vehicles stuck in the mud. Minor road flooding near Pine Valley and just east of Lucerne Valley. On 9.7, normally dry Mill Creek near Forest Falls ran deep and wide, stranding campers. There was flooding in Campo, east of Julian, Ocotillo, and in Cathedral City along the Whitewater Wash.
2/28/2014 - 3/1/2014	A very wet storm was the only significant storm of the 2013-14 wet season. Rainfall ranged from 1 inch at the coast to up to 8 inches in the mountains. Up to 1 inch fell in the desert. Yucaipa Ridge measured over 11 inches.	Urban and flash flooding with mud/debris flows, causing numerous road closures and swift water rescues in and around Anaheim, San Diego-Fashion Valley, Escondido, Fallbrook and Lake Elsinore. Mud slides closed Hwy. 74 (Ortega Highway) stemming from the Falls Fire burn scar. Many road closures in the Coachella Valley where rivers saw rises of 2 to 5 feet, in some instances within 12 hours. On 3.1, flooding resulted in Oceanside, Temecula, Sea World San Diego, as well as minor street flooding in Mission Viejo.
8/12/2014	A heavy thunderstorm struck east of Julian.	A debris flow blocked Hwy. 78 east of Julian on the Banner Grade that was one to two feet deep. The Banner Fire burn scar contributed to this flow.
9/7-8/2014	Weakening Hurricane Norbert brought moisture to produce thunderstorms mainly in Riverside and San Diego Counties. Rainfall amounts of 1 to 2 inches fell over the city of Riverside, San Bernardino and Hemet, while the mountains in that county saw up to 0.60" near Sky Valley. Early morning thunderstorms on 9.8 drenched parts of the Coachella Valley which received 0.33" up to just over 3 inches near the lower foothill in Thousand Palms and La Quinta.	Widespread flash flooding, most notably in the Coachella Valley on 9.8. Mud and water closed roads and stranded vehicles in La Quinta, Palm Desert, and Thousand Palms. Homes in La Quinta were surrounded by water. Moving water was 3 feet deep on roads and 4 to 5 feet of standing water submerged vehicles. Mud was several feet deep on Varner Road.
12/3/2014 – 12/4/2014	A Pacific storm brought moderate to heavy rain. Two-day rainfall totals of 1-2" were recorded west of the mountains, while the southern slopes of the San Bernardino County mountains saw up to 5" of rain (isolated amount of 14.5" at Yucaipa Ridge).	Flooding resulted, with mud, debris and water closing several roadways and stranding vehicles. Mud with debris 10 feet high piled up on Soboba Rd. north of San Jacinto. A swift water rescue was needed.
7/6/2015	Monsoon thunderstorms hit the mountains and upper desert. A few spots received up to around one-third of an inch, including a portion of the Lake Fire burn area south of Big Bear Lake.	Several debris flows resulted, including one consisting mostly of ash and mud over portions of Highway 38, up to a foot deep in some areas.

Date(s)	Weather	Adverse Impacts
7/18/2015 – 7/19/2015	Moisture from Hurricane Dolores, along with monsoon moisture resulted in showers and thunderstorms over most Southern California. Rainfall ranged from 0.5-4", including a record 1.71" at San Diego on 7.18 (unprecedented rainfall: single-day and July monthly total). The San Diego River at Fashion Valley had 2 crests above monitor stage, 7.7 feet on the 18th and 8.8 feet on 7.19. On 7.19 over 6" of rain fell over several hours just west of Desert Center.	A debris flow hit the burn scar of Silverado Canyon. Flash floods hit Moreno Valley, Perris, and La Mesa on 7.19. A wet microburst struck Tierrasanta on 7.18, causing wind damage. A haboob caused wind damage in the Anza Borrego Park and in Palm Desert. The rain caused the first rain-out of a Los Angeles Angels baseball game since 1995, and a rare 2-hour rain delay at the San Diego Padres baseball game. Over 2000 lightning strikes were reported on 7.18, some starting small brush fires. Near Desert Center on 7.19 eastbound lanes of Interstate 10 collapsed where they crossed a heavily flowing wash. A vehicle drove into the hole in the collapsed bridge, trapping the driver and requiring rescue. I-10 was closed in both directions causing huge traffic backups.
9/15/2015	A Pacific trough tapped into remnant moisture from tropical cyclone Linda. 1-2" of rain was common across the entire region.	Major traffic jam during the morning commute in LA and Orange County, along with a debris flow in Silverado Canyon, and widespread urban flooding.
1/5/2016 – 1/7/2016	A strong, low latitude jet stream brought a series of storms through Southern California with periods of moderate to heavy rain. Three-day rainfall totals were around 2-7" for the coast, valley and foothill areas, and 1- 3" for the deserts. After several years of drought, this was the only precipitation event of significance during an otherwise disappointing strong El Niño season.	Flooding resulted nearly everywhere, with southwestern San Diego County being hardest hit. Floods buried cars in Ocean Beach and Mission Valley. High water rescues occurred on 1.6 around San Diego. Small mudslides, including boulders on highways were reported near Ramona, Redlands, Crestline, Orange, Rancho San Diego and De Luz. Three debris flows in Silverado Canyon below a burn scar.

2018 Southern California Mudflows

In January 2018, a series of mudflows occurred in the Los Angeles, Orange, Riverside, and Santa Barbara Counties. These mudflows occurred in areas that had previously experienced major wildfires. Subsequent rains resulted in multiple mudflow events. Specifically, the Montecito Mudslide caused 21 reported deaths, multiple injuries, and at least $177 million in property damage.[5]

1994 Northridge Earthquake Landslide Related Impact

As a result of the magnitude 6.7 Northridge, California, earthquake, more than 11,000 landslides occurred over an area of 10,000 km^2. Most were in the Santa Susana Mountains and in mountains north of the Santa Clara River Valley. The earth movement destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. It also caused deaths from Coccidioidomycosis (Valley Fever), the spore of which was released from the soil and blown toward the coastal populated areas. The spore was released from the soil by the landslide activity.

[5] Robert D. Niehaus, Inc., Preliminary Impact Assessment: Montecito Mudslides, 2018

Agoura Hills Landslides

Examples of landslide events in the City of Agoura Hills since 1990 include the Via Amistosa, Morrison Ranch, Liberty Canyon Slope Failure, Laura La Plante, Laro, and Chateau Park landslides. In 1999, Agoura Hills experienced the Kanan Slope Repair as a result of the El Nino storms of 1998.

CAUSES AND CHARACTERISTICS OF LANDSLIDES

Landslide Events and Impacts

Landslides are a common hazard in California. Weathering and the decomposition of geologic materials produces conditions conducive to landslides and human activity further exacerbates landslide potential. Many landslides are difficult to mitigate, particularly in areas of large historic movement with weak underlying geologic materials.

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. These rock falls are fast moving with materials free falling or bouncing down slopes. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage.

As communities continue to modify the terrain and influence natural processes, it is important to be aware of the physical properties of the underlying soils as they (along with climate) create landslide hazards. This is especially important with the demands placed on buildable land (particularly in urban areas) that increases the tendency to build on geologically marginal areas such as hillside lots.

LANDSLIDE HAZARD IDENTIFICATION

Landslides are often triggered by periods of heavy rainfall. Earthquakes, subterranean water flows, pipeline ruptures, and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events.

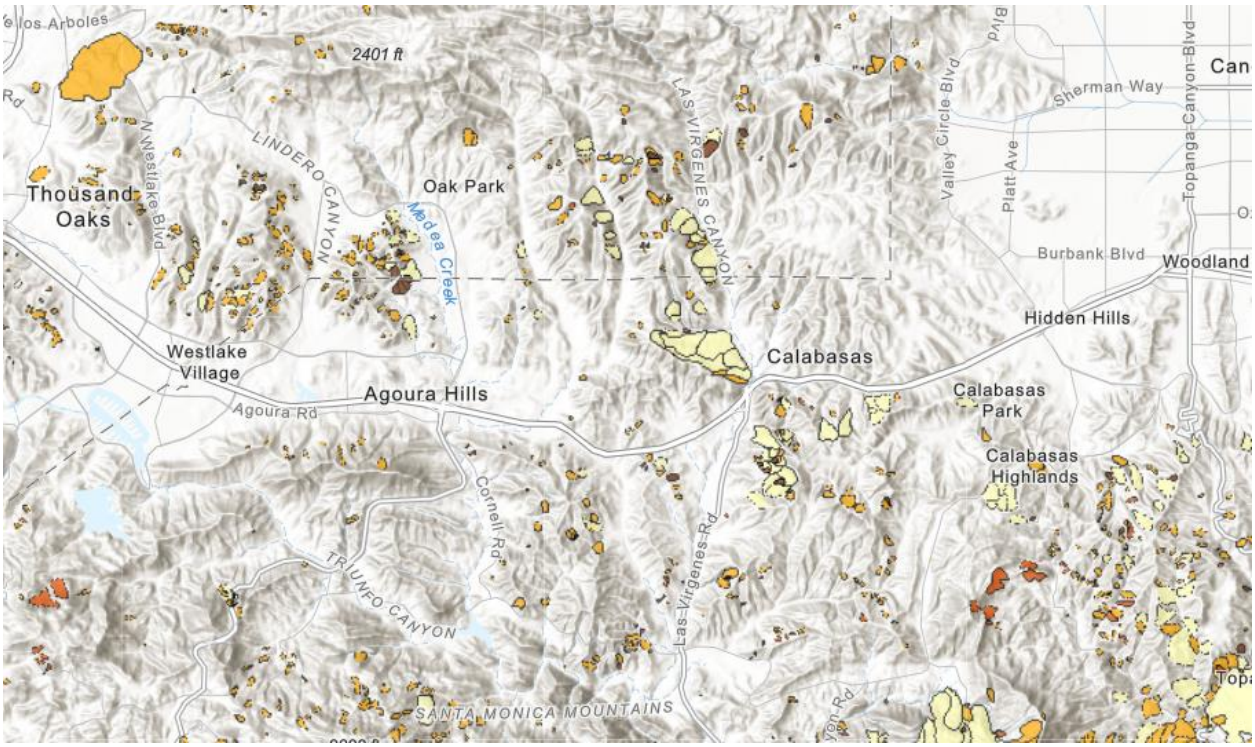
Natural Processes

Natural processes can cause landslides or re-activate historical landslide sites. Seismic tremors can trigger landslides on slopes with a history of landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on moderate slopes above steep streams and riverbanks.

Potential Landslide Areas

Landslide Inventory

The California Geological Survey has cataloged historic and probable future landslide areas in the state. The map below depicts the locations identified for the LVMWD Service Area.



Map 20: Landslide Inventory and Locations within the LVMWD Service Area

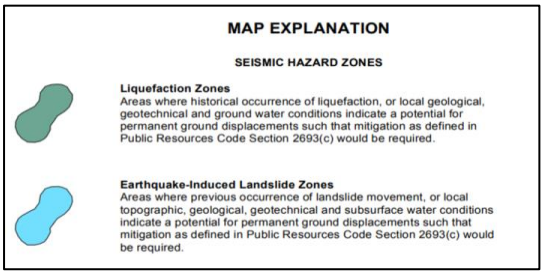
Key

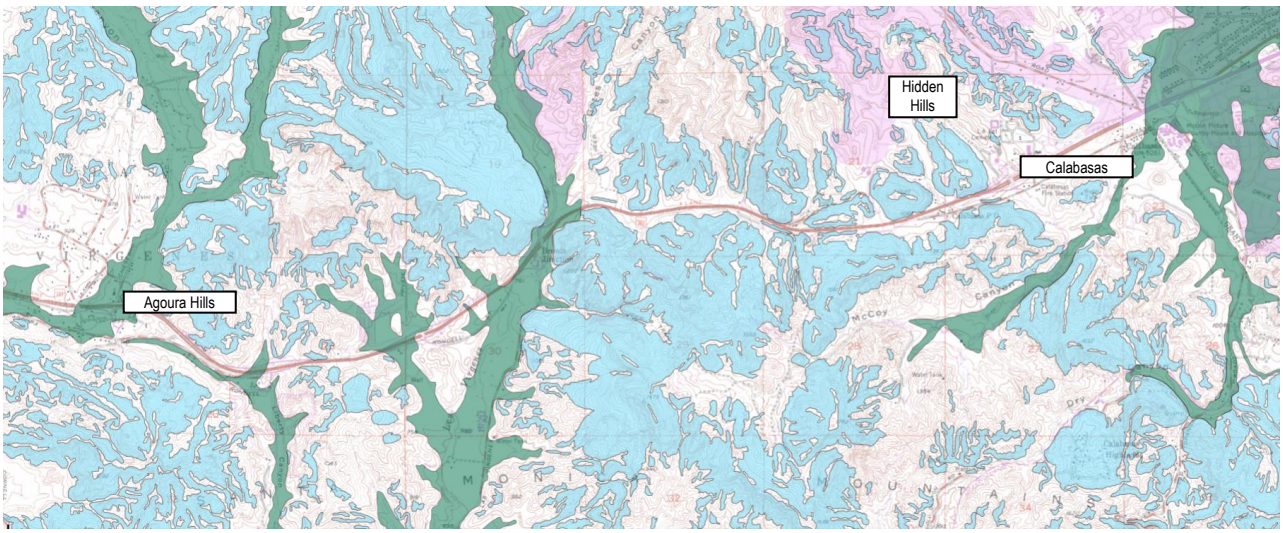
- Historic, Definite
- Historic, Probable
- Historic, Questionable
- Dormant Young, Definite
- Dormant Young, Probable
- Dormant Young, Questionable
- Dormant Mature, Definite
- Dormant Mature, Probable
- Dormant Mature, Questionable
- Dormant Old/Relict, Definite
- Dormant Old/Relict, Probable
- Dormant Old/Relict, Questionable
- Dormant Age Not Specified, Definite
- Dormant Age Not Specified, Probable
- Dormant Age Not Specified, Questionable

Per the California Geological Survey, "Two of these levels, historic/active and dormant-young, are associated with relatively recent activity in a geologic context, possibly within the past 100 years. The main distinction between these levels is that records of historic movement exist for the first, but not for the second. Both of these activity levels represent landslide movement under essentially the same slope and climate conditions as currently exist and landslides so designated pose the highest risk of reactivation. In contrast, the remaining two levels, dormant-mature and dormant-old, are assigned to slides that have been substantially modified by erosion, implying that much longer periods of time, perhaps thousands of years, have elapsed since major movement occurred. Dormant mature and dormant old landslides are much less likely to move, although there are areas where the rock has been weakened by prior movement and thus are likely more susceptible to reactivation than non-slide areas."

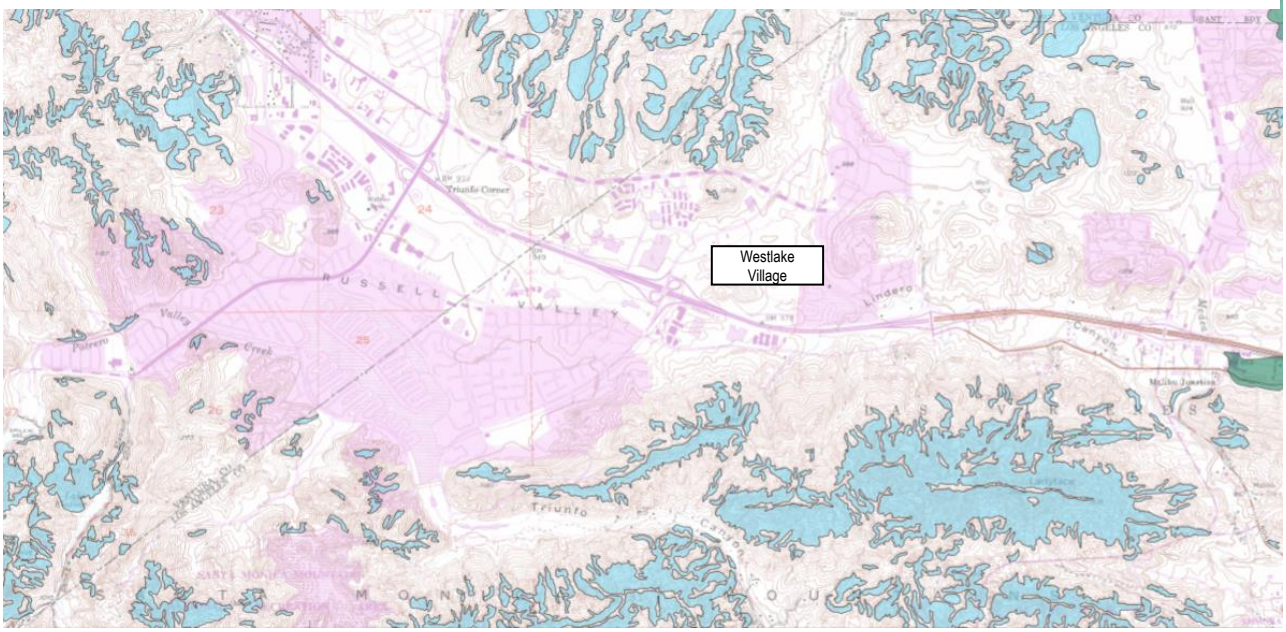
Earthquake Induced Landslides

The following maps indicate the locations within the LVMWD Service Area that are at the most risk from earthquake induced landslides (Source: California Geological Survey, 2000). Dark green indicates liquefaction zones. Light blue indicates earthquake-induced landslide zones.





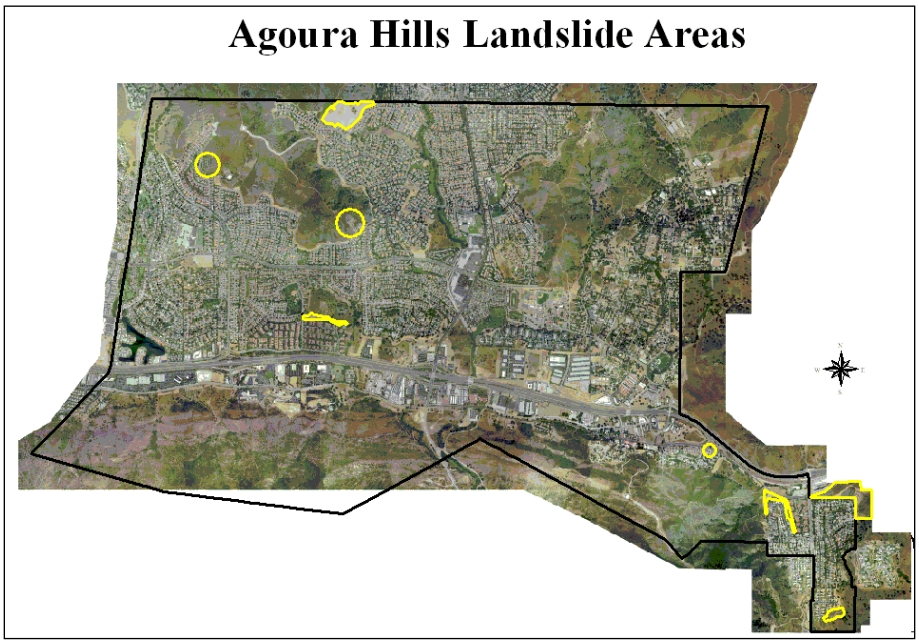
Map 21: Calabasas Seismic Hazard Zone Quadrangle



Map 22: Thousand Oaks Seismic Hazard Zone Quadrangle

Agoura Hills

The City of Agoura Hills has identified areas that may be prone to landslides. Yellow boundaries enclose areas that may be prone to landslide events within the City.



Map 23: Agoura Hills Landslide Areas

Source: City of Agoura Hills Internal Map

Calabasas

In the City of Calabasas, areas that are generally prone to landslide hazards include existing old landslides; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. See Landslide Inventory map and Earthquake Induced Landslide map for additional details.

Hidden Hills

Historically, the City of Hidden Hills has minimal landslide activity (see Landslide Inventory map). However, there are areas of earthquake-induced landslides within the City that pose a future risk (see Earthquake Induced Landslide map).

Westlake Village

In the City of Westlake Village, potential landslide hazards are primarily limited to areas of sedimentary rocks in the northeast tip of the City. Areas with sediments have moderate to high slope instability potential. Areas with volcanic rocks have moderate to low slope instability potential.

Estimated Impact of an Event

If major landslide or debris flow were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure from Debris Flows and Landslides
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 10% of the LVMWD Service Area will result in the following projected losses.

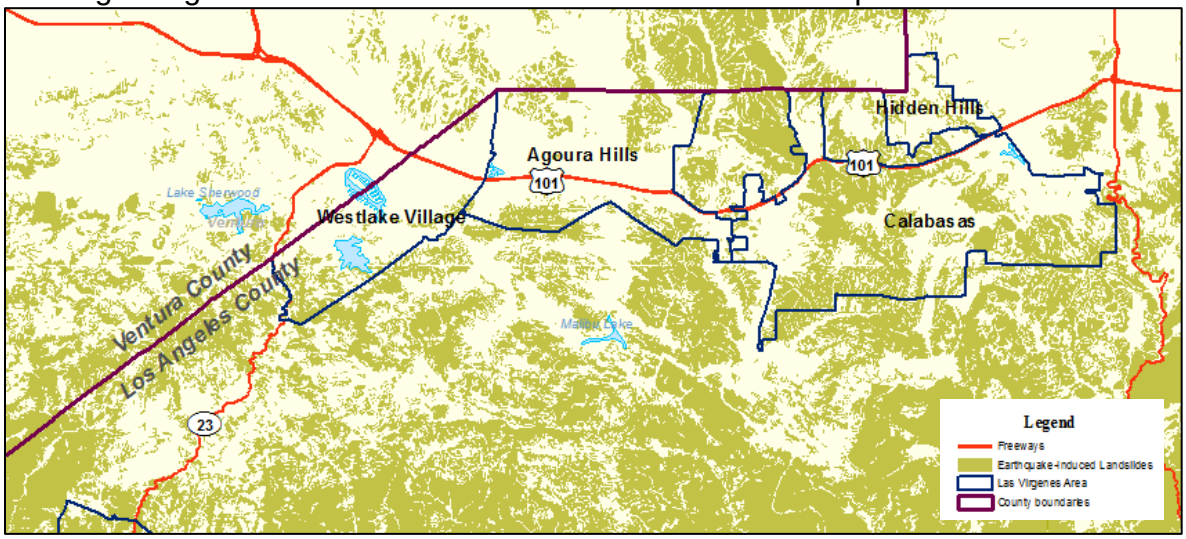
Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 10% Loss Occurs
Population	20,692	24,202	1,921	8,440	5,526
Total City Employment	11,200	11,900	-	13,886*	2,310
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$432,059,500
Total Housing Units	5,562	6,097	510	2,934	1,510

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

LANDSLIDE VULNERABILITIES

Earthquake Induced Landslides

The map below depicts areas prone to earthquake induced landslides. The severity of seismically induced landslides and related damage is dependent on the level of ground shaking and groundwater conditions at the time of the earthquake.



Map 24: Landslide Vulnerable Areas Due to Earthquakes

Potential Impact Due to Land Development, Grading, and Excavation

Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and excavation can decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content.

Drivers for hillside development include intensification of existing development on residential lots and expansion into undeveloped areas. Intensification consists of additional construction and modification of existing construction or the complete demolition and redevelopment of a residential lot.

Intensification expands developed pad areas into previously “natural” hill slope areas and often involves a corresponding increase in the size and volume of the onsite sewage disposal systems. Other human activities effecting landslides include: excavation, drainage modifications, groundwater alterations, and changes in vegetation and soil conditions.

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. Ineffective storm water management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology and topography of an area; development that results in an increase in impervious surfaces impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides. Building Codes require drainage devices to dispose storm runoff away from hillside developments. Storm runoff is designed to be discharged into the storm drain system. Storm drain catch basins are normally maintained by Public Works Departments and are regularly cleaned to prevent any flooding or ponding.

Changes in Vegetation and Soil Conditions

Wildland fires in hills covered with chaparral are often a precursor to debris flows in burned out canyons. The extreme heat of a wildfire can create a soil condition in which the earth becomes impervious to water by creating a waxy-like layer just below the ground surface. Since water cannot be absorbed into the soil, it rapidly accumulates on slopes, often gathering loose particles of soil in to a sheet of mud and debris.

If vegetation on very steep slopes has been removed either by wildfire or man-made development, there is an increased risk of a landslide. Additionally, changing away from native ground cover plants may increase the risk of landslide. For example, if certain vegetation requires heavy watering, soil conditions can change and trigger landslides.

Landslide Risk Factors

Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

- On or close to steep hills;
- Steep road-cuts or excavations;
- Existing landslides or places of known historic landslides (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground);
- Steep areas where surface runoff is channeled, such as below culverts, V - shaped valleys, canyon bottoms, and steep stream channels; and
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.
- Canyon areas below hillside and mountains that have recently (within 1-6 years) been subjected to a wildland fire.

LANDSLIDE MITIGATION STRATEGIES

LVMWD Mitigation Activities

The LVMWD continues to pursue mitigation actions to respond to the potential for landslides and debris flows. Key activities include:

- Drainage and Debris Clearance
- Ongoing Inspections and Assessments of All LVMWD Facilities and Infrastructure
- Site Inspections of Landslide and Debris Flow Risk for New Facilities and Infrastructure

SECTION 9: WINDSTORM

THE NATURE OF THE WINDSTORM THREAT

Severe windstorms pose a significant risk to life and property by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds have the potential to cause damage to local homes and businesses from falling trees and debris. In addition, windstorms increase the risk of wildfire as the moisture content decreases in brush and vegetation on hillsides, especially in urban interface areas.

HISTORY OF SEVERE WINDSTORM EVENTS IN THE AREA

Severe windstorms can occur at any time of the year though strong Santa Ana Winds generally occur annually from October to March. For example, the nearby San Gabriel Valley was struck by severe windstorms from November 30 to December 1, 2011. Wind speeds of 70 mph caused extensive tree damage and power outages, resulting in several cities declaring emergencies. The table below provides a summary of severe weather events in the region that provide examples of the risks to the LVMWD Service Area (Source: National Weather Service, "A History of Significant Weather Events in Southern California", May 2017).

Date(s)	Weather	Adverse Impacts
1.31.2016	A powerful storm with a surface low that rapidly deepened in the Southern California Bight brought an exceptionally strong cold front with widespread damaging wind gusts of 40-70 mph from the coast to the mountains. A broken line of thunderstorms formed along the front and combined with post frontal winds.	Over 500 downed trees caused extensive damage. One woman was killed and two were injured when a pine tree eight feet in diameter crushed four cars in Pacific Beach.
5.12-5.15.2014	A strong late-season Santa Ana wind event raked the region. Winds gusted to 40 to 45 mph in parts of the coast and valleys, and 60 to 80 mph in the foothills.	The winds knocked down many trees and power lines, and blew off some roof tiles. Numerous fires erupted especially in San Diego County, burning over 27,000 acres and causing more than $50 million in property damage. The Poinsettia fire in Carlsbad and the Cocos Fire in San Marcos damaged homes, but no serious injuries or deaths resulted.
2.28-3.1.2014	A strong storm hit Southern California with westerly winds. A report of a 102 mph wind gust came from the Bear Mountain ski resort weather equipment on 2.28. Thunderstorm wind gusts.	Numerous large trees and power poles toppled, as well as damage at John Wayne Airport. Thunderstorms on the 2.28 downed several trees and damaged power lines and other structures.
12.12.2011	As many as five waterspouts were observed off La Jolla. Three off Windandsea Beach, and possibly two others off La Jolla Shores. Farther inland, a funnel cloud was spotted over La Mesa.	

Date(s)	Weather	Adverse Impacts
3.20.2011	Strong storm winds hit the mountains and desert. Gusts reached 110 mph at Burns Canyon.	Significant roof damage was incurred in Apple Valley.
2.3.2008	Wind gusts associated with a powerful winter storm exceeded 70 mph.	The winds caused considerable damage in the mountains and deserts.
1.2.2006	Post frontal winds more than 50 mph widespread across the region.	The “M” above Moreno Valley was demolished. Trees were downed, power lines, power poles, on to houses and cars. In Crestline there were 20 homes left uninhabitable. In San Diego Bay boats broke loose from their moorings.
2.3.2005	Strong storm winds of 70 mph hit the region.	Homes in Idyllwild were damaged by felled trees. Downed power lines in the Inland Empire. Big rig overturned on I-8.
1.24.2002	Santa Ana winds.	
4.18.2000	A severe thunderstorm brought downburst winds estimated at 80 to 100 mph from Bellflower to Diamond Bar. 0.75” hail was reported in Downey.	Severe damage to factories and mobile home parks in Paramount (one mobile home was blown over). Wind damage was done to trees, power lines and numerous buildings along the entire path. In Norwalk, a large Eucalyptus fell onto I-5, closing the freeway for 3 hours, backing up traffic 17 miles.
2.23-24.1998	Strong widespread storm winds 40-60 mph.	Trees and power lines knocked down. Damage.
8.20.1997	The remnants of Tropical Storm Ignacio tracked northward moving inland in central California with gale force winds over portions of the Southern California coastal waters. This occurred during the strong El Niño of 1997-98.	
12.21-22.1996	Storm winds 40-50 mph.	
12.21-22.1996	Storm winds 40-50 mph.	
2.7.1994	Tornado from Newport Beach to Tustin. A weak tornado also touched down in Sun Valley in the San Fernando Valley.	Roof and window damage and trees blown down in Orange County.
2.1.1994	A strong area of high pressure over the Great Basin brought gusty Santa Ana winds to the region. In Rialto wind gusts reached 65 mph.	Tree and power line damage.
2.1.1994	A strong area of high pressure over the Great Basin brought gusty Santa Ana winds to the region. In Rialto wind gusts reached 65 mph.	Tree and power line damage.
12.24.1993	Santa Ana winds: gust 75 mph at Ontario.	
11.2-4.1993	Santa Ana winds gusted to over 60 mph.	The Old Topanga fire burned from Calabasas to the ocean consuming hundreds of homes.
11.2-4.1993	Santa Ana winds gusted to over 60 mph.	The Old Topanga fire burned from Calabasas to the ocean consuming hundreds of homes.

Date(s)	Weather	Adverse Impacts
10.26-27.1993	Santa Ana winds: gust 62 mph at Ontario.	Twenty fires ravaged Southern California including in Laguna Hills. 4 dead, 162 injured, $1 billion economic losses in property alone and 194,000 acres were destroyed.
2.19-21.1991	Strong northerly winds resulted from a deep low pressure system over Arizona. Top gusts reached 63 mph in the Santa Monica Mountains, 52 mph in Van Nuys, and 36 mph at LAX airport.	
12.11.1989	Strong Santa Ana winds. Gusts to 100 mph near the Grapevine.	Winds reduced visibilities to near zero in the desert areas, and closed major interstate highways east of Ontario.
5.29.1988	Gale force winds hit the coast. Gusts to 60 mph in the mountains, 45 mph at LAX. Gusts to 40 mph at San Diego.	Hang glider crashed and died. Power went out. Brush fires started.
2.16-19.1988	Very strong Santa Ana winds: Gusts of 90 mph at Newport Beach, 70+ mph in the San Gabriel Mountain foothills on 2.17. Gusts to 76 mph at Monument Peak - Mt. Laguna on 2.18. Gust 63 at Ontario on 2.17, gust 50 at Rancho Cucamonga on 2.16.	Planes flipped in Burbank and at John Wayne airports. Boats were torn from moorings in Newport Harbor. Numerous trees and power lines downed and power outages all near the foothills of the San Gabriel and San Bernardino Mountains. On 2.19 in Pauma Valley a mobile home was overturned and shingles were torn off roofs. Fontana schools were closed due to wind damage at schools. Three were killed when a big rig truck overturned and burned, one was killed having stepped on a downed power line). Power outages hit 200,000 customers in LA and Orange counties. Minor structural damage occurred to signs, etc. Grass fires resulted. Roof damage was widespread in communities around Glendale and Pasadena. Severe damage to factories and mobile home parks in Paramount (one mobile home was blown over). Wind damage was done to trees, power lines and numerous buildings along the entire path. In Norwalk, a large Eucalyptus fell onto I-5, closing the freeway for 3 hours, backing up traffic 17 miles.
1.21-22.1988	Strong offshore winds following a major Pacific storm. Gusts to 80 mph at the Grapevine and gusts to 60 mph at Ontario on the night of 1.21. Gusts were reported up to 80 mph in San Diego County on 1.22.	Power poles, road signs big rigs knocked down in the Inland Empire. In San Diego County, 6 were injured, roofs were blown off houses, trees were toppled and crops destroyed. A barn was demolished and a garage crushed by a giant tree in Pine Valley. 20 buildings were destroyed or damaged at Viejas. Avocado and flower crops were destroyed in Fallbrook and

Date(s)	Weather	Adverse Impacts
		Encinitas, respectively. Five greenhouses were destroyed in Encinitas.
6.6.1987	Rare June thunderstorms hit the LA region and Mojave Desert. A severe thunderstorm hit Palmdale and Lancaster. 1" diameter hail at Mt. Pinos in northern LA County, ¾" hail at Palmdale, 1/2" hail hit Pine Mountain near the LA-Kern county line. Lightning struck the Santa Monica Bay.	Power was knocked out. Lightning sparked small fires. In Lancaster, mobile homes were damaged by strong winds (possible tornado?) and lightning. Two-by-fours were driven into the roofs of mobile homes. Utility poles were uprooted and broken in half.
11.23.1986	Strong Santa Ana winds hit LA and mountain foothills. Gusts to 54 mph were recorded, but estimated gusts were 70 mph. Only 30-40 mph gusts were estimated at Mt. Laguna.	An unfinished house in Glendale was blown to bits. Numerous beach rescues were needed for sailors and windsurfers. Two sailboat masts were snapped in a boat race at Channel Islands.
10.2.1986	Rain and thunderstorms hit LA area. 1.50" in Pasadena (in a little more than 1 hour), 1.02" in LA (in less than 1 hour), nearly 1" in Lake Arrowhead in 40 minutes, and 0.77" in Monrovia. 3" of hail piled up in Pasadena. Wind gusts to 35 mph. Hail nearly ½" in diameter in Westwood. In Blythe, winds gusted over 50 mph and 0.79" fell in 30 minutes. San Diego County was largely missed, with only 0.22" reported at Palomar Mountain.	Classes were cancelled at CSU-Northridge from power outages and several serious traffic accidents resulted in Pasadena because of hail. Minor flooding.
11.30-12.1.1982	Widespread strong wind with a big storm.	Power out to 1.6 million homes.
10.9.1982	Santa Ana winds gusted to 60 mph.	A major wildfire moved across the Santa Monica Mountains.
2.10.1978	A powerful Pacific storm brought coastal winds measured as high as 92 mph.	Severe wind damage to area harbors. The Port of Los Angeles was closed for 10 hours until debris clogging the port could be cleared. In Oceanside 70 mph winds ripped a bait shop from the municipal pier.
2.18.1970	Strong Santa Ana winds hit the region with gusts as high as 85 mph.	The winds toppled signs, damaged boats, overturned parked planes, broke windows, and lead to a temporary closure of Interstate 10.
2.20-25.1969	Strong storm winds.	Telephone, power, and gas outages.
1.18-28.1969	Strong storm winds.	4 dead from falling trees. Power outages.
3.8.1968	Strong storm winds.	Winds downed trees, damaged utility lines, unroofed buildings and disrupted traffic.
12.2-3.1966	Strong storm winds.	Power outages.
1.16.1966	Strong Santa Ana winds surfaced over the coast and valleys.	The winds destroyed several pleasure boats, damaged construction sites and the local avocado/citrus crop, and led to the closure of several highways. One man was killed when struck by a falling tree.

Date(s)	Weather	Adverse Impacts
3.16.1964	Strong Santa Ana winds hit the region.	Winds downed trees and power lines, damaged homes, overturned parked planes, and fanned wildfires. Damages from the fires alone reached into the millions of dollars. The same areas were hit by mudslides and debris flows a week later when heavy rains fell over recently burned ground.
11.19-20.1963	Strong storm winds, particularly along the coast.	Hundreds of trees downed. Power lines downed.
4.20.1962	Strong winds whipped through the region.	Winds toppled trees, snapped power lines, dislodged roofs, broke plate glass windows, and downed store signs. In the deserts, traffic was restricted by blowing dust and sand, with some vehicles suffering paint damage due to the blowing sand.
11.5-6.1961	Strong Santa Ana winds fanned fires in Bel Air and Brentwood. 74° at 10 pm at LA, 5° dew point. 3% relative humidity in Burbank on 11.6.	Fire in Topanga Canyon. 103 injured firemen, $100 million economic losses including 484 buildings (mostly residential) and 6,090 acres destroyed.
1.4-5.1959	A strong Pacific Storm brought very strong and damaging winds to the region.	Boats were damaged in harbors across Southern California, 400 chickens were killed in their cages at a poultry farm in Vista and a dust storm in Barstow led to a 15-car pileup that injured 18 people.
11.21-22.1957	Extremely destructive Santa Ana winds.	Winds produced a 28,000 acre brush fire on a 40-mile front west of Crystal Lake. People were ordered off streets in some areas due to flying debris. 12 of 33 passengers on an airplane over Ontario were hurt by a downdraft in extreme turbulence. Paint was completely stripped off of windward sides of 4 cars stalled in a Fontana sandstorm.
11.19-29.1956	A strong and prolonged Santa Ana wind event started on 11.19 and ended on 11.29. On 11.20 a 100 mph gust was recorded at a forest lookout near Saugus.	A fire north of Descanso started on 11.19, killed 11 and burned 44,000 acres. Two wooden bridges and a power plant were destroyed.
11.25.1918	Strong windstorm produced a wind gust of 96 mph at Mt. Wilson.	
2.24.1891	Strong and continuous storm winds blew at 40 mph.	Boats were smashed on shore. A roof was taken off a warehouse.
11.13.1880	Severe Santa Ana winds and sandstorms in Southern California.	Extensive damage.

CAUSES AND CHARACTERISTICS OF WINDSTORMS IN THE LVMWD SERVICE AREA

Windstorm events in the LVMWD Service Area can be caused by short term, topographically influenced, high wind gusts as well as extended duration Santa Ana wind conditions. "Santa Ana Winds" typically occur between October and March. Santa Ana winds are characterized by strong dry offshore winds originating from the Great Basin and Upper Mojave Desert. Wind temperatures can range from extremely hot to cold. Damage can occur directly from the high wind speeds generated or from the secondary effects of very low humidity, which increases the threat of wildfires, particularly in the fire-prone chaparral country.

WINDSTORM HAZARD IDENTIFICATION

Given the location and topography of the area, severe windstorms are a possibility. While the historic occurrence of these events on the LVMWD Service Area has been minimal (when they occur) these events do pose a threat to life, property, utility delivery systems, infrastructure, and transportation. Furthermore, if a severe windstorm results in a prolonged utility disruption, it may be necessary to utilize private and public resources to aid in the care and sheltering of displaced residents. High winds also increase the threat posed by wildfires and can lead to major losses to the region. In addition, the economic impact of providing shelter, conducting repairs, and the disruption to local businesses can result in economic losses to the entire area. Finally, a severe windstorm can cause the loss of historic trees in the area and require the services of certified arborists.

The risk of trees falling is one of the more significant hazards resulting from high wind events. The leafy canopy and structural elements of a tree crown present a drag type barrier to winds. Trees naturally minimize wind drag through the re-orientation of leaves and through the independent motion of limbs and branches, thus reducing the transfer of uniform sway motion forces to the trunk. The Beaufort Wind Scale (BWS) specifically notes problems with trees as wind speeds increase. The BWS references the likelihood of whole tree motion as wind speeds exceed 32 miles per hour (MPH), twig breakage at 39 MPH and whole tree wind-throw as wind speeds exceed 55 MPH. The susceptibility of trees to wind-throw can be influenced by the general structural condition of the trees, the location of the trees in reference to wind patterns and the level and frequency of pruning maintenance.

The following chart depicts the Beaufort scale which is used to estimate wind strengths.

Beaufort Force	Speed (MPH)	Wind Description - State of Sea - Effects on Land
0	Less 1	Calm - Mirror-like - Smoke rises vertically
1	1-3	Light - Air Ripples look like scales; No crests of foam - Smoke drift shows direction of wind, but wind vanes do not
2	4-7	Light Breeze - Small but pronounced wavelets; Crests do not break - Wind vanes move; Leaves rustle; You can feel wind on the face
3	8-12	Gentle Breeze - Large Wavelets; Crests break; Glassy foam; A few whitecaps - Leaves and small twigs move constantly; Small, light flags are extended
4	13-18	Moderate Breeze - Longer waves; Whitecaps - Wind lifts dust and loose paper; Small branches move
5	19-24	Fresh Breeze - Moderate, long waves; Many whitecaps; Some spray - Small trees with leaves begin to move
6	25-31	Strong Breeze - Some large waves; Crests of white foam; Spray - Large branches move; Telegraph wires whistle; Hard to hold umbrellas
7	32-38	Near Gale - White foam from breaking waves blows in streaks with the wind - Whole trees move; Resistance felt walking into wind
8	39-46	Gale - Waves high and moderately long; Crests break into spin drift, blowing foam in well-marked streaks - Twigs and small branches break off trees; Difficult to walk
9	47-54	Strong Gale - High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray - Slight structural damage
10	55-63	Storm - Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility - Trees broken or uprooted; Considerable structural damage
11	64-73	Violent Storm - Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Edges of wave crests blown into froth; Poor visibility - Seldom experienced inland; Considerable structural damage
12	>74	Hurricane - Sea white with spray. Foam and spray render visibility almost non-existent – Widespread damage. Very rarely experienced on land.

Estimated Impact of an Event

If major windstorm were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers (due to power outages)
- Damage to LVMWD Infrastructure from Tree Falls and Flying Debris
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 10% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 10% Loss Occurs
Population	20,692	24,202	1,921	8,440	5,526
Total City Employment	11,200	11,900	-	13,886*	2,310
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$432,059,500
Total Housing Units	5,562	6,097	510	2,934	1,510

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

WINDSTORM VULNERABILITIES

Windstorms can result in damage to structures, disrupt utilities, and require emergency tree services (i.e. limb failures, clearance of private property trees fallen into roadways, etc.). With regards to wind related damage to structures; LVMWD facilities have not experienced significant damage due to windstorms during the last decade. Nevertheless, the impact of a severe windstorm can be significant and mitigation planning can reduce losses if an event were to occur. Specific windstorm related issues are outlined below.

Life and Property

Detached tree limbs and building elements present a hazard to life and property as well as infrastructure. Furthermore, utility providers and emergency services can be overwhelmed during a major event. At risk populations include assisted care facilities and home-bound residents that are dependent on electrical power (see Utilities and Infrastructure section below). For example, in December 2011, the City of Pasadena, California experienced a severe windstorm with reported gusts near 100 MPH. The resulting power outages and debris impacted residents for weeks.

Utilities and Infrastructure

Windstorms can cause structural damage to buildings and other critical infrastructure. Overhead electrical and telephone lines are particularly vulnerable to damage from wind and debris as are microwave and satellite facilities. High winds commonly occur during winter storms and can cause trees to bend, sag, or fail (tree limbs or entire trees) which then come into contact with nearby power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wild land fires. In order to prepare for such events, Southern California Edison (SCE) has developed its own Hazard Mitigation Plan.

Transportation

Windblown debris, tree limbs and wind thrown trees can damage traffic control apparatus, block roadways, damage vehicles, and cause extreme traffic congestion - impeding emergency and vehicles and hampering repair efforts.

Increased Fire Threat

The entire Los Angeles County region is subject to Santa Ana Winds with regards to their impact on fire conditions. Winds can serve as a catalyst in the canyons to spread fire at a rapid rate. Prolonged winds during the warmer months of the year can decrease vegetation moisture levels and increase the ignition potential in dry underbrush. When urban/wildland interface fires occur, Santa Ana Wind conditions can drive flames and increase the spread speed and severity of the fire. This is a significant concern near homes, especially where brush clearance has been lax.

During high wind periods, there is also a threat of downed power lines causing wildfires. In response, SCE began a public notice campaign to reiterate its policy that utility power may be shut-off during high fire risk periods when extreme weather threatens the power lines.

Santa Ana Winds

"Santa Ana Winds" are generally defined as warm, dry winds that blow from the east or northeast (offshore). Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah). These regional winds typically occur from October to March and, according to most accounts, are named either for the Santa Ana River Valley where they originate or for the Santa Ana Canyon, southeast of Los Angeles, where they pick up speed. These winds occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles basin.

Map 25: Santa Ana Wind Circulation Pattern

The complex topography of Southern California combined with various atmospheric conditions creates numerous scenarios that may cause widespread or isolated Santa Ana events. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon. Forecasters at the National Weather Service offices in Oxnard and San Diego usually place speed minimums on these winds and reserve the use of "Santa Ana" for winds greater than 25 knots 28.8 mph). These winds accelerate to speeds of 35 knots (40.3 mph) as they move through the canyons and passes, with gusts up to 50 to 60 knots (57.5 mph to 69.0 mph).

The Santa Ana Wind Circulation Map shows the direction of the Santa Ana winds as they travel from the stable, high-pressure weather system called the Great Basin High through the canyons and towards the low-pressure system off the Pacific. The Southern California region in the path of the ocean-bound Santa Ana winds Clockwise circulation around the center of this high-pressure area forces air down slope from the high plateau.

Source: NASA / JPL-Caltech, 2002

Figure 11: Santa Ana Wind Satellite Image

The air warms as it descends toward the California coast at the rate of 5 degrees Fahrenheit per 1000 feet due to compressional heating. Thus, compressional heating provides the primary source of warming. The air is dry since it originated in the desert and it dries out even more as it is heated. Resulting in low humidity and increase risk of wildfires.

Windstorm Probabilities

Although windstorms can occur at any time of the year, Southern California's Santa Ana winds routinely occur from October to March occur every year (see Causes and Characteristics of Windstorms in the LVMWD Service Area and Santa Ana Winds sections for additional details). Consequently there is a significant probability of high wind events during these months. Historically, severe winds in the Los Angeles Region typically occur during these months (see History of Severe Windstorm Events in the Area section). As a result, the LVMWD Planning Group has evaluated the risk and determined that the risk of occurrence is considered to be high during these fall and winter months. However, strong winds can occur at any time of the year. Consequently the probability of occurrence from April to September is considered to be moderate to low.

WINDSTORM MITIGATION STRATEGIES

Interagency Efforts

In the case of buildings and structures, the likelihood of structural element detachment is influenced by local building code requirements, the location of buildings in reference to wind patterns and in the level of maintenance and upkeep. In addition, one of the strongest and most widespread existing mitigation strategies pertains to tree clearance.

Currently, California State Law and LA County Fire Code requires utility companies to maintain specific clearances (depending on the type of voltage running through the line) between electric power lines and all vegetation (Fire Code section 325.1 Electrical Transmission Lines). Furthermore, homeowners are required to allow a utility company to comply with the law.

Failure to provide access to utility power lines can result in liability to the homeowner for damages or injuries resulting from a vegetation hazard. Many insurance companies do not cover these types of damages if the policy owner has refused to allow the hazard to be eliminated.

Continuous upgrades to engineering design criteria based on the latest industrial progress, geotechnical findings, and Code revisions are being conducted. For instance, Dynamic Shake Table Tests were recently made mandatory for certain equipment in addition to analytical design.

LVMWD Mitigation Activities

The LVMWD severe wind mitigation actions include:

- Tree Trimming Around LVMWD Facilities and Critical Infrastructure (Tree Damage)
- Emergency Power Generation to Support Key Pump Stations (Power Outage)
- Ongoing Inspections and Assessments of All LVMWD Facilities and Infrastructure

SECTION 10: FLOOD / SEVERE WINTER STORM

THE NATURE OF THE FLOOD AND SEVERE WINTER STORM THREAT

The LVMWD Service Area is situated near the western portion of the Santa Monica Mountains and has experienced flooding in the past from major winter storm events. Flooding poses a threat to life and safety and can cause severe damage to public and private property. Due to the natural mountainous terrain as well as changes in the landscape (due to development) and natural disasters such as wildfire, flooding can be a factor in the area.

HISTORICAL RECORD OF FLOODING

History of Flooding in Southern California

Historically, the region has experienced extended periods (on the order of years) of either wet or dry weather. Additionally, in any given year the amount of precipitation can vary widely. The National Weather Service has documented the following significant flood and flash flood events in Southern California since 2010.

Date(s)	Weather	Adverse Impacts
1.18-22.2010	A very wet and dynamic series of storms dropped two to four inches of rainfall in the deserts, to four to eight inches west of the mountains, to six to 12 inches on the coastal slopes.	Widespread flooding resulted across the region. Some of the worst flash flooding occurred in the high desert on the 1.21 due to the prolonged heavy rainfall. Scores of homes and several schools sustained damage, and many roads were washed out in Hesperia, Apple Valley, Victorville and Adelanto. Numerous swift water rescues were needed, one of which likely saved four teens trapped in a storm water drain. Two deaths in Tijuana were attributed to the flooding.
8.25.2010	Powerful thunderstorms hit Forest Falls and Hemet with heavy rain.	Flash floods resulted.
8.26.2010	Powerful thunderstorms hit Wrightwood and Warner Springs with heavy rain.	Flash floods resulted.
12.17-22.2010	A very wet period developed as strong westerly flow across the Pacific tapped a pool of deep subtropical moisture near Hawaii, resulting in days of moderate to heavy rainfall. Four to 12 inches of rain fell in the coastal and valley areas over six days, 12 to 28 inches in the mountains, up to 9 inches in the high desert and less than 4 inches in the lower desert.	Major landslides and flash flooding impacted the communities of Laguna Beach, Apple Valley, along the Whitewater Channel in the Coachella Valley near Palm Springs, Highland, Corona, Loma Linda, La Jolla, and the city of San Diego from 12.21 to this day. Qualcomm Stadium was flooded but was miraculously drained and prepared for the Poinsettia Bowl held there on 12.23.
7.31.2012	A strong thunderstorm produced heavy rain in the Split Mountain area of the Anza Borrego Desert.	A 15-foot wall of water rushed through Split Mountain Road in Fish Creek. Two hikers, a man and his son, were caught in the canyon, but were able to get to higher ground and were unharmed. Their pickup truck, however, was washed 1.5 miles down the canyon and destroyed.
8.17.2012	A massive thunderstorm dropped 5.36” of rain on Yucaipa Ridge.	Runoff caused several mudslides down the hill in Forest Falls, one was 5 feet deep.

Date(s)	Weather	Adverse Impacts
8.30.2012	Thunderstorms erupted in the mountains above Cathedral City. A thunderstorm produced 1.53" in one hour at March AFB in Riverside.	Major flash flooding in Cathedral City included 1 to 2 feet of rapidly moving water, closing several roads. Water forced mud and debris into several businesses in town, causing significant damage. Flash flooding in Moreno Valley went into a few homes. A rescue was needed to save a stranded motorist. Several roads and freeways were closed because of water and/or mud.
9.11.2012	A stationary thunderstorm brought persistent, heavy rain to Mecca. 3 to 5" of rain fell in just a couple hours (more than a year's worth).	Floodwaters damaged a school, a mobile home park and several orchards.
12.13.2012	Heavy rain from a winter storm spread rainfall across the San Diego metro area of 1.25 to 2 inches.	The rain triggered an eight-ton, six-foot diameter boulder to roll into a Poway home. There were also numerous flood related issues on the roadways, including a few that required swift water rescues. High tide and flooding runoff combined to flood PCH in Seal Beach and Sunset Beach. Some garages were inundated.
7.21.2013	Thunderstorms erupted across the mountains and deserts. Radar estimated two to four inches of rainfall in one hour for some of the storms.	The newly vulnerable burn scar of the Mountain fire got brief heavy rain on the 21st that produced a flash flood and a debris flow called an "ash flow." One of these flowed into a pond, displaced the water, and killed the resident fish. Several other desert roads near Sky Valley, Mecca, and Borrego Springs were rendered impassable from the water and debris. In Big Bear City, some of these floodwaters entered a few homes. In remote Anza Borrego Desert State Park, three vehicles were washed downstream.
8.18.2013	Heavy thunderstorms developed in the high desert. Radar estimated rainfall west of Victorville at seven inches.	Floodwaters damaged and closed several highways west of Phelan and in Apple Valley and filled the El Mirage Dry Lake.
8.23.2013	Heavy thunderstorms on the San Jacinto Mountains.	Debris and water came down from the Mountain Fire burn into Palm Springs.
8.25.2013	Monsoon thunderstorms. Agua Caliente recorded over two inches of rainfall incredibly in 35 minutes.	Floodwaters filled the Whitewater channel, which goes through several golf courses and crosses many roads from Palm Springs to La Quinta. Flash floods also in the Anza Borrego Desert.
8.29.2013	Thunderstorms struck Riverside and the San Bernardino Mountains where over one inch of rain fell in 20 minutes.	Riverside was inundated with flooding of streets up to two feet deep. Riverside City College canceled classes. Flash floods occurred around the Perris area and along Highway 18 in the San Bernardino Mountains
9.6-7.2013	Thunderstorms developed in the mountains and deserts and Inland Empire each day. Pea to dime sized hail and damaging winds also accompanied these storms.	On 9.6, mud and water covered the highway near Warner Springs, stranding multiple vehicles stuck in the mud. Minor road flooding near Pine Valley and just east of Lucerne Valley. On 9.7, normally dry Mill Creek near Forest Falls ran deep and wide, stranding campers. There was flooding in Campo, east of Julian, Ocotillo, and in Cathedral City along the Whitewater Wash.

Date(s)	Weather	Adverse Impacts
2.28-3.1.2014	A very wet storm was the only significant storm of the 2013-14 wet season. Rainfall ranged from 1 inch at the coast to up to 8 inches in the mountains. Up to 1 inch fell in the desert. Yucaipa Ridge measured over 11 inches.	Urban and flash flooding with mud/debris flows, causing numerous road closures and swift water rescues in and around Anaheim, San Diego-Fashion Valley, Escondido, Fallbrook and Lake Elsinore. Mud slides closed Hwy. 74 (Ortega Highway) stemming from the Falls Fire burn scar. Many road closures in the Coachella Valley where rivers saw rises of 2 to 5 feet, in some instances within 12 hours. On 3.1, flooding resulted in Oceanside, Temecula, Sea World San Diego, as well as minor street flooding in Mission Viejo.
5.23.2014	Thunderstorms over the San Diego County mountains drifted over the adjacent deserts.	Flash flooding occurred along and north of Highway 78, south of Borrego Springs.
7.5.2014	Thunderstorms erupted in the Inland Empire, San Bernardino Mountains, and the High Desert.	Flash flooding closed roads in the High Desert along I-15 and Hwy. 247 and required a swift water rescue in Yucaipa. On 7/5 flash flooding occurred along Hwy. 247 in Landers.
7.27.2014	Thunderstorms erupted in the mountains of San Diego County and even along the coast.	Flash flooding occurred in La Jolla Shores and near Warner Springs along Hwy 79.
8.3.2014	Heavy thunderstorms hit the Inland Empire, the mountains and the lower desert. Mt. Baldy Village got 4.40 inches, with four inches falling in 60 minutes.	Flash flooding and debris flows were common. Road closures and damage.
8.12.2014	A heavy thunderstorm struck east of Julian.	A debris flow blocked Hwy. 78 east of Julian on the Banner Grade that was one to two feet deep. The Banner Fire burn scar contributed to this flow.
9.7-8.2014	Weakening Hurricane Norbert brought moisture to produce thunderstorms mainly in Riverside and San Diego Counties. Rainfall amounts of 1 to 2 inches fell over the city of Riverside, San Bernardino and Hemet, while the mountains in that county saw up to 0.60" near Sky Valley. Early morning thunderstorms on 9.8 drenched parts of the Coachella Valley which received 0.33" up to just over 3 inches near the lower foothill in Thousand Palms and La Quinta.	Widespread flash flooding, most notably in the Coachella Valley on 9.8. Mud and water closed roads and stranded vehicles in La Quinta, Palm Desert, and Thousand Palms. Homes in La Quinta were surrounded by water. Moving water was 3 feet deep on roads and 4 to 5 feet of standing water submerged vehicles. Mud was several feet deep on Varner Road.
12.3-4.2014	A Pacific storm brought moderate to heavy rain. Two-day rainfall totals of 1-2" were recorded west of the mountains, while the southern slopes of the San Bernardino County mountains saw up to 5" of rain (isolated amount of 14.5" at Yucaipa Ridge).	Flooding resulted, with mud, debris and water closing several roadways and stranding vehicles. Mud with debris 10 feet high piled up on Soboba Rd. north of San Jacinto. A swift water rescue was needed.
12.12-13.2014	A strong Pacific storm brought heavy rain. Widespread rainfall amounts of 1 to 1.5" in the coast and valley areas. Mountain locations got up to 4".	River rises in the San Diego River resulted in a levee breach which flooded the parking lot of Qualcomm Stadium. Several other roadways in San Diego County were closed due to flooding with mud and debris in the road, especially near the Tijuana River Valley.
5.14.2015	A strong late-season winter storm, along with some thunderstorms, hit the region. San Diego reported 1.30" of rain in one hour. A nine-minute period within that main hour, totaled 0.71", which is near the 1/100 return interval.	Flooding in Mission Hills and Midway District of San Diego was up to 4 feet deep. Several swift water rescues.

Date(s)	Weather	Adverse Impacts
7.6.2015	Monsoon thunderstorms hit the mountains and upper desert. A few spots received up to around one-third of an inch, including a portion of the Lake Fire burn area south of Big Bear Lake.	Several debris flows resulted, including one consisting mostly of ash and mud over portions of Highway 38, up to a foot deep in some areas.
7.18-19.2015	Moisture from Hurricane Dolores, along with monsoon moisture resulted in showers and thunderstorms over most Southern California. Rainfall ranged from 0.5-4", including a record 1.71" at San Diego on 7.18 (unprecedented rainfall: single-day and July monthly total). The San Diego River at Fashion Valley had 2 crests above monitor stage, 7.7 feet on the 18th and 8.8 feet on 7.19. On 7.19 over 6" of rain fell over several hours just west of Desert Center.	A debris flow hit the burn scar of Silverado Canyon. Flash floods hit Moreno Valley, Perris, and La Mesa on 7.19. A wet microburst struck Tierrasanta on 7.18, causing wind damage. A haboob caused wind damage in the Anza Borrego Park and in Palm Desert. The rain caused the first rain-out of a Los Angeles Angels baseball game since 1995, and a rare 2-hour rain delay at the San Diego Padres baseball game. Over 2000 lightning strikes were reported on 7.18, some starting small brush fires. Near Desert Center on 7.19 eastbound lanes of Interstate 10 collapsed where they crossed a heavily flowing wash. A vehicle drove into the hole in the collapsed bridge, trapping the driver and requiring rescue. I-10 was closed in both directions causing huge traffic backups.
7.29-30.2015	Scattered thunderstorms occurred mainly over the mountains and deserts with wide-ranging rainfall totals from a few tenths of an inch to locally over 2".	Flash flooding occurred in Idyllwild, Timoteo Canyon, Calimesa and Moreno Valley.
9.7-8.2015	Subtropical moisture from remnants of Hurricane Linda brought thunderstorms to most of the region. Additional thunderstorms on 9.8 developed over the mountains and spread into the Inland Empire and Orange County, as well as near I-15 in San Diego County. Hail was mostly nickel-sized, but a few larger. A small dust storm hit Riverside.	Flash floods hit Victorville (which included a swift water rescue). Another flash flood in Forest Falls also had a swift water rescue, but also one drowning death. On 9.8 several trees and poles were downed in the Riverside area from the dust storm.
9.15.2015	A Pacific trough tapped into remnant moisture from tropical cyclone Linda. 1-2" of rain was common across the entire region.	Major traffic jam during the morning commute in LA and Orange County, along with a debris flow in Silverado Canyon, and widespread urban flooding.
10.16.2015	Strong thunderstorms hit northern Ventura and LA counties.	Flash flooding and mud and debris flows occurred in the San Gabriel Mountains, Cuyama, and the Antelope Valley.
10.18.2015	Thunderstorms dropped very heavy rainfall in Death Valley. Scotty's Castle measured 2.72 inches of rain in roughly five hours.	Major flash flooding hit the Grapevine Canyon area of Death Valley National Park. Mesquite Springs Campground and Grapevine Ranger Station were evacuated; eight vehicles full of visitors and three park rangers were stranded overnight near Ubehebe Crater. Trenches up to six feet deep were cut into Scotty's Castle Road. 24 power poles were downed. Mud and debris damaged or destroyed the water supply infrastructure, stables, visitors center, and the cookhouse.
11.3-4.2015	A wet winter storm brought locally heavy rain to Southern California. San Diego recorded a one-day total of 1.09" on 11.3, setting a daily rainfall record. 0.10" to 1.5" fell elsewhere, heaviest in southern San Diego County. Hail of one quarter inch was reported in Dana Point and southern San Diego County.	Urban flooding in Spring Valley and Lemon Grove with water up to the doors of some vehicles and several roads closed.

Date(s)	Weather	Adverse Impacts
1.5-7.2016	A strong, low latitude jet stream brought a series of storms through Southern California with periods of moderate to heavy rain. Three-day rainfall totals were around 2-7" for the coast, valley and foothill areas, and 1- 3" for the deserts. After several years of drought, this was the only precipitation event of significance during an otherwise disappointing strong El Niño season.	Flooding resulted nearly everywhere, with southwestern San Diego County being hardest hit. Floods buried cars in Ocean Beach and Mission Valley. High water rescues occurred on 1.6 around San Diego. Small mudslides, including boulders on highways were reported near Ramona, Redlands, Crestline, Orange, Rancho San Diego and De Luz. Three debris flows in Silverado Canyon below a burn scar.

Significant Floods in the LVMWD Service Area Region

The National Flood Insurance Program tracks flood losses for the U.S. The following table lists the NFIP loss totals for the cities within the LVMWD Service Area from 1978 through 2018.

Community Name	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Agoura Hills	60	34	0	26	$552,567.03
Calabasas	19	9	0	10	$99,249.09
Hidden Hills,	37	23	0	14	$391,043.63
Westlake Village	4	1	0	3	$566.83

SOURCE: https://bsa.nfipstat.fema.gov/reports/1040.htm CWOP – Closed Out Without Payment

CAUSES AND CHARACTERISTICS OF FLOODS

A flood, as defined by the National Flood Insurance Program is: A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual or rapid accumulation or runoff of surface waters from any source, or mudflow.

Flooding may occur as a result of sustained heavy rainfall, microbursts (short periods of large volumes of rain), large wave activity on the coast, or reservoir/dam failure. A "100-Year Recurrence Interval" is defined as a flood that according to historical data has a probability of occurrence once in 100 years. This benchmark used by FEMA to establish a regulatory baseline for all flooding events. Similar benchmarks are defined for 25, 50, 500-year events.

Annual Rainfall

In the LVMWD Service Area the recorded history of rainfall varies greatly. Rainfall amounts have ranged from no rain at all in some years to well over normal averages in very wet years. Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than in consistent amounts throughout the year.

Dam and Reservoir Failure

Loss of life and damage to structures, roads, and utilities may result from a reservoir or dam failure. Several factors influence the severity of a full or partial reservoir or dam failure: the amount of water released, topography, and the density of downstream populations and structures.

The Las Virgenes Municipal Water District (LVMWD) serves the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village as well as several unincorporated areas of Los Angeles County. The LVMWD maintains two major facilities in Westlake Village:

- The Las Virgenes Reservoir is located at 2860 Three Springs Drive
- The Westlake Filtration Plant located at 32601 Torchwood Place (filters water from the Las Virgenes Reservoir prior to delivery to customers)

The Las Virgenes Reservoir has a surface area of approximately 160 acres and contains nearly 3 billion gallons of water. The reservoir was built from 1970 to 1972 and is comprised of two earthen dams built on a bedrock foundation. The main dam is 160 feet high, 2,000 feet long, 20 feet wide at the top, and 750 feet wide at the bottom. The saddle dam is 50 feet high, 750 feet long, 20 feet wide at the top, and 425 feet wide at the bottom.

Figure 12: Las Virgenes Reservoir

FLOOD HAZARD IDENTIFICATION

Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course. As described earlier, due to the close proximity to the Santa Monica Mountain range and variations of topography, there is a potential for flood throughout the entire area. Furthermore, due to continued growth, economic development and an increase of impermeable areas, the region's storm water collection and conveyance system may become overwhelmed.

Tropical Storms and El Nino Conditions

Another source of heavy rainfall is from summer tropical storms. These tropical storms usually coincide with El Nino years. El Nino is a disruption of the ocean-atmosphere system in the tropical Pacific Ocean having important consequences for weather in California. Among these consequences is increased rainfall across the southern tier of the U.S. and Peru.

During El Nino periods, trade winds begin to relax in the central and western Pacific Ocean leading to a depression of the thermocline in the eastern Pacific Ocean and an elevation of the thermocline in the west. The result is a rise in sea surface temperature and heavier than normal rainfall in Southern California. In the past, El Nino conditions have caused damage to the entire Los Angeles County area.

Geography and Geology

LVMWD Service Area geologic features mainly consist of un-consolidated and semi-consolidated alluvial materials underlain and bounded on the north and east by consolidated sediments and crystalline rocks. These deposits consist of a shallow layer of Quaternary fill that has been washed down from the Santa Monica Mountains.

The materials are generally poorly sorted sands and gravels, intermingled with silts and clays. This lack of open ground forces water to remain on the surface and rapidly accumulate. If it were not for the existing flood control system in the area with its concrete lined river and stream beds, flooding would be a much more common occurrence.

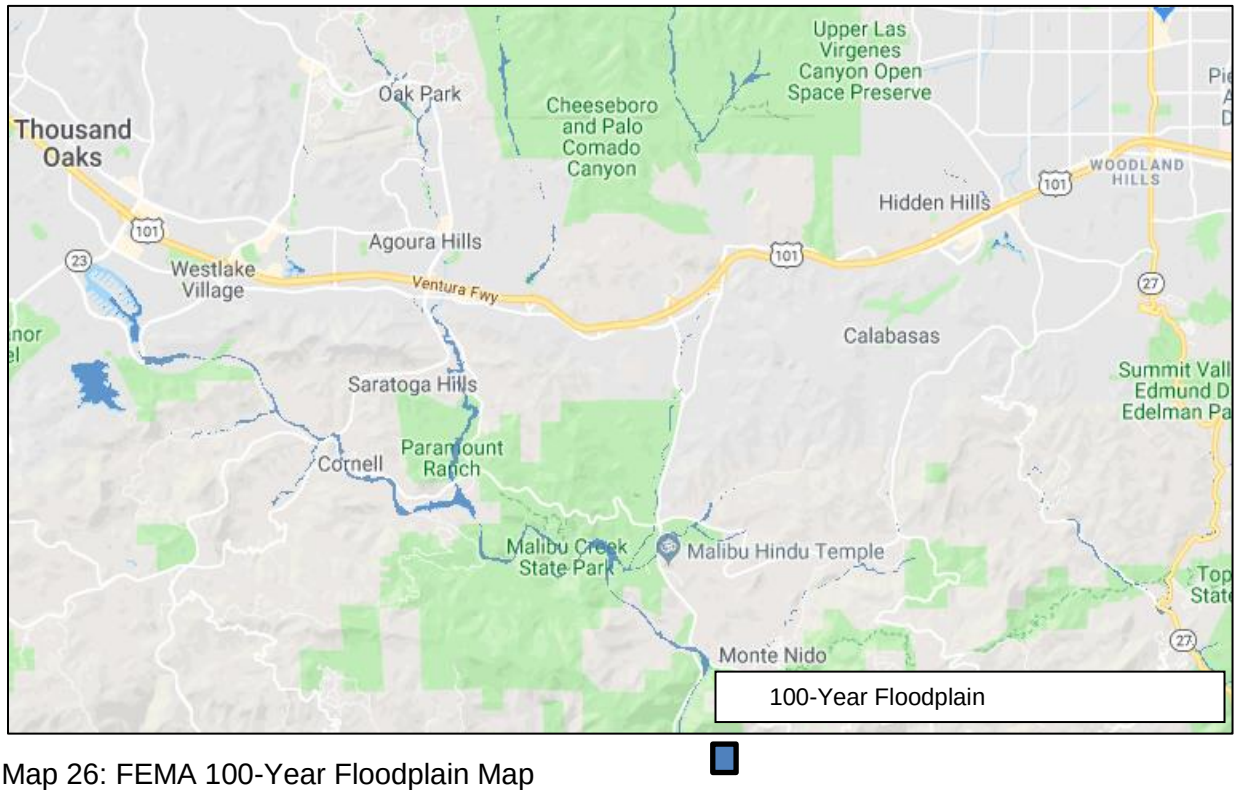
Urban Development

The trend towards development has resulted in less open land and greater flood potential. In-fill building is becoming a much more common practice in many areas. Developers tear down an older home which typically covers up to 40% of the lot size and replace it with a single massive home or multi-unit town homes or apartments which may cover 90-95% of the lot. The consequence is less surface area for water to seep into the ground causing excessive run-off.

Another potential source of flooding is “asphalt creep.” The street space between the curbs of a street is a part of the flood control system. Water leaves property and accumulates in the streets, where it is directed towards the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when streets are being resurfaced, a one to two-inch layer of asphalt is laid down over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus, the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

Flood Maps and Flood Insurance Studies

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The National Flood Insurance Program (NFIP) was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. NFIP regulations (44 Code of Federal Regulations Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level.



Map 26: FEMA 100-Year Floodplain Map

Source: CA.gov

Estimated Impact of an Event

If major flooding were to occur, the consequences to local populations, employment, and housing could be significant. For the LVMWD, the impact may involve:

- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure from Sink Holes, Landslides, and Flood Inundation
- Loss of Power Leading to Disruptions to Pump Stations

Customer and economic disruptions to 10% of the LVMWD Service Area will result in the following projected losses.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 10% Loss Occurs
Population	20,692	24,202	1,921	8,440	5,526
Total City Employment	11,200	11,900	-	13,886*	2,310
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$432,059,500
Total Housing Units	5,562	6,097	510	2,934	1,510

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

FLOOD VULNERABILITIES

The major concern regarding the impact on communities from flood events is the loss of life and property. Critical infrastructure failures are also a threat and may require days or weeks to repair. Similarly, the impact to business and industry can result in immediate and long term economic loss.

Property Loss

Extensive damage can be caused by flooding and landslide damage related to soil saturation from flood events. The type of property damage caused by flood events depends on the location, depth, and velocity of flood waters. Flood waters can wash buildings off foundations and sweep personal property downstream.

Critical Infrastructure

Critical infrastructure can be damaged during floods especially when high water levels combine with flood debris. Damage can occur to water and sewer systems, electrical supplies, pipelines, transportation networks, emergency facilities, communications networks, and other essential sites. Furthermore, contamination of underground wells and reservoirs can impact local water supplies. Finally, flood waters and debris can overflow local storm water systems causing traffic disruptions and pose a hazard to the health of the local community.

Business and Industry

Flood events impact businesses by damaging property and interrupting access by employees, suppliers, and customers. Furthermore, a loss of utilities caused by flooding can prevent businesses and industry from functioning. In addition, local or regional flooding can result in lower worker productivity, disrupt traffic, and increase commute times.

FLOOD MITIGATION STRATEGIES

LVMWD Mitigation Activities

The LVMWD flood and severe winter storm mitigation actions include:

- Emergency Power Generation to Support Key Pump Stations (Power Outage)
- Drainage and Debris Clearance
- Ongoing Inspections and Assessments of All LVMWD Facilities and Infrastructure
- Site Inspections for Flood Prone Risk for New Facilities and Infrastructure

SECTION 11: TERRORISM

THE NATURE OF THE TERRORISM

Terrorism is a continuing threat throughout the world and within the United States. There is no history of terrorist acts or terrorist groups operating in the LVMWD Service Area. Consequently, the probability of a terrorist attack is considered low. Nevertheless, it is still important to consider the potential for terrorist activities especially since there are a variety of political, social, religious, cultural, and economic factors that underlie the broad term "terrorist". In addition, since terrorists often focus on high visibility targets and civilian populations, the potential consequences of an attack underscore the need to consider terrorism as part of this mitigation plan.

Furthermore, while Mass Violence events such as "Active Shooter" incidents are generally considered workplace or school focused and are criminal acts, they can also be considered forms of terrorism. There are specific characteristics that can link some Active Shooter cases to terrorism. Namely the targeting of vulnerable populations resulting in loss of life and an intent to intimidate. While the risk of Mass Violence events such as Active Shooter incidents is still considered low, including all forms of terrorism is an important component of a comprehensive mitigation plan.

HISTORY OF TERRORIST AND MASS VIOLENCE EVENTS IN THE LVMWD SERVICE AREA REGION

The LVMWD Service Area has not experienced a terrorist act or incidence of mass violence; however, it does include a variety of important businesses, public sites, pipelines, electrical infrastructure, and high-profile individuals which could attract the attention of terrorists. In addition, there are multiple schools, shopping areas, public venues, and private businesses that could experience mass violence attacks. The consequences of a terrorist act or mass violence incident in the region could also impact the local area, e.g., disruption of CA 101, Pacific Coast Highway, local streets, etc. Furthermore, there is a possibility that extremist groups or lone attackers could operate from the area and use it as a base of operations for attacks elsewhere.

Specific Threats

Recent trends toward large scale incidents generating significant casualties make preparedness and the mechanisms for effective response essential. In addition to large scale attacks, a full range of assault styles must be considered. Terrorists or mass violence perpetrators may include a variety of methods including letter bombs, large-scale bombs, active shooter incidents, car or truck attacks, knife assaults, bio-chemical attacks, car bombs, suicide attacks, or hostage taking.

Venues likely to suffer the impact of terrorism or mass violence include critical infrastructure (e.g., pump stations, dams, etc.) government facilities, military facilities and recruiting offices, military suppliers, hospitals, entertainment and cultural facilities, religious centers, shopping malls, business complexes, movie theaters, public arenas, colleges, schools, and research centers.

Motivation

Conventional political motivation for terrorism continue, however issues involving organized crime, narcotics trafficking, ecological/animal rights, abortion/right-to-life groups, and perceived economic injustice can also involve terrorist groups or lone individual "Lone Wolf" planning, and operations. In addition, increased motivation may be attributed to the growing use of the Internet for terrorist recruitment, training, and communications as well as social media as outlets for mass violence perpetrators to publicize their activities and motivation.

CAUSES AND CHARACTERISTICS OF TERRORISM

Terrorism

Defining Terrorism

There are multiple definitions of terrorism in common use. The United States Code defines terrorism as premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents usually intended to influence an audience. The United States Department of Justice defines terrorism as a violent act dangerous to human life, in violation of the criminal laws of the U.S. or any segment to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. The FBI defines terrorism as the unlawful use of force or violence against persons or property to intimidate or coerce government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

All three of these definitions share important components:

1. Criminal action
2. The action must include violence against civilians
3. The action is carried out in order to further political or social objectives
4. The action is intended to coerce a government or civilian population

Terrorism Hazard Identification

The categories below serve to differentiate terrorist organizations or individuals according to common goals and motivation. It should be noted that these categories of terrorism and terrorist groups are constantly changing. In addition, the "Lone Wolf" terrorism (individuals not connected to a terror cell or larger group, but who commit acts of public violence, often on behalf of a personal grievance) has added another dimension.

Category	Description
Separatist	Separatist groups are those with the goal of separation from existing entities through independence, political autonomy, or religious freedom or domination. The ideologies separatists subscribe to include social justice or equity, anti-imperialism, as well as the resistance to conquest or occupation by a foreign power.
Ethnocentric	Groups of this persuasion see race as the defining characteristic of a society, and therefore a basis of cohesion. There is usually the attitude that a particular group is superior because of their inherent racial characteristics.
Nationalistic	The loyalty and devotion to a nation, and the national consciousness derived from placing one nation's culture and interests above those of other nations or groups. This can find expression in the creation of a new nation or in splitting away part of an existing state to join with another that shares the perceived "national" identity.
Revolutionary	Dedicated to the overthrow of an established order and replacing it with a new political or social structure. Although often associated with communist political ideologies, this is not always the case, and other political movements can advocate revolutionary methods to achieve their goals
Political	Political ideologies are concerned with the structure and organization of the forms of government and communities. While observers outside terrorist organizations may stress differences in political ideology, the activities of groups that are diametrically opposed on the political spectrum are similar to each other in practice.
Religious	Religiously inspired terrorism is on the rise. While Islamic terrorists and organizations have been the most publicized, all of the major world religions have extremists that have taken up violence to further their perceived religious goals. Religiously motivated terrorists see their objectives as holy writ, and therefore infallible and non-negotiable
Social	Often particular social policies or issues will be so contentious that they will incite extremist behavior and terrorism. Frequently this is referred to as "single issue" or "special interest" terrorism. Some issues that have produced terrorist activities in the United States and other countries include animal rights, abortion, ecology/environment, and minority rights.

Category	Description
Domestic	These terrorists are "home-grown" and operate within and against their home country. They are frequently tied to extreme social or political factions within a particular society and focus their efforts specifically on their nation's socio-political arena.
International or Transnational	Often describing the support and operational reach of a group, these terms are often loosely defined, and can be applied to widely different capabilities. *International groups* typically operate in multiple countries but retain a geographic focus for their activities. Hezbollah has cells worldwide, and has conducted operations in multiple countries, but is primarily concerned with events in Lebanon and Israel. *Transnational groups* operate internationally, but are not tied to a particular country, or even region. Al Qaeda is transnational; being made up of many nationalities, having been based out of multiple countries simultaneously, and conducting operations throughout the world. Their objectives affect dozens of countries with differing political systems, religions, ethnic compositions, and national interests

Source: http://www.terrorism-research.com/groups/categories.php

International Terrorist Groups

International terrorist groups can operate anywhere and act without regard to national borders. U.S. Code Title 18 Part I, Chapter 113b § 2331 defines international terrorism as activities that:

(A) involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State, or that would be a criminal violation if committed within the jurisdiction of the United States or of any State;

(B) appear to be intended:
  (i) to intimidate or coerce a civilian population;
  (ii) to influence the policy of a government by intimidation or coercion; or
  (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and

(C) occur primarily outside the territorial jurisdiction of the United States, or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate or coerce, or the locale in which their perpetrators operate or seek asylum

The U.S. State Department issues and maintains the Foreign Terrorist Organization (FTO) List which documents current threat groups. The current FTO is listed below:

1. Abu Sayyaf Group (ASG)
2. Aum Shinrikyo (AUM)
3. Basque Fatherland and Liberty (ETA)
4. Gama'a al-Islamiyya (Islamic Group - IG)
5. HAMAS
6. Harakat ul-Mujahidin (HUM)
7. Hizballah
8. Kahane Chai (Kach)
9. Kurdistan Workers Party (PKK, aka Kongra-Gel)
10. Liberation Tigers of Tamil Eelam (LTTE)
11. National Liberation Army (ELN)
12. Palestine Liberation Front (PLF)
13. Palestine Islamic Jihad (PIJ)
14. Popular Front for the Liberation of Palestine (PFLP)
15. PFLP-General Command (PFLP-GC)
16. Revolutionary Armed Forces of Colombia (FARC)
17. Revolutionary People's Liberation Party/Front (DHKP/C)
18. Shining Path (SL)
19. al-Qa'ida (AQ)
20. Islamic Movement of Uzbekistan (IMU)
21. Real Irish Republican Army (RIRA)
22. Jaish-e-Mohammed (JEM)
23. Lashkar-e Tayyiba (LeT)
24. Al-Aqsa Martyrs Brigade (AAMB)
25. Asbat al-Ansar (AAA)
26. al-Qaida in the Islamic Maghreb (AQIM)
27. Communist Party of the Philippines/New People's Army
28. Jemaah Islamiya (JI)
29. Lashkar i Jhangvi (LJ)
30. Ansar al-Islam (AAI)
31. Continuity Irish Republican Army (CIRA)
32. Islamic State of Iraq and the Levant (al-Qa'ida in Iraq)
33. Islamic Jihad Union (IJU)
34. Harakat ul-Jihad-i-Islami/Bangladesh (HUJI-B)
35. al-Shabaab
36. Revolutionary Struggle (RS)
37. Kata'ib Hizballah (KH)
38. al-Qa'ida in the Arabian Peninsula (AQAP)
39. Harakat ul-Jihad-i-Islami (HUJI)
40. Tehrik-e Taliban Pakistan (TTP)
41. Jundallah
42. Army of Islam (AOI)
43. Indian Mujahedeen (IM)
44. Jemaah Anshorut Tauhid (JAT)
45. Abdallah Azzam Brigades (AAB)
46. Haqqani Network (HQN)
47. Ansar al-Dine (AAD)
48. Boko Haram
49. Ansaru
50. al-Mulathamun Battalion (AMB)
51. Ansar al-Shari'a in Benghazi
52. Ansar al-Shari'a in Darnah
53. Ansar al-Shari'a in Tunisia
54. ISIL Sinai Province (formerly Ansar Bayt al-Maqdis)
55. al-Nusrah Front
56. Mujahidin Shura Council in the Environs of Jerusalem
57. Jaysh Rijal al-Tariq al Naqshabandi (JRTN)
58. ISIL-Khorasan (ISIL-K)
59. Islamic State of Iraq and the Levant's Branch in Libya
60. Al-Qa'ida in the Indian Subcontinent
61. Hizbul Mujahideen (HM)
62. ISIS-Bangladesh
63. ISIS-Philippines
64. ISIS-West Africa
65. ISIS-Greater Sahara
66. al-Ashtar Brigades (AAB)
67. Jama'at Nusrat al-Islam wal-Muslimin (JNIM)

International terrorist groups often have state sponsors who view terrorism as a tool of foreign policy. State sponsors of terrorism engage in anti-Western terrorist activities by funding, organizing, networking, and providing other support to many extremists.

Country	Designation Date
Democratic People's Republic of Korea (North Korea)	November 20, 2017
Iran	January 19, 1984
Sudan	August 12, 1993
Syria	December 29, 1979

Source: U.S. State Department

Domestic Terrorism in the United States

Domestic terrorism involves attacks within the United States perpetrated by homegrown groups or individuals. U.S. Code Title 18 Part I, Chapter 113b § 2331 defines domestic terrorism as activities that:

(A) involve acts dangerous to human life that are a violation of the criminal laws of the United States or of any State;

(B) appear to be intended—

i. to intimidate or coerce a civilian population;

ii. to influence the policy of a government by intimidation or coercion; or

iii. to affect the conduct of a government by mass destruction, assassination, or kidnapping; and

(C) occur primarily within the territorial jurisdiction of the United States.

Domestic Terrorism Examples

Year	Event	Description
April 19, 1995	Oklahoma City Bombing	Truck bomb resulting in 168 people killed
July 27, 1996	Centennial Olympic Park Bombing	1996 Summer Olympic bombing in Atlanta, GA resulting in 2 deaths and 111 injuries
September 18, 2001 (start)	U.S. Anthrax Attacks	A series of letters containing anthrax spores lasting several weeks resulting in 5 deaths and 17 infections
May 31, 2009	Assassination of Dr. George Tiller	Murder of a nationally known physician that performed late-term abortions
June 10, 2009	U.S. Holocaust Memorial Museum Shootings	Shooting attack of a believed neo-Nazi resulting in 1 death
November 5, 2009	Fort Hood Shootings	Shooting attack of a believed Islamic extremist resulting in 13 deaths and 30 wounded
August 5, 2012	Wisconsin Sikh Temple Shootings	Shooting attack at the Oak Creek Sikh Temple in Wisconsin resulting in 6 deaths and 4 wounded
February 18, 2010	Austin, Texas IRS Airplane Attack	Aircraft attack on an IRS office building by a believed anti-government / anti-corporate business extremist resulting in 1 death
April 15, 2013	Boston Marathon Bombing	Bombing at the Boston Marathon resulting in 3 deaths and several hundred injuries.
June 17, 2015	Charleston Church Shooting	Shooting attack at the Emanuel African Methodist Episcopal Church resulting in 9 killed and 3 injured
December 2, 2015	San Bernardino Inland Regional Center Shootings	Shooting attack resulting in 14 people killed and 24 injured at the San Bernardino County Department of Public Health training event and holiday party
June 12, 2016	Orlando Pulse Nightclub Shootings	Shooting attack resulting in 49 people killed and 58 injuries at the Pulse Nightclub in Orlando
October 1, 2017	Las Vegas Route 91 Harvest Music Festival Shootings	Shooting attack at the Harvest Music Festival by a lone sniper from the Mandalay Bay Hotel resulting in 58 killed and 851 injured

Post 9/11

After September 11, 2001, the United States has increased its security policies and procedures at the national and local level. Since then, Federal Grants for counter-terrorism have increased to approximately seventy-five billion dollars per year from federal and state governments according to Kim Murphy of Los Angeles Times in an article dated August 2011. These grants have provided local counties and cities funds to strengthen their security procedures, implement needed mitigation actions, or provide first responders with specialized training and equipment.

Weapons of Mass Destruction (WMD)

Weapons of Mass Destruction are a specific type of threat that must be considered by any community. For the Los Angeles County region, this may involve the activation of a WMD within the area or a large-scale attack in a nearby location. Consequently, ongoing awareness and training of local emergency responders, government, and healthcare providers is important to ensure that such events are quickly identified and managed.

Five Types of WMD That Could be Used by Terrorists

WMD can be segregated into five categories using the acronym B-NICE: Biological, Nuclear, Incendiary, Chemical and Explosive.

1. Four common types of biological agents are bacteria, viruses, rickettsia, and toxins.
2. Nuclear terrorism can occur in two different ways.
    a. Detonation or threat of detonation of a nuclear bomb
    b. Dispersion of radiological material using a conventional explosive or other dispersal device
3. An incendiary device is any mechanical, electrical, or chemical device used to intentionally initiate combustion and start a fire.
4. Chemical agents can be classified into five categories: nerve agents, blister agents, blood agents, choking agents, and irritating agents.
5. Explosive devices are the most common WMD (70% of all terrorist attacks).

While explosives are the most common method, any of the WMDs listed can be deployed at any time. Consequently, threat awareness and vigilance are critical to prevent future attacks.

In one well-known case a plot to detonate a car bomb at the Los Angeles International Airport was uncovered by an alert U.S. Customers inspector. On December 14, 1999, Ahmed Ressam (aka the Millennium Bomber) was arrested after a U.S. Customs inspector had his vehicle searched after he had successfully boarded a ferry from Canada to Port Angeles, Washington. The inspector is credited for noticing Ressam's behavior as unusual and ordering a secondary customs search and a check of his passport. As a result, chemicals and explosive timing devices were found in the trunk of his vehicle and his passport was identified as counterfeit. Ressam was subsequently jailed and convicted on multiple counts.

Mass Violence

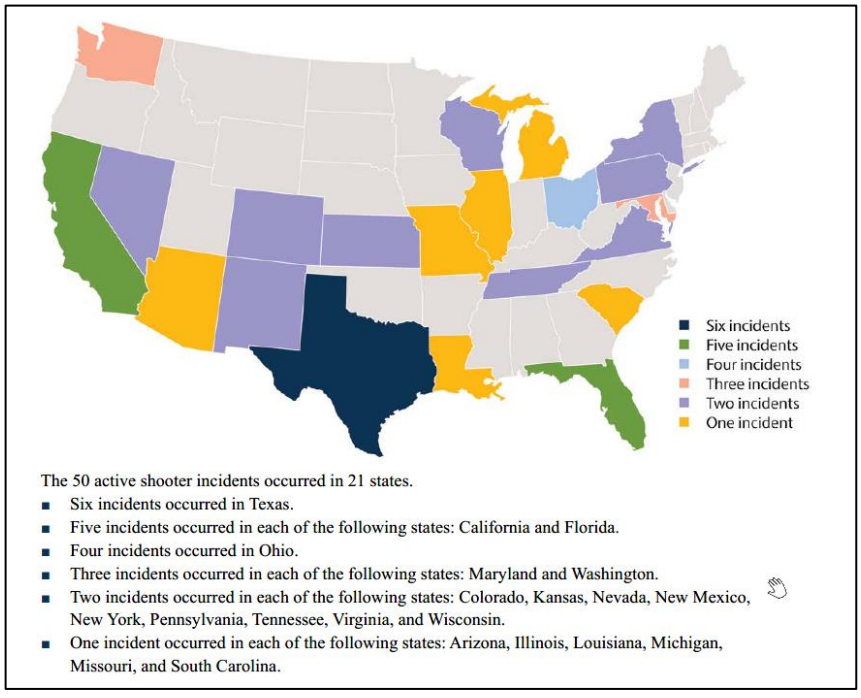
Defining Mass Violence

Mass violence involves shootings, car or truck attacks against pedestrians, and other targeting that results in harm to multiple victims. As defined by the Federal Bureau of Investigation (FBI), an active shooter is an individual actively engaged in killing or attempting to kill people in a populated area. The federal definition of "mass killings," according to the Investigative Assistance for Violent Crimes Act is, "three or more killings in a single incident." (not including the shooter).

Mass Violence Incidents in the United States

According to the FBI[6], from 2016 to 2017 there were 50 active shooter incidents in the U.S. that resulted in 943 casualties (221 people killed, and 722 people wounded, excluding the shooters).

- The highest number of casualties (58 killed and 489 wounded) occurred during the Route 91 Harvest Festival in Las Vegas, Nevada, in 2017.
- The second highest number of casualties (49 killed and 53 wounded) occurred at Pulse, a nightclub in Orlando, Florida, in 2016.
- The third highest number of casualties (26 killed and 20 wounded) occurred at the First Baptist Church in Sutherland Springs, Texas, in 2017.



Map 27: Active Shooter Incidents in the U.S. from 2016 to 2017

[6] U.S., Department of Justice, Federal Bureau of Investigation, Active Shooter Incidents in the United States in 2016 and 2017, April 2018.

ESTIMATED IMPACT OF A TERRORIST EVENT OR MASS VIOLENCE INCIDENT

If a terrorist event causing a disruption to LVMWD services were to occur, the consequences to local populations and employment may be significant depending on the site or sites targeted.

For the LVMWD, the impact may involve:

- Loss of Life and Injuries
- Disruption of Water and Sewage Services to Customers
- Damage to LVMWD Infrastructure
- Loss of Power Leading to Disruptions to Pump Stations

The table below provides the estimated impact of a disaster using a 1% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Westlake Village	Impact if a 1% Loss Occurs
Population	20,692	24,202	1,921	8,440	553
Total City Employment	11,200	11,900	-	13,886*	231
Economy**	$811,395,000	$1,614,403,000	$500,000	$1,894,297,000	$43,205,950
Total Housing Units	5,562	6,097	510	2,934	151

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

TERRORISM VULNERABILITIES

The probability that an individual or location will be targeted by a terrorist is a function of several factors including the attractiveness of target, the potential for success of the event and the potential for avoiding identification and capture. Categories of potential targets include:

- Pump Stations
- Dams and Reservoirs
- Pipelines and Infrastructure
- LVMWD Offices and Facilities

REGIONAL RESPONSE, MITIGATION, AND PREVENTION ACTIVITIES

The Los Angeles County Sheriff's Department is the lead law enforcement agency for the region regarding terrorist events and mass casualty incidents. Individual cities will be responsible for consequence management. Currently the Lost Hills Sheriff's station and individual cities implement projects and or programs to help prevent a terrorist or mass casualty situation or be prepared if one were to occur. The following are practices or projects that are currently active in the Region.

Emergency Response Actions

The Los Angeles County Sheriff's Department acts as the lead agency for crisis management, perimeter security, access control, traffic/crowd control, evacuations, notifications, and safeguarding evidence. Crisis management activities may include:

- Investigation, tracking, and maintaining scene integrity.
- Coordinating coroner issues with the Los Angeles County Coroner's Department.
- Use of Special Weapons and Tactics (SWAT) or Rapid Deployment Force (RDF) units
- Assisting with damage assessment and fatalities management.

The Los Angeles County Fire Department is the lead agency for fire response, hazardous materials events, and medical/rescue operations. The County Fire Department provides support as necessary to the Sheriff for Crisis Management activities. Existing procedures, such as the Fire Department's Hazardous Materials Response procedures and NBC Response Protocols are used as necessary. The Fire Department assists with:

- Fire and rescue operations
- Emergency medical services coordination
- Perimeter and access control
- Evacuation operations
- Notifications
- Safeguarding evidence
- Damage assessment
- Fatalities management
- Addressing environmental needs
- Obtaining personnel with radiological training
- Insuring decontamination procedures (radiological and chemical) are in place
- Insuring biological agents are contained

Equipment and JRIC

In September 2011, Los Angeles County received an $8.9 million grant from the Department of Homeland Security. The funds were a part of a 2010 federal grant of $69.9 million to the Los Angeles-Long Beach Urban Area. The grant was intended to address the unique equipment, training and planning needs of large urban areas in managing terrorism threats.[7] The Los Angeles County Sheriff's Department received the bulk of the $8.9 million grant and will use $6.2 million for equipment, such as an aerial video downlink technology, mobile surveillance cameras, tactical robots, radiation detection devices and bomb suits.

Nearly 70 percent of the total Los Angeles-Long Beach Urban Area funds were spent on the region's Joint Regional Intelligence Center (JRIC). The JRIC is staffed by federal, state and local intelligence analysts and investigators responsible for the 44,000-square-mile territory surrounding Los Angeles. The JRIC opened in 2006 and is the largest of approximately 40 facilities nationwide and is used to coordinate data from 200 agencies in seven counties.

Terrorism Early Warning Group

In 1996, the Los Angeles County Sheriff Department established the Terrorism Early Warning (TEW) Group.[8] The purpose of the TEW Group is to act as an interdisciplinary group in which local, state, and federal agencies work together to share information and combine resources, and to enhance the ability to identify and respond to acts and threats of terrorism. This interagency approach allows for early response and enforcement by clearing the communication channels between agencies and creating an environment that facilitates information and intelligence sharing. The result is an effective network that has the ability to identify information which might indicate impending terrorist activity. This group is a significant resource for identifying and assessing potential threats, making appropriate notifications and recommendations, and aiding in mission planning and the efficient allocation of resources.

[7] http://ourweekly.com/los-angeles/sheriff%E2%80%99s-department-spend-89-million-anti-terror-equipment-training-and-intelligence

[8] http://file.lacounty.gov/lasd/cms1_144939.pdf

TERRORISM MITIGATION STRATEGIES

LVMWD Mitigation Activities

The LVMWD terrorism mitigation actions include:

- Security Barriers and Fencing (Physical Threats)
- Security Monitoring and Camera Surveillance (Physical Threats)
- SCADA Security Upgrades
- Ongoing Security Inspections and Assessments of All LVMWD Facilities and Infrastructure

SECTION 12: PLAN MAINTENANCE AND MONITORING

This Plan Maintenance section details the formal process that will ensure that the Las Virgenes Municipal Water District Hazard Mitigation Plan is an active and relevant document. This section includes a schedule for monitoring and evaluating the plan and producing revisions every five years. Additionally, a description of how the LVMWD will integrate public participation throughout the plan maintenance process is provided.

This section includes an explanation of how the LVMWD intends to incorporate the mitigation strategies outlined in this plan into existing planning mechanisms such as the District's Strategic Planning mechanisms. In addition, a brief discussion on future development trends is provided to highlight potential areas of focus when updating the HMP.

FUTURE DEVELOPMENT TRENDS

Due to development restrictions and space limitations property development trends within the Las Virgenes Municipal Water District Service Area are stable with limited residential and commercial development. Any increases in the urban/wildland interface and the customer base of the LVMWD are controlled through local land use and zoning requirements by each city.

IMPLEMENTATION AND PLAN ADOPTION

The Las Virgenes Municipal Water District Board of Directors has final authority for approving and adopting the Hazard Mitigation Plan for the District. The HMP is then submitted to the State Hazard Mitigation Officer at the California Governor's Office of Emergency Services (Cal OES). Cal OES is responsible for submitting the plan to the Federal Emergency Management Agency (FEMA) for review. The review includes the criteria outlined in FEMA Mitigation Planning Final Rule 44 CFR Part 201 (September 2009). Upon acceptance by FEMA, the LVMWD will maintain its eligibility for Hazard Mitigation Grant Program funds.

Continued Public Involvement

The LVMWD is dedicated to involving the public in the Hazard Mitigation Plan process. Members of the public, businesses, and other interested parties have the opportunity to provide feedback on local area risks and the Hazard Mitigation Plan. Copies of the plan are catalogued and maintained in appropriate departments as well as on LVMWD web site to be easily accessible for public viewing. In addition, an ongoing public outreach effort provides a continual feedback opportunity to the public for their input and comments (see Public Involvement, under Annex C: Planning and Public Involvement for additional details).

Coordinating Body

The Las Virgenes Municipal Water District Planning Group and Steering Committee were responsible for coordinating and undertaking the formal review process. The Planning Group members were responsible for ensuring that reviews and updates to the plan were performed. Further, the Steering Committee and Planning Group provide coordination between the cities, intra-District departments, and with other public agencies.

The Planning Group and Steering Committee conduct annual reviews of the Hazard Mitigation Plan and when deemed necessary by the Hazard Mitigation Planning Group in coordination with the Steering Committee, determine if a public meeting is to be held. The meetings provide the public a forum where they can express their concerns, opinions, or ideas about the plan. In addition, the LVMWD maintains an ongoing ability to receive and respond to public concerns via the District's web site.

Adoption and Implementation

The LVMWD Board of Directors was responsible for adopting the Hazard Mitigation Plan and in conjunction with the Steering Committee and Planning Group which are responsible for plan implementation.

The LVMWD Project Manager serves as a convener to facilitate the Hazard Mitigation meetings. Plan implementation and evaluation are a shared responsibility among all of the Hazard Mitigation Planning Group Members. The HMP is reviewed on a continual basis and as situations change. In addition a formal review and update process is scheduled every five (5) years.

IMPLEMENTATION THROUGH EXISTING PROGRAMS

Integration of the Hazard Mitigation Plan into Existing Planning Mechanisms

In addition to ongoing disaster preparation and mitigation efforts, the LVMWD continually evaluates its current and future projects for integration into the overall Hazard Mitigation Plan and the District's Strategic Plan. Key members of the HMP Planning Group responsible for integration of the HMP into existing programs include representatives from Facilities & Operations, Finance, and Technical Services.

In addition, the LVMWD coordinates with the cities within its Service Area (Agoura Hills, Calabasas, Hidden Hills, and Westlake Village) which are part of the Las Virgenes-Malibu Council of Governments (LVMCOG). The LVMWD has incorporated key parts of the LVMCOG Multi-Jurisdictional Hazard Mitigation Plan into its HMP planning process.

ECONOMIC ANALYSIS OF MITIGATION PROJECTS

FEMA's approaches to identify the costs and benefits and costs associated with hazard mitigation strategies, measures, or projects include a Benefit/Cost Review and more detailed Benefit-Cost Analyses (BCA). Conducting an economic analysis for a mitigation activity can assist the cities in determining whether a project is worth undertaking now in order to avoid disaster-related damages later.

Benefit-Cost Review

The Benefit-Cost Review process includes monetary as well as non-monetary costs and benefits associated with each action. Some projects can be extremely cost-effective but not as beneficial for the community at large. The Planning Team considered a wide variety of questions, such as:

- How many people will benefit from the action?
- How large an area is impacted?
- How critical are the facilities that benefit from the action (e.g., is it more beneficial to protect the fire station than the administrative building, even though it costs more)?
- Environmentally, does it make sense to do this project for the overall community?

Benefit-Cost Analysis

The Benefit-Cost analysis is used to determine if the cost of investing in a specific mitigation project, i.e., the "cost" will result in reduced damages in the future, i.e., the "benefits" and if the loss prevented justifies the expenditure of funds for the project. If the benefit is greater than the cost, then the project is cost effective; if the benefit is less than the cost, then the project is not cost effective.

The Benefit-Cost Analysis is essentially the same for each type of hazard mitigation project. The only differences are the types of data that are used (e.g., if the project is for earthquake, flood, wind, or fire mitigation). To determine the Benefit-Cost, the project cost is compared to the anticipated dollar loss that will be prevented by the mitigation

project. For example, if the project cost is $100,000 and the expected loss averted is $1,000,000, then the benefit exceeds the cost and is therefore cost effective. The ratio of the benefit versus the cost is 10:1 ($1,000,000 divided by $100,000). Priority is given to those projects with the highest Benefit-Cost Ratio or those projects with the greatest benefit to the community.

Benefit-Cost Analysis Exemptions

The following categories of mitigation measures are exempt from the FEMA policy on Benefit-Cost analysis:

- 5% Initiative Projects: States, which receive a Presidential declaration, are eligible to use up to 5% of available HMGP funding at their discretion.
- Tornado Initiative: States, which receive a Presidential declaration, are eligible to use up to an additional 5% of available HMGP funding at their discretion.
- Substantial Damage Waivers for acquisition of substantially damaged structures in 100-year floodplain.
- Mitigation planning related grants.

Benefit-Cost Methodology Utilized

DMA 2000 does not require Hazard Mitigation Plans to include BCA's for specific projects.[9] Consequently a Benefit-Cost Review approach is used for the Hazard Mitigation Plan. Future projects will be evaluated using a similar process.

For the LVMWD HMP, mitigation projects were reviewed and prioritized by the HMP Planning Group which considered:

- The expected benefit to the community according to the following categories:
  - Protection of Life / Loss of Life Reduction
  - Protection of Property / Property Loss Reduction
  - Protection of the Environment / Environmental Loss Reduction
  - Increase Public Awareness
  - Scope of Impact (i.e., the degree to which the project benefits the community or region)
- Costs: total estimated expense including ongoing maintenance requirements
- Constraints: the availability of resources, if funds were already budgeted or if additional budget funding was required, and the timeline for completion (if known)
- Other considerations included whether projects were already in progress or part of another effort (e.g., part of an existing District program, County-wide program or city initiative)

[9] FEMA Publication 386-5, State and Local Mitigation Planning, Using Benefit-Cost Review in Mitigation Planning, May 2007

The following tables provide examples of the Benefit-Cost Review factors considered:

Benefit Factors	Evaluation Score
Protection of Life/Loss of Life Reduction	High / Medium / Low / None
Protection of Property/Property Loss Reduction	High / Medium / Low / None
Protection of the Environment/Environmental Loss Reduction	High / Medium / Low / None
Increased Public Awareness	High / Medium / Low / None
Scope of Impact	High (benefits the entire city or region) Medium (benefits a large part of the city or region) Low (benefits a targeted or limited area) None

Cost Factor	Evaluation Score
More than $500K regionally or $50K locally	High
$250K to $499K regionally or $25K to $49.9K locally	Moderately High
$100K to $249K regionally or $10K to $24.9K locally	Medium
$50K to $99K regionally or $5K to $9.9K locally	Moderately Low
Less than $50K regionally or $5K locally	Low
In-house Time	None

Constraint Factor	Evaluation Score
Resources	No Resources Available Limited Resources Available Resources Allocated and Assigned
Funding	No Funds Available (Need to Obtain New Funding) Limited Funds Available Funds Allocated
Time	Rapid or Condensed Timeframe Moderate Timeframe No Time Constraints

Plan Monitoring, Evaluation, Updates, and Formal Review Process

The Las Virgenes Municipal Water District Hazard Mitigation Plan will be evaluated on an annual basis to determine the effectiveness of programs, and to reflect changes in programs or plans that may affect mitigation priorities. The Planning Group is responsible for monitoring and evaluating the progress of the mitigation strategies in the plan and updating the plan. The Steering Committee approves any major changes.

The Steering Committee and Planning Group will review the goals and action items to determine their relevance to changing conditions within the LVMWD Service Area Region, as well as changes in Local, State, or Federal policy, and to ensure they are addressing current and expected conditions. The Steering Committee and Planning Group will also review the risk assessment portion of the plan to determine if this information should be updated or modified, given any new available data.

The Planning Group comprised of representatives from each key LVMWD department and supports the Steering Committee by attending regularly scheduled meetings to review local planning efforts and evaluate progress on mitigation projects. The Planning Group will report progress to the Steering Committee and work with other departments to implement the mitigation strategies contained in this Hazard Mitigation Plan.

The departments responsible for the various action items identified in Section 13: Hazard Mitigation Goals and Strategies will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies require revision.

Public Involvement

Public involvement is a key component of hazard mitigation planning (per 44 CFR §201.6(c)(4)(iii)). The LVMWD provides access of the Hazard Mitigation Plan to the public and will continue to involve the public in the Hazard Mitigation Planning, Implementation, and Maintenance process through several mechanisms:

Distribution Method	Description
LVMWD Web Page	• Downloadable online copies of the Hazard Mitigation Plan are posted on the web site. • Members of the public may provide feedback on the HMP and/or mitigation projects via Email.
LVMWD Headquarters Facility	• Mitigation and conservation brochures and handouts are made available at the LVMWD Headquarters.
Public Meetings and Events	• Participation in Local Disaster Preparedness Events. • LVMWD Board Meetings (as applicable per published Agenda items).
Public Surveys	• Public Preparedness, Mitigation, and Risk Surveys may be conducted to obtain feedback from the public and input or comments regarding hazard mitigation planning, prioritization of mitigation efforts and risks, and community mitigation and preparedness needs.

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SECTION 13: HAZARD MITIGATION GOALS AND STRATEGIES

This section describes the framework that focuses the plan on developing successful mitigation strategies. The framework is made up of three parts: Mission, Goals, and Strategies.

MISSION

The Mission of the Las Virgenes Municipal Water District Hazard Mitigation Plan is to promote sound public policy and programs designed to protect the public, critical facilities, infrastructure, private and public property, and the environment from natural and human generated hazards. This will be achieved by developing, implementing, and maintaining this plan to guide the LVMWD towards creating and maintaining a safer more sustainable community.

HAZARD MITIGATION PLAN GOALS

The Plan Goals describe the overall direction that the LVMWD can take to minimize the impacts of hazards. The Plan Goals help to guide the direction of future activities aimed at reducing risk and preventing losses. The Plan Goals are the foundation for the broad direction of the Mission Statement and the specific recommendations that are outlined in the strategies. These goals are divided into 4 major categories:

To Protect Life, Property, Environment

- Implement activities that assist in protecting lives by improving infrastructure, critical facilities, and other property to be more resistant to hazards.
- Reduce losses and repetitive damages for chronic hazard events.
- Encourage preventative measures in areas vulnerable to hazards.

Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with hazards.
- Provide information on tools and other opportunities to assist in implementing mitigation activities.

Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.

Emergency Management

- Establish policies to ensure mitigation projects for critical facilities, services, and infrastructure.
- Enforce and update current practices to support mitigation.
- Strengthen emergency operations by increasing collaboration and coordination among departments, public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

HAZARD MITIGATION STRATEGIES

The Hazard Mitigation Plan identifies action items developed and submitted through data collection, research, and the public participation process. Mitigation plan activities may be considered for funding through Federal and State grant programs as well as other funds made available to the LVMWD and internal budgets. To help ensure activity implementation, each action item includes estimated timeframes and a list of coordinating organizations. Mitigation strategies were assigned a priority based on a combination of factors including urgency, importance, and benefit/cost. Constraints may apply to some of the action items. These constraints may be a lack of city staff, lack of funds, or vested property rights which might expose the Region to legal action as a result of adverse impacts on private property. See Section 12 Plan Maintenance and Monitoring: Economic Analysis of Mitigation Projects for further details regarding the method used to evaluate the feasibility of mitigation projects.

Hazard Mitigation Prioritization of Projects and Actions

According to the Disaster Mitigation Act (DMA) 44 CFR 201.6(c)(3)(iii)), local mitigation plans must contain a strategy (or action plan) whereby "Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs. A comprehensive cost-benefit calculation is not required as part of the Hazard Mitigation Plan (per FEMA Local Hazard Mitigation Plan Review Guide) however a detailed cost-benefit analysis may be needed later if an application for federal mitigation grant funding is made).

Benefit Prioritization and Categorization

Each of the projects listed on the following pages were reviewed and prioritized by the HMP Planning Group and considered the expected benefit to the community versus the estimated cost. Other considerations included whether projects were already in progress or part of another effort, if funds were already budgeted or if additional budget funding was required, the availability of resources, ongoing maintenance requirements, and the timeline for completion (if known).

Benefits were evaluated based on five major categories:

1. Protection of Life / Loss of Life Reduction
2. Protection of Property / Property Loss Reduction
3. Protection of the Environment / Environmental Loss Reduction
4. Increase Public Awareness
5. Scope of Impact

Prioritization Review

As part of this Hazard Mitigation Plan, the Planning Group and Steering Committee reviewed the project prioritization criteria in accordance with 44 CFR 201.6(d)(3).

The prioritization review incorporated an assessment of lessons learned and changes in current conditions including:

- Financial Constraints and Funding Considerations
- Regulatory and Legal Requirements
- Political and Jurisdictional Changes
- Development Patterns
- Changes in Disaster Planning and Recovery Priorities (including Risk Assessments)
- Post-Disaster Conditions (as applicable)

Based on the review, the Planning Group and Steering Committee determined that the pervious prioritization criteria were still valid and consistent with the goals established for the HMP. Consequently, the benefits of each project were evaluated and assigned a value (High, Medium, Low, or None). Any changes in the mitigation project list (including project revisions or new projects) considered the following criteria as defined below:

Priority 1	High Priority: The project provides a high benefit with relatively low to moderate cost and/or requires minimal implementation effort. Funding and/or resources may already be assigned or are readily available.
Priority 2	Moderate Priority: The project provides a medium benefit. Resources, costs and/or funding may need to be allocated or obtained.
Priority 3	Low Priority: The project provides a benefit, but the estimated benefits may be limited in scope. Resources and/or funding must be allocated.

Public Mitigation Planning Input

The public was invited to provide their input into the HMP and mitigation planning process (see Annex C: Planning and Public Involvement).

Strategy Organization

The Mitigation Strategies presented provide a listing of activities that the LVMWD can implement to reduce risk. They reflect ongoing activities and future actions to be taken in order to reduce the loss of property and life. All of the projects listed were evaluated in terms of the benefit versus cost and were found to be beneficial (see Section 12: Plan Maintenance and Monitoring for an explanation of the evaluation process utilized). The strategies are organized as follows:

Project Name	Name of the mitigation project strategy.	
Hazard Category	Nature of the threat	
Status	Project status, e.g., Complete, Partially Complete, or Ongoing	
Strategy	Short Strategy description.	
Action Items	Bullet points of key actions that will be completed to implement (or continue) the strategy.	
Implementation Description and Estimated Benefits	A brief description of major activities associated with the project and the estimated benefits. For example, expand on the Action Items above by providing a few sentences to describe the overall project and its benefits. "The project will result in a reduction in risk from…"	
Coordinating Department	The department with regulatory responsibility to address the named hazard, or that is willing and able to organize resources, find appropriate funding, or oversee implementation, monitoring, and evaluation. Participating departments are listed with the main department responsible in BOLD. For example: Operations, Maintenance, Planning, etc.	
Timeline/Completion Date/Priority	The estimated timeframe for implementation along with a general implementation priority.	
	Priority 1	Immediate: The project provides a high benefit with relatively low to moderate cost and/or requires minimal implementation effort. Funding and/or resources may already be assigned or are readily available.
	Priority 2	Important: The project provides a moderate benefit. Resources, costs and/or funding may need to be allocated or obtained.
	Priority 3	Significant: The project provides a benefit but resources, costs and/or funding must be allocated.
Total Cost	Estimated cost of the project.	
Funding Source(s)	Where the funding will be obtained. For example: General fund, Federal Grant, State Grant, etc. Finding can be a goal to obtain in the future and not necessarily already funding. For example, "Obtain State Grant"	
Constraints	Constraints that may apply. These constraints may include a lack of staff, lack of funds, or vested property rights which might expose the District to legal action as a result of adverse impacts on private property.	

Plan Goals Addressed			
	Public Awareness		Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

Mitigation strategies were reviewed and approved by the Steering Committee and Planning Group.

FACILITIES & OPERATIONS MITIGATION PROJECTS

SCADA System Communications

Hazard Category	Terrorism – Cyber Threats
Status	Design Complete
Strategy	Review and update SCADA security.
Action Items	Ensure secure data transmission across all District facilities.
Implementation Description and Estimated Benefits	Increase reliability across all District enterprises reducing vulnerabilities due to disaster events.
Coordinating Department	**Facilities**, Customer Service, Operations, Tech Services, IT/IS
Timeline/Completion Date/Priority	Priority 1: Activity anticipated in fiscal years 20-21 and 20-22.
Total Cost	$143,653
Funding Source(s)	CIP Project No. 10520
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Stationary Emergency Generator Pump Stations

Hazard Category	Power Outage and Wildfires
Status	In design phase.
Strategy	Ensure power availability to support pump stations

Action Items	Complete Design, Bid, Build
	• Installation of generators at critical pump stations:
	  ○ Jed Smith
	  ○ Twin Lakes
	  ○ Cold Canyon
	  ○ Seminole
	• Generator will power duty pumps at each pump station Construction will be done during off peak water demand season. The stations will be done simultaneously

Implementation Description and Estimated Benefits	Implementation will allow for critical facilities to remain in operation in the event of sustained power outage. This will also provide uninterrupted water service during wild fires
Coordinating Department	**Facilities**, Customer Service, Operations
Timeline/Completion Date/Priority	Priority 1
Total Cost	$3,326,028
Funding Source(s)	Grant CAL OES. CIP Project No. 10672.
Constraints	Funding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

GenConnections Water Pump Stations

Hazard Category	All Hazards
Status	In Progress
Strategy	Standardization of CamLok System
Action Items	Replace existing connection point with new connections.
Implementation Description and Estimated Benefits	Eliminate risk of in compatibility of District equipment or rental equipment.
Coordinating Department	**Facilities**, Customer Service, and Operations
Timeline/Completion Date/Priority	Priority 1
Total Cost	$44,849
Funding Source(s)	CIP in progress (Project No. 10677).
Constraints	Staff availability

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Trunk Sewer Improvements / Inspection / Cleaning

Hazard Category	Hazardous Materials Release
Status	Budgeting (in progress)
Strategy	Ensure system reliability
Action Items	Budgeting, RFP, and Contract Award
Implementation Description and Estimated Benefits	Increase reliability, ensure system integrity, comply with SSMP requirements.
Coordinating Department	**Operations** and Facilities
Timeline/Completion Date/Priority	FY19-20
Total Cost	$106,228
Funding Source(s)	FY19-20 Maintenance Budget Sanitation segment fund - paid through monthly sewer service fees.
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

AB Bus Mods

Hazard Category	Power Outage and Wildfires
Status	Ongoing
Strategy	Enable electrical bus tie breaker to be opened.
Action Items	• Review Single Line Drawing • Hire Design Engineer • Budget • Bid • Award Contract
Implementation Description and Estimated Benefits	Increase reliability of power system and provide ability for preventative maintenance of equipment.
Coordinating Department	**Facilities** and Operations
Timeline/Completion Date/Priority	Priority 1
Total Cost	$100,000
Funding Source(s)	CIP partial funding (CIP Project No. 10661) Initial budget is for study only. Construction cost estimate will be developed following the study.
Constraints	Staff Availability / Funding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Security Gates – Westlake

Hazard Category	Terrorism / Theft
Status	Bidding – In progress.
Strategy	Reduce Facilities Risk
Action Items	Add fencing and swing gates
Implementation Description and Estimated Benefits	Reduce risk of intrusion or threats to potable system.
Coordinating Department	**Facilities,** Customer Service, and Operations
Timeline/Completion Date/Priority	Priority 1
Total Cost	TBD
Funding Source(s)	CIP
Constraints	Available Contractor for Bidding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

Mobile Emergency Generators

Hazard Category	Power Outage and Wildfires
Status	Complete
Strategy	Provide power to remote pump stations
Action Items	• Assessment of facilities that the District can immediately access to during power outages. Sites that are considered limited access, remote, or necessary generator size too large to be pulled by the District's current equipment but considered critical pump stations will be listed for a stationary generator. • Size portable generators to operate the average duty pumps for the easily accessed facilities.
Implementation Description and Estimated Benefits	Towable for easy transportation. Ability to power less critical pump stations during time of disaster. KW Size covers most of the existing stations.
Coordinating Department	**Operations**, Facilities, and Customer Service
Timeline/Completion Date/Priority	Priority 1
Total Cost	$256,787
Funding Source(s)	CIP complete (CIP No. 10676)
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Emergency Generator - Rancho Compost Facility

Hazard Category	Power Outage
Status	Planning phase.
Strategy	Provide power during extended power outages.
Action Items	Design, Bid, Build • Installation of generator will be done during winter season which is the low compost demand season. • Stationary Emergency Generator will be sized to power all equipment, communications, and lighting within Rancho Compost Facility.
Implementation Description and Estimated Benefits	Completion will allow Tapia to continue to pump sludge and be processed to compost in Rancho Compost Facility during power outages. Currently they can only hold back for 2 days.
Coordinating Department	**Operations** and Facilities
Timeline/Completion Date/Priority	Priority 2
Total Cost	TBD – No budget allocated
Funding Source(s)	Grant Funds – Cal OES
Constraints	Funding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

Brush Clearance and Tree Trimming

Hazard Category	Wildfires
Status	Ongoing
Strategy	Protect District assets by ensuring defensible space for wildfires
Action Items	Assess facilities for vulnerabilities.
Implementation Description and Estimated Benefits	Reduce risk of fire and damage to facilities.
Coordinating Department	Facilities
Timeline/Completion Date/Priority	Priority 3
Total Cost	TBD
Funding Source(s)	CIP
Constraints	Staff Availability / Funding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

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TECHNICAL SERVICES MITIGATION PROJECTS

CMWD Interconnect

Hazard Category	Climate Change / Drought
Status	Ongoing. The project is currently awaiting completion of Calleguas Municipal Water District's Environmental Impact Report for the project.
Strategy	The project will provide the District with up to 20 cubic feet per second of supply for planned and unplanned Metropolitan Water District of Southern California shutdowns and support wintertime refilling of Las Virgenes Reservoir. In addition, the project involves extending an existing recycled water main to provide new service to Canyon Oaks Park and eliminate a long service line to Yerba Buena School. The interconnection will improve water supply reliability for both agencies.
Action Items	• Approval of CMWD CEQA document needed to begin construction. • The Install new 30-inch pipeline between the northwest portion of the Districts water system and Calleguas Municipal Water District's Lindero Feeder. • A pump station will be needed to provide service to CMWD; and a pressure reducing valve (PRV) facility will be needed to provide service from CMWD to the District.
Implementation Description and Estimated Benefits	The project will result in a reduction of risk from potential water shortages due to climate change, or emergencies.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 1: The project is within LVMWD's IIP (No. 10556) and is currently being funded by rate revenue and Proposition 84 Integrated Regional Management Implementation Grant. Project completion is dependent of the completion of the EIR. The project is anticipated to finish within 1-2 years.
Total Cost	$5,206,566
Funding Source(s)	2015 Proposition 84 Integrated Regional Water Management Implementation Grant: $1,975,517.45 General Fund
Constraints	The start of construction of the project is dependent of the completion of Calleguas Municipal Water Districts EIR.

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Rancho Solar Generation

Hazard Category	Power Outage
Status	Ongoing
Strategy	Purchase solar power from a solar panels through a Power Purchase Agreement (PPA). The PPA provides LVMWD to invest the capital to build, operate and maintain a 4-MW single-axis tracker solar array connected to the SCE distribution system. The JPA will purchase the power generated at the projected rate of 5.295 cents per Kwh with no escalation for a 25-year period with up to 2 five-year renewal terms. The JPA will have the option to purchase the project on listed or fair market value.
Action Items	• Borrego Solar System will build, operate and maintenance 20 acres of the Rancho site. • Purchase of solar power at a rate of 5.295 kwh. SCE will provide bill credits for energy generated and used.
Implementation Description and Estimated Benefits	• The project will result in solar power for many of the district's facilities during emergencies. • Potential save to the district $10.3 million over 25 years.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 1: The project is currently within LVMWD's 5-year Infrastructure Improvement Plan. The project is set to be completed in FY 19-20. Total project cost is estimated to be $596,556 with a reimbursement of $105,000 by solar power provider (net project cost of $491,556).
Total Cost	$596,556
Funding Source(s)	Rate Revenue
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
X	Partnerships and Implementation	X	Emergency Management

Westlake Filter Plant

Hazard Category	Wildfire
Status	The project is ongoing, currently in the preliminary design phase.
Strategy	Repair Westlake Filter Plant damages that were caused by the Woolsey Fire. Improve Facility building to reduce risk of wildfires or external fires. Improve landscaping to reduce risk of spread of fires within and around the facility.
Action Items	• Assess damages to the facility during the Woolsey Fire, and possible structural fire risk of the building, that may have caused spread of fire within the structure. • Repair and improve Westlake Facility structure to reduce risk of external fires such as wildfires i.e., closing eaves with fire retardant materials. • Strategic planning of landscaping and irrigation elements to reduce risk of wildfires and spread of brush fires. Look into alternative land coverage to reduce fire risks.
Implementation Description and Estimated Benefits	The project will result in reduction of building damages caused by external fires, such as wildfires.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 1: The project is current and ongoing.
Total Cost	$1,942,500
Funding Source(s)	Funding of the project will come from rate revenue, LVMWD's insurance, and FEMA/Cal-OES through the Public Assistance Grant Program.
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

HQ and Remote Site Repairs

Hazard Category	Wildfire
Status	The project is ongoing, and currently in the preliminary design phase.
Strategy	Repair/replace irrigation in HQ and remote sites (tanks, PS, etc.) that are effected by the fire. Irrigation replace will be conscious in water conservation, while creating a landscaping plan that reduces the risk of brush fires.
Action Items	• Assess the current site locations, if irrigation and landscaping is the best management practice to reduce fire keeping in mind slope stabilization for the facility. • Look at alternative land coverage to reduce risk of wildfires • Strategically plan landscaping to minimize fire risk. • Irrigation to reduce risk of brush fire
Implementation Description and Estimated Benefits	The project will result in a reduction in risk from wildfires.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 1
Total Cost	$832,500
Funding Source(s)	Funding of the project will come from rate revenue, LVMWD's insurance, and FEMA/Cal-OES through the Public Assistance Grant Program.
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Rancho Fire Repair

Hazard Category	Wildfire
Status	The project is ongoing, and currently in the preliminary design phase.
Strategy	• Rancho Compost Facility had severe damage to its infrastructure during the Woolsey Fire. • The Amendment Building and biofilter and the foul-air line experienced structural damage. • Reactor Building and Control Building experienced shattered windows. • The project involves repairing the facilities damaged structures, while improving upon the facilities resiliencies towards wildfires, due to the facilities designation within a Very High Fire Hazard Severity Zone designated by CalFire.
Action Items	• Assess damages in Rancho Compost Facility • Repair damages to existing structures. • Improve the structures resiliency to wildfire and other external fires. • Improve landscaping to improve resiliency towards brush/wildfires, and alternative ground cover.
Implementation Description and Estimated Benefits	The project will result in the reduction in risk from fires
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 1: The project estimated timeframe of implementation is FY 20-21.
Total Cost	$1,942,500
Funding Source(s)	Funding of the project will come from rate revenue, LVMWD's insurance, and FEMA/Cal-OES through the Public Assistance Grant Program.
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

Twin Lakes Drainage

Hazard Category	Flood
Status	Completed in FY 2016-2017
Strategy	Modification of the drainage system at the Twin lakes Tank site to prevent damages to downstream properties due to tank overflow
Action Items	Redirecting the drainage system to the south, connecting to an existing Cal Trans storm drain on the north side of the 118 Freeway
Implementation Description and Estimated Benefits	The project will result in a reduction of damaged homes due to storm water and accidental Twin Lake Tank overflow by modifying existing drainage to flow south to an existing Cal Trans storm drain.
Coordinating Department	The project will result in mitigation of natural flooding, and flooding caused by Twin Lakes tanks overflow.
Timeline/Completion Date/Priority	Priority 1: Project was completed as of October 2016
Total Cost	$323,111
Funding Source(s)	Rate Revenue
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
X	Partnerships and Implementation	X	Emergency Management

Troutdale Pipeline

Hazard Category	Wildfire / Earthquake
Status	Ongoing
Strategy	• Reinstall pipeline on Mulholland Highway near Troutdale Drive and Waring Drive, in unincorporated Los Angeles County. The bridge is owned and operated by Los Angeles Country of Public Works. During the Woolsey Fire, a bridge on the intersection of Troutdale and Waring Drive catastrophically failed as a result of the November 2018 Woolsey Fire. The metal support structure of the bridge collapsed due to the intense heat of the fire. A 12-inch main which was supported by the structure was also damaged. • The main provides a critical loop of the sub-system to provide adequate fire flow capacity and operational flexibility for water conveyance. The project is to install a temporary main on the side of the temporary bridge, until a new permanent bridge is installed in the next 5-7 years.
Action Items	• Install temporary HDPE pipeline to provide service attached temporary bridge on intersection of Troutdale Drive and Waring Drive. This section has already been completed. • Install new pipeline with seismic restraints when permanent bridge is installed in 5-7 years. The new pipeline will be built shortly after the new bridge is installed.
Implementation Description and Estimated Benefits	The project will result in earthquake mitigation.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 3: The project is contingent on LACDPW construction of the new bridge. Estimated time of completion is 2025-2027.
Total Cost	$330,000
Funding Source(s)	Rate Revenue
Constraints	Due to environmental and other permitting delays, out of the control of LACDPW, the permanent bridge would not be constructed for five to seven years.

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
X	Partnerships and Implementation	X	Emergency Management

Pure Water Project

Hazard Category	Climate Change / Drought
Status	Ongoing. The project is currently construction a small scale pilot of the full scale AWT.
Strategy	Building a new Advanced Water Treatment Plant (AWT) to treat recycled water from Tapia Reclamation Facility. The treated recycled water will then enter Las Virgenes Reservoir, to augment potable water.
Action Items	• Conduct mixing study at Las Virgenes Reservoir to see if mixing within the reservoir is adequate to meet compliance with SBDDW-16-02 Surface Water Augmentation (SWA) Regulations. • Study available land within the District Service Area that will minimize cost and environmental impacts to convey water from Tapia Reclamation Plant to the location of the AWT. • Build a small scale AWT pilot. The Pure Water Project demonstration project which will include an 80 gpm plant to provide to validate technology, operator training, and public outreach. • Preliminary design report, and design of the full scale AWT. Construction is times for 2029.
Implementation Description and Estimated Benefits	The project will result in resiliency of the system during drought and climate change.
Coordinating Department	Technical Services
Timeline/Completion Date/Priority	Priority 3: The estimated full completion of the project is 2030.
Total Cost	$120,000,000
Funding Source(s)	Rate revenue
Constraints	Lack of Funds. Invested property rights, due to building new structure in undeveloped land. Public perception of using recycled water to augment potable water.

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

INFORMATION SYSTEMS MITIGATION PROJECTS

IS Master Plan

Hazard Category	Terrorism / Cyber Threat
Status	Key computers are currently backed-up in offsite/out of state location. The District pays for continued service.
Strategy	Disaster Recovery/Business Continuity
Action Items	Key Computers are connected to offsite/out of state server locations, The Key Computers systems ae backed up on daily bases to offsite/out of state locations.
Implementation Description and Estimated Benefits	Key computer systems are being replicated to offsite / out of state locations. Business Continuity in the event of a natural disaster
Coordinating Department	Information Technologies
Timeline/Completion Date/Priority	Priority 1: Continual replication of key computer systems to offsite location.
Total Cost	$50,000
Funding Source(s)	General fund
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

AMR / AMI Meter Reading

Hazard Category	Climate Change / Drought
Status	RFP / Ongoing
Strategy	Complete deployment of AMR/AMI meter reading system District Wide
Action Items	AMR/AMI Network with data collectors, new meters, new meter lids, and meter data management system.
Implementation Description and Estimated Benefits	AMR/AMI will aid with water loss reporting with leak detection. The system will assist the conservation efforts. In addition, the system will allow for better recording of customer usage and patterns.
Coordinating Department	Customer Service and Operations
Timeline/Completion Date/Priority	Timeline for implementation is late 2019 early 2020. • Priority 1: RFP published. • Priority 2: Alpha Phase of system testing. • Priority 3: Full deployment of AMR/AMI system.
Total Cost	10,500,000
Funding Source(s)	Grant funding and bank loan
Constraints	Currently looking for bank loan funding

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation		Emergency Management

Video Surveillance

Hazard Category	Terrorism / Theft / Crime
Status	Ongoing
Strategy	Video Surveillance of Facilities
Action Items	Hire consultant to assess facilities and recommend video solutions for HQ, Tapia, Rancho and Westlake.
Implementation Description and Estimated Benefits	Installation of Video equipment, to provide security and safety.
Coordinating Department	Information Technologies
Timeline/Completion Date/Priority	Priority 2: Starting with Tapia then Rancho and Westlake.
Total Cost	$200,000
Funding Source(s)	General fund
Constraints	None

Plan Goals Addressed			
	Public Awareness	X	Protect Life, Property, and the Environment
	Partnerships and Implementation	X	Emergency Management

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SECTION 14: ANNEX A: RESOURCES

The following resources were used in the development and update of the Las Virgenes Municipal Water District Hazard Mitigation Plan. In addition to the resources listed, information sources included District documents such as General Plans, Strategic Plans, studies, and reports.

Name	Category	Web Site Address	Description
2016 California Jurisdictions Addressing Climate Change	State Government	http://opr.ca.gov/planning/icarp/	Climate Change Program and Data
Army Corps of Engineers	Federal Government	www.usace.army.mil	Flood and dam information
Association of State Floodplain Managers	Research, Educational, and Standards Organizations	www.floods.org	Flood mitigation and planning information
Building Seismic Safety Council (BSSC)	Research, Educational, and Standards Organizations	www.bssconline.org	Earthquake and seismic code information
California Climate Change	State Government	http://climatechange.ca.gov/	Climate Change Data
California Department of Conservation: Southern California Regional Office	State Government	www.consrv.ca.gov	Earthquake and flood information
California Department of Transportation (Caltrans)	State Government	www.dot.ca.gov	Transportation and traffic information
California Department of Water Resources (DWR)	State Government	www.water.ca.gov	Flood information
California Division of Forestry & Fire Protection	State Government	www.fire.ca.gov	Fire codes, landslide, wildfire mitigation and programs
California Division of Mines and Geology (DMG)	State Government	www.consrv.ca.gov	Earthquake information
California Geological Survey, Department of Conservation	State Government	www.consrv.ca.gov	Earthquake information
California Governor's Office of Emergency Services (Cal OES)	State Government	www.oes.ca.gov	State hazard mitigation guidance
California in 2050: Some Sizzling Predictions	State Government	www.cpuc.ca.gov	Temperature Rise Prediction for California
California Nevada Climate Applications Program (CNAP)	Research, Educational, and Standards Organizations	https://scripps.ucsd.edu/programs/cnap/	Climate Change and Santa Ana Wind Information and Map
California Number of Extreme Heat Days by Year	Research, Educational, and Standards Organizations	http://cal-adapt.org/tools/extreme-heat/	Temperature Rise Prediction for California
California Resources Agency	State Government	www.resources.ca.gov	Earthquake information
California State Controller's Office	State Government	www.sco.ca.gov/and_state_cafr.html	City Comprehensive Financial Reports

Name	Category	Web Site Address	Description
California-Nevada Climate Applications Program	Research, Educational, and Standards Organizations	https://wrcc.dri.edu/Climate/Tracker/CA/index.html	Climate Change Data
City of Agoura Hills	Local Government	www.ci.agoura-hills.ca.us	Local profile, planning, hazard, and mitigation information
City of Agoura Hills, Commercial and Residential Projects Second Quarter 2018 Quarterly Report	City of Agoura Hills	www.ci.agoura-hills.ca.us/government/departments/planning-community-development/development-summaries	Commercial and Residential Development Projects, 2018
City of Calabasas	Local Government	www.ci.calabasas.ca.us	Local profile, planning, hazard, and mitigation information
City of Hidden Hills	Local Government	www.hiddenhillscity.org	Local profile, planning, hazard, and mitigation information
City of Westlake Village	Local Government	www.wlv.org	Local profile, planning, hazard, and mitigation information
Comprehensive Annual Financial Report 2016-2017 for the City of Agoura Hills	City Data	www.ci.agoura-hills.ca.us/government/departments/finance/comprehensive-annual-finance-report	City data (including employer and revenue data)
Comprehensive Annual Financial Report 2016-2017 for the City of Westlake Village	City Data	www.wlv.org/158/Administrative-Services-Financial-Manage	City data (including employer and revenue data)
Comprehensive Annual Financial Report for the Fiscal Year Ended June 2017 for the City of Calabasas	City Data	www.cityofcalabasas.com/pdf/documents/finance/cafrs/cafr-2017.pdf	City data (including employer and revenue data)
Department of Homeland Security	Federal Government	www.dhs.gov	Terrorism response, preparedness, and threats
Federal Bureau of Investigation	Federal Law Enforcement	www.fbi.gov	Terrorism response, active shooter incidents, preparedness, and threats
Federal Emergency Management Agency (FEMA)	Federal Government	www.fema.gov	Federal Disaster Information, Flood Information Rate Maps (FIRM), and Landslide Information
FEMA 100-Year Floodplain Map	Federal Government	http://gis.bam.water.ca.gov/bam/	FEMA Effective 100-Year Floodplain Maps for the LVMWD Region
FEMA National Flood Hazard Layer (Official)	Research, Educational, and Standards Organizations	www.arcgis.com	FIRM Data
Firewise	Research, Educational, and Standards Organizations	www.firewise.org	Fire / wildfire mitigation and programs
Fresno Bee	News Organization	www.fresnobee.com	History of Wildfires in California
Google Maps	Public Resource	www.maps.google.com	Maps and Satellite Images
Intellicast	Public Resource	www.intellicast.com	Weather and Climate Data

Name	Category	Web Site Address	Description
International Code Council, Los Angele s Basin Chapter	Research, Educational, and Standards Organizations	www.icclabc.org	Building Code information
Las Virgenes Municipal Water District	Utility	www.lvmwd.com	Water and dam information
Los Angeles County Fire Department	Local and Regional Government	www.lacofd.org	Fire codes and wildfire mitigation and programs
Los Angeles County Office of Emergency Services	Local and Regional Government	www.lacoa.org	Disaster and mitigation information. Disaster Management Areas.
Los Angeles County Public Works Department	Local and Regional Government	www.ladpw.org	Earthquake and debris removal information
Los Angeles Sheriff's Department	Local Law Enforcement	www.sheriff.lacounty.gov	Terrorism response, preparedness, and threats
NASA / JPL-Caltech	Research, Educational, and Standards Organizations	http://photojournal.jpl.nasa.gov/catalog/PIA03445	Santa Ana Wind Information and Map
National Flood Insurance Program (NFIP)	Federal Government	www.fema.gov/nfip	Flood information
National Integrated Drought Information System	Federal Government	www.drought.gov/drought/states/california www.drought.gov/drought/california-no-stranger-dry-conditions-drought-2011-2017-was-exceptional	California Drought Information
National Interagency Fire Center (NIFC)	Federal Government	www.nifc.gov	Fire codes and wildfire mitigation and programs
National Resources Conservation Service (NRCS), US Department of Agriculture	Federal Government	www.nrcs.gov	Flood mitigation, landslide, and watershed projects
National Weather Service	Federal Government	www.weather.gov www.weather.gov/media/sgx/documents/weatherhistory.pdf	Weather and Climate Data
National Weather Service Climate Prediction Center	Federal Government	www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php	Drought Outlook Data and Map
NOAA	Federal Government	www.noaa.gov	Weather and Climate Data
Office of the State Fire Marshal (OSFM)	State Government	www.osfm.fire.ca.gov	Fire codes and wildfire mitigation and programs
Pipelines and Hazards Materials Safety Division	Federal Government	www.phmsa.dot.gov	Pipeline Data
Robert D. Niehaus, Inc.	The Economic Impacts of the Montecito Mudslides	http://www.rdniehaus.com/rdn/wp-content/uploads/2018/03/RDN_Montecito_Mudslides_Impacts-1.pdf	Montecito Mudslide Report
Southern California Association of Governments (SCAG)	Local Government	www.scag.ca.gov	City profiles, data, and maps
Southern California Earthquake Center (SCEC)	Research, Educational, and	www.scec.org	Earthquake and fault information

Name	Category	Web Site Address	Description
	Standards Organizations		
Southern California Seismic Network	Research, Educational, and Standards Organizations	http://www.scsn.org	Earthquake and fault information
Southern California Edison Public Safety Power Shutoff Process	Utility	www.sce.com/wps/wcm/connect/9ef7f86a-ca79-41c8-b34f-b0dd449baf39/PSPS_Timeline.pdf?MOD=AJPERES	Electric Utility Emergency Power Shutoff Process Timeline
Terrorism Research	Research, Educational, and Standards Organizations	www.terrorism-research.com	Terrorism Information
The National Drought Mitigation Center University of Nebraska-Lincoln	Research, Educational, and Standards Organizations	https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?West	Drought Maps
U.S. Census Bureau	Federal Government	www.census.gov www.census.gov/quickfacts	City and Regional demographic data
U.S. Census, American Fact Finder	Federal Government	https://factfinder.census.gov	City and Regional demographic data
U.S. Department of Health & Human Services	Federal Government	https://aspe.hhs.gov/poverty-guidelines	Average U.S. Poverty Level
U.S. Department of the Interior, Bureau of Reclamation	Federal Government	www.usbr.gov	Flood information
U.S. Fire Administration (USFA) of the Federal Emergency Management Agency	Federal Government	www.usfa.fema.gov	Fire codes and wildfire mitigation and programs
U.S. State Department	Federal Government	www.state.gov/j/ct/list/c14151.htm	Terrorism Information
USC Geospatial Institute	Research, Educational, and Standards Organizations	www.spatial.usc.edu	Area and hazard mapping, loss estimates, and HAZUS
USGS National Landslide Information Center	Federal Government	www.landslides.usgs/nlic	Landslide information
USGS Water Resources	Federal Government	www.water.usgs.gov	Flood information
Western Regional Climate Center	Research, Educational, and Standards Organizations	https://wrcc.dri.edu	Climate Data
Western States Seismic Policy Council (WSSPC)	Research, Educational, and Standards Organizations	www.wsspc.org	Earthquake information

SECTION 15: ANNEX B: MEETING AGENDAS AND ATTENDEES

LVMWD HAZARD MITIGATION PLAN KICK-OFF MEETING

LAS VIRGENES MUNICIPAL WATER DISTRICT

SIGN-IN SHEET

LVMWD Hazard Mitigation Plan
Kick-off Meeting
May 22, 2019
4232 Las Virgenes Road
Conference Room D
Calabasas, CA 91302

Name	Initials	Department
Acevedo, Mercedes	Initials Hidden for Security Purposes	Facilities & Operations
Anders, Douglas		FACILITIES & OPERATIONS
Korkosz, James		F&O MANAGER
Patterson, Don		
Saccareccia, Angela		Finance
Schlageter, Eric		TECH SERVICES
Takemura, Bob		MLC
Zhao, John		

2019 LVMWD HMP Kickoff Meeting Signin Sheet.docx 1
MLC & Associates, Inc.

mlc

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SECTION 16: ANNEX C: PLANNING AND PUBLIC INVOLVEMENT

PUBLIC INFORMATION AND HANDOUTS

The LVMWD provides ongoing information to the public related to water conservation, waste water reduction and hazardous materials contamination prevention, and emergency preparedness.

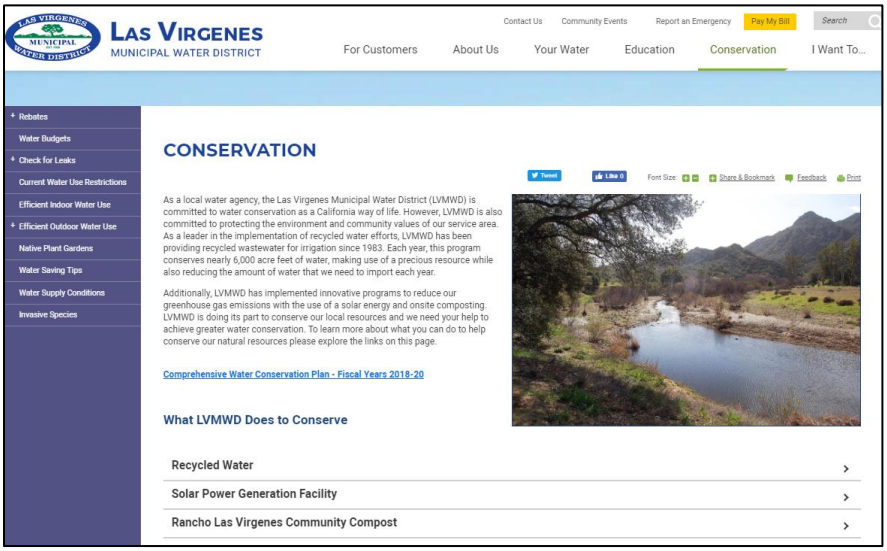

Figure 13: LVMWD Conservation Information

In addition, the District posts ongoing updates related to the recent Woolsey Fire and the impact to the local community related to the services that the LVMWD provides.

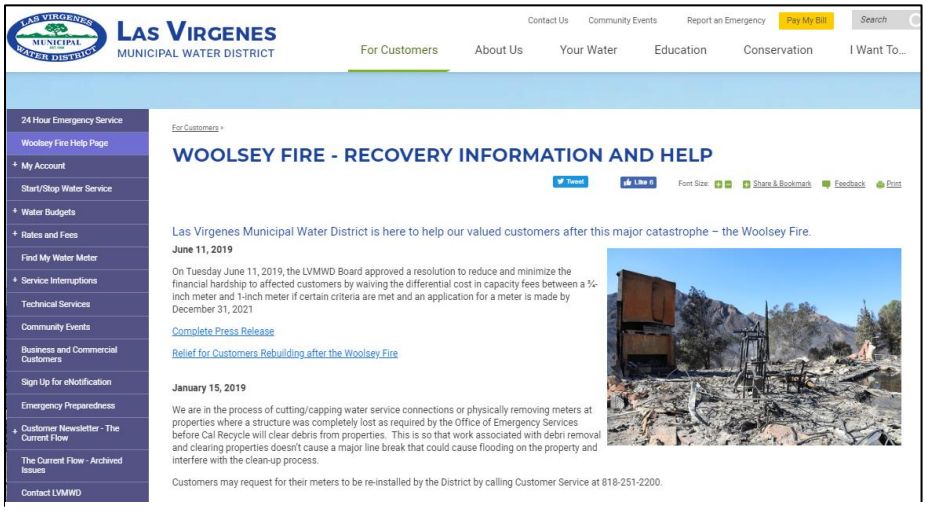

Figure 14: Woolsey Fire Update

Workshops and Events

The LVMWD participates in local community outreach events to promote water conservation and drought preparedness to combat the impact of climate change.

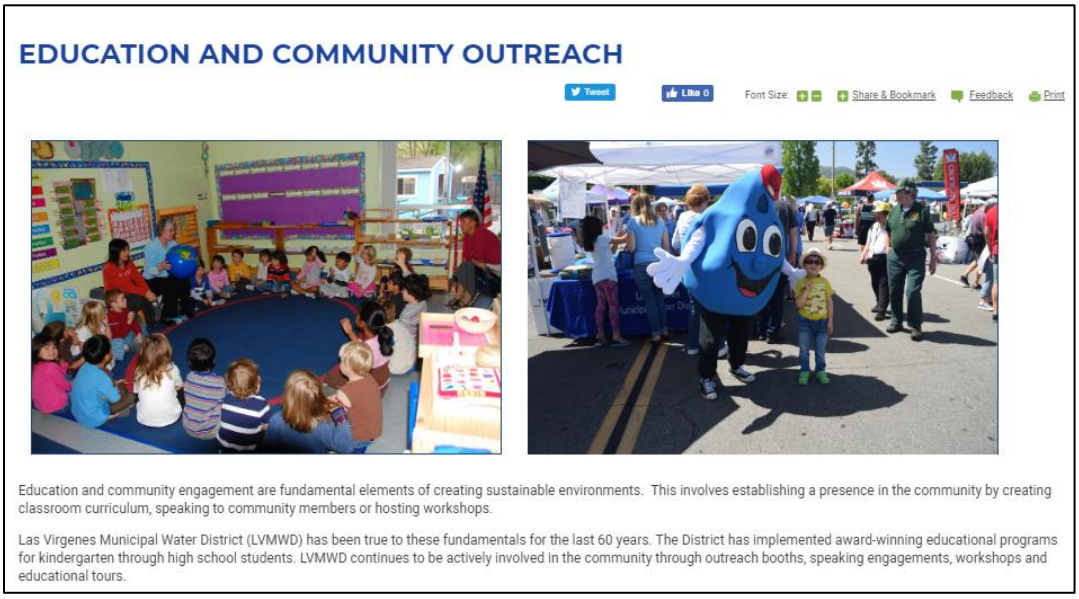

Figure 15: LVMWD Community Outreach

Las Virgenes Municipal Water District Web Site

The LVMWD web site includes important information related to hazard mitigation including:

- Drought and Water Conservation
- Fire and Public Safety
- Disaster Preparedness

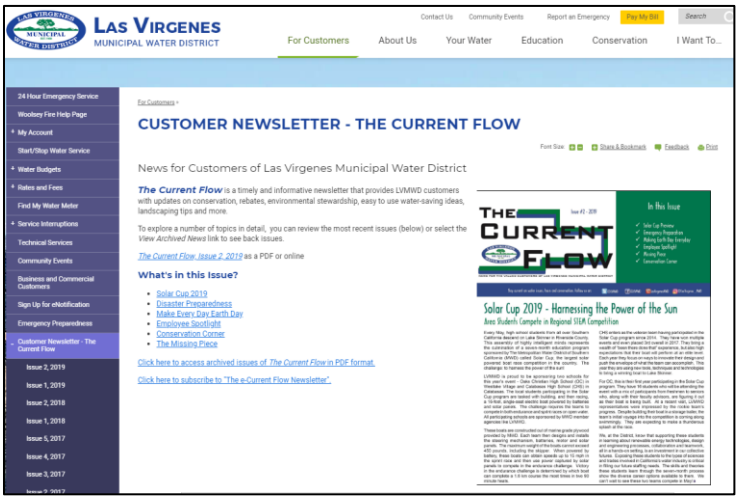

Figure 16: LVMWD Newsletter

LVMWD HMP Feedback

The LVMWD Hazard Mitigation Plan was posted to the web site and the public was encouraged to provide feedback. In addition, LVMWD Board items related to disaster response, planning, and mitigation are placed on the Agenda for public input and discussion.

SECTION 17: ANNEX D: PLAN APPROVAL DOCUMENTATION

To be inserted after Board Approval

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SECTION 18: ANNEX E: LOCAL HAZARD MITIGATION PLAN REVIEW TOOL

The *Local Hazard Mitigation Plan Review Tool* demonstrates how the Local Hazard Mitigation Plan meets the regulation in 44 CFR §201.6 and offers State and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The **Regulation Checklist** provides a summary of FEMA's evaluation of whether the plan has addressed all requirements.
- The **Plan Assessment** identifies the plan's strengths as well as documents areas for future improvement. This section also includes a list of resources for implementation of the plan.
- The **Multi-Jurisdiction Summary Sheet** is a mandatory worksheet for multi-jurisdictional plans that is used to document which jurisdictions are eligible to adopt the plan.
- The **Hazard Identification and Risk Assessment Matrix** is a tool for plan reviewers to identify if all components of Element B are met.

Jurisdiction: Las Virgenes Municipal Water District	**Title of Plan:** LVMWD Hazard Mitigation Plan	**Date of Plan:** 7/03/2019
Local Point of Contact: Eric Schlageter		**Address:** Las Virgenes Municipal Water District 4232 Las Virgenes Road Calabasas, CA 91302-1994
Title: Senior Engineer / HMP Project Manager		
Agency: Las Virgenes Municipal Water District (LVMWD)		
Phone Number: 818.251.2142		**E-Mail:** eschlagerter@LVMWD.com

State Reviewer:	**Title:**	**Date:**
Date Received at State Agency		
Date Sent to FEMA		

FEMA Reviewer: **Derek J. Lambeth**	**Title:** **Emergency Services Coordinator**	**Date: 7/8/19**
Date Received in FEMA Region IX		
Date Not Approved		
Date Approvable Pending Adoption		
Date Approved		

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the plan by element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in the *Local Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)		**Location in Plan** **(section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS				
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	a. Does the plan provide documentation of how the plan was prepared? This documentation must include the schedule or timeframe and activities that made up the plan's development as well as who was involved.	**1. INTRODUCTION** Acknowledgements 1-1 Plan Development & Update Process 1-9 Plan Adoption and Coordinating Body 1-11 **15. ANNEX B** HMP Kick-off Meeting 15-1		
	b. Does the plan list the jurisdiction(s) participating in the plan that are seeking approval?	**N/A – Water District HMP**		
	c. Does the plan identify who represented each jurisdiction? (At a minimum, it must identify the jurisdiction represented and the person's position or title and agency within the jurisdiction.)	**1. INTRODUCTION** Acknowledgements 1-1 LVMWD Ability Support Mitigation 1-4 Plan Development & Update Process 1-9 Plan Participants 1-10 Plan Adoption and Coordinating Body 1-11 **15. ANNEX B** HMP Kick-off Meeting 15-1		

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)		**Location in Plan** **(section and/or page number)**	**Met**	**Not Met**
A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	a. Does the plan document an opportunity for neighboring communities, local, and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interested parties to be involved in the planning process?	**1. INTRODUCTION** Plan Development & Update Process 1-9 Plan Participants 1-10 Coordination with Existing Programs 1-12 **12. PLAN MAINTENANCE AND MONITORING** Continued Public Involvement 12-1 Coordinating Body 12-2 Implementation Through Existing Programs 12-3 Public Involvement 12-7		
	b. Does the plan identify how the stakeholders were invited to participate in the process?	**1. INTRODUCTION** Acknowledgements 1-1 LVMWD Ability Support Mitigation 1-4 Plan Development & Update Process 1-9 Plan Participants 1-10 Plan Adoption and Coordinating Body 1-11		
A3. Does the plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	a. Does the plan document how the public was given the opportunity to be involved in the planning process?	**1. INTRODUCTION** Plan Development & Update Process 1-9 Plan Participants 1-10 **12. PLAN MAINTENANCE AND MONITORING** Continued Public Involvement 12-1 Public Involvement 12-7 **ANNEX C: PLANNING AND PUBLIC INVOLVEMENT** LVMWD HMP Feedback 16-2		
	b. Does the plan document how the public's feedback was incorporated into the plan?	**1. INTRODUCTION** Plan Participants 1-10 **12. PLAN MAINTENANCE AND MONITORING** Continued Public Involvement 12-1 Public Involvement 12-7 **ANNEX C: PLANNING AND PUBLIC INVOLVEMENT** LVMWD HMP Feedback 16-2		

A4. Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	**1. INTRODUCTION** Plan Development & Update Process 1-9 Plan Participants Internal and External Input 1-10 Coordination with Existing Programs 1-12 **3. RISK ASSESSMENT** Vulnerabilities and Loss Estimates 3-7 Future Development Trends 3-8 to 3-11 **4. EARTHQUAKE** Historical Record of EQ in S.CAL 4-2 Earthquake Probability 4-4 Estimated Impact of an Event 4-6 Earthquake Vulnerabilities 4-7 to 4-8 **5. WILDFIRE** Historical Record of Significant Fires 5-1 to 5-2 Causes & Characteristics of Wildfires 5-3 Very High Fire Hazard Severity Zones 5-3 to 5-5 Estimated Impact of an Event 5-6 Wildfire Vulnerabilities 5-6 **6. CLIMATE CHANGE** Nature of the Climate Change Threat 6-1 Climate Change & Drought History 6-2 Estimated Impact of an Event 6-4 Climate Change Vulnerabilities 6-5 to 6-7 **7. ENERGY DISRUPTION** Historical Record of Power Outages 7-2 Power Outage Hazard Identification 7-3 Estimated Impact of an Event 7-6 **8. LANDSLIDE AND DEBRIS FLOWS** Natura of the Landslide and Debris Flow Threat 8-1 Historical Record of Landslide Events 8-2 to 8-4 2018 Southern CA Mudflows 8-4 1994 Northridge EQ Landslide Impact 8-4 Agoura Hills Landslides 8-5 Estimated Impact of an Event 8-6 **9. WINDSTORM** Estimated Impact of an Event 9-3 Windstorm Vulnerabilities 9-3 **10. FLOOD / SEVERE WINTER STORM** Historical Record of Flooding 10-1 to 10-5 Estimated Impact of an Event 10-9 **11. TERRORISM** Causes & Characteristics of Terrorism 11-2 Mass Violence Incidents in the U.S. 11-8 Estimated Impact of an Event 11-9 **12. PLAN MAINTENANCE AND MONITORING** Coordinating Body 12-2 Implementation Through Existing Programs 12-3		

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)		**Location in Plan** **(section and/or page number)**	**Met**	**Not Met**
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))		**1. INTRODUCTION** Plan Development & Update Process 1-9 Plan Participants 1-10 **12. PLAN MAINTENANCE AND MONITORING** Continued Public Involvement 12-1 Public Involvement 12-7		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	a. Does the plan identify how, when, and by whom the plan will be **monitored** (how will implementation be tracked) over time?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 Plan Development & Update Process 1-9 Mitigation Strategy 5-Yr Action Plan 1-12 **12. PLAN MAINTENANCE AND MONITORING** Adoption and Implementation 12-2		
	b. Does the plan identify how, when, and by whom the plan will be **evaluated** (assessing the effectiveness of the plan at achieving stated purpose and goals) over time?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 to 1-5 Plan Development & Update Process 1-9 Plan Implementation, Monitoring, and Evaluation 1-11 Coordinating Body 1-11 Mitigation Strategy 5-Yr Action Plan 1-12 **12. PLAN MAINTENANCE AND MONITORING** Coordinating Body 12-2 Adoption and Implementation 12-2 Plan Monitoring, Evaluation, Updates, and Formal Review Process 12-6		
	c. Does the plan identify how, when, and by whom the plan will be **updated** during the 5-year cycle?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 to 1-5 Plan Development & Update Process 1-9 Plan Implementation, Monitoring, and Evaluation 1-11 Coordinating Body 1-11 Mitigation Strategy 5-Yr Action Plan 1-12 **12. PLAN MAINTENANCE AND MONITORING** Coordinating Body 12-2 Adoption and Implementation 12-2 Plan Monitoring, Evaluation, Updates, and Formal Review Process 12-6		
ELEMENT A: REQUIRED REVISIONS				

ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT (Reviewer: See Section 4 for assistance with Element B)				
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	a. Does the plan include a general description of all natural hazards that can affect each jurisdiction?	Risk Assessment pp. 3-1 to 3-4 Earthquake pp. 4-1 to 4-8 Wildfire pp. 5-1 to 5-16 Climate Change pp. 6-1 to 6-8 Landslide and Debris Flows 8-1 to 8-12 Windstorm 9-1 to 9-11 Flood/Severe Winter Storm 10-1 to 10-10		
	b. Does the plan provide rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area?	N/A – All commonly recognized natural hazards are included in the HMP		
	c. Does the plan include a description of the **type** of all natural hazards that can affect each jurisdiction?	Risk Assessment pp. 3-1 to 3-4 Earthquake pp. 4-1 to 4-8 Wildfire pp. 5-1 to 5-16 Climate Change pp. 6-1 to 6-8 Landslide and Debris Flows 8-1 to 8-12 Windstorm 9-1 to 9-11 Flood/Severe Winter Storm 10-1 to 10-10		
	d. Does the plan include a description of the **location** for all natural hazards that can affect each jurisdiction?	Risk Assessment pp. 3-3 to 3-19 Earthquake pp. 4-2 Wildfire pp. 5-1 to 5-5 Climate Change pp. 6-2 to 6-7 Landslide and Debris Flows 8-2 to 8-8 Windstorm 9-6 Flood/Severe Winter Storm 10-1 to 10-5		
	e. Does the plan include a description of the **extent** for all natural hazards that can affect each jurisdiction?	Risk Assessment 3-1 to 3-4 Earthquake 4-1 to 4-8 Wildfire 5-1 to 5-16 Climate Change 6-1 to 6-8 Landslide and Debris Flows 8-1 to 8-12 Windstorm 9-1 to 9-11 Flood/Severe Winter Storm 10-1 to 10-10		
B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	a. Does the plan include information on **previous occurrences** of hazard events for each jurisdiction?	Risk Assessment 3-3 to 3-12 Earthquake 4-2 Wildfire 5-1 to 5-2 Climate Change 6-2 Landslide and Debris Flows 8-2 to 8-4 Windstorm 9-1 to 9-5 Flood/Severe Winter Storm 10-1 to 10-5		
	b. Does the plan include information on the **probability** of future hazard events for each jurisdiction?	Earthquake 4-4 Wildfire 5-9 to 5-10 Climate Change 6-5 to 6-7 Landslide and Debris Flows 8-2 to 8-4 Windstorm 9-10 Flood/Severe Winter Storm 10-1 to 10-5		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	a. Is there a description of each hazard's **impacts** on each jurisdiction (what happens to structures, infrastructure, people, environment, etc.)?	Risk Assessment 3-1 to 3-4 Earthquake 4-1 to 4-8 Wildfire 5-1 to 5-16 Climate Change 6-1 to 6-8 Landslide and Debris Flows 8-1 to 8-12 Windstorm 9-1 to 9-11 Flood/Severe Winter Storm 10-1 to 10-10		

	b. Is there a description of each identified hazard's overall **vulnerability** (structures, systems, populations, or other community assets defined by the community that are identified as being susceptible to damage and loss from hazard events) for each jurisdiction?	Risk Assessment 3-1 to 3-12 Earthquake 4-1 to 4-8 Wildfire 5-1 to 5-16 Climate Change 6-1 to 6-8 Landslide and Debris Flows 8-1 to 8-12 Windstorm 9-1 to 9-11 Flood/Severe Winter Storm 10-1 to 10-10		
B4. Does the plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))		Flood/Severe Winter Storm 10-5		
ELEMENT B: REQUIRED REVISIONS				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	a. Does the plan document each jurisdiction's existing authorities, policies, programs and resources?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 to 1-5 Plan Mission and Goals 1-5 to 1-6 Plan Participants 1-8 Plan Adoption 1-9 Coordination with Existing Programs 1-10 Mitigation Strategy 5-Yr Action Plan 1-10		
	b. Does the plan document each jurisdiction's ability to expand on and improve these existing policies and programs?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 to 1-5 **12. PLAN IMPLEMENTATION AND MONITORING** Implementation Through Existing Programs 12-3 Plan Monitoring, Evaluation, Updates, and Formal Review Process 12-6		
C2. Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))		N/A – Not Under LVMWD Authority		
C3. Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))		**1. INTRODUCTION** Plan Mission and Goals 1-7 to 1-8 Mitigation Strategy 5-Yr Action Plan 1-12 **12. PLAN IMPLEMENTATION AND MONITORING** Plan Monitoring, Evaluation, Updates, and Formal Review Process 12-6 **13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1		

C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	a. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the impacts from hazards?	**13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1 Hazard Mitigation Strategies 13-2 to 13-25		
	b. Does the plan identify mitigation actions for every hazard posing a threat to each participating jurisdiction?	**13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1 Hazard Mitigation Strategies 13-2 to 13-25		
	c. Do the identified mitigation actions and projects have an emphasis on new and existing buildings and infrastructure?	**13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1 Hazard Mitigation Strategies 13-2 to 13-25		
C5. Does the plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	a. Does the plan explain how the mitigation actions will be prioritized (including cost benefit review)?	**1. INTRODUCTION** Economic Analysis of Mitigation Projects 1-12 **12. PLAN IMPLEMENTATION AND MONITORING** Economic Analysis of Mitigation Projects 12-3 to 12-5 **13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1 Hazard Mitigation Prioritization of Projects and Actions 13-3		
	b. Does the plan identify the position, office, department, or agency responsible for implementing and administering the action, potential funding sources and expected timeframes for completion?	**1. INTRODUCTION** LVMWD Ability Support Mitigation 1-4 **13. HAZARD MITIGATION GOALS & STRATEGIES** Hazard Mitigation Goals 13-1 to 13-25		
C6. Does the plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when	a. Does the plan identify the local planning mechanisms where hazard mitigation information and/or actions may be incorporated?	**1. INTRODUCTION** Coordination with Existing Programs 1-12 **15. PLAN MAINTENANCE AND MONITORING** Implementation Through Existing Programs 12-3		

appropriate? (Requirement §201.6(c)(4)(ii))	b. Does the plan describe each community's process to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms?	**1. INTRODUCTION** Coordination with Existing Programs 1-12 **15. PLAN MAINTENANCE AND MONITORING** Implementation Through Existing Programs 12-3		
	c. The updated plan must explain how the jurisdiction(s) incorporated the mitigation plan, when appropriate, into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts.	**1. INTRODUCTION** Coordination with Existing Programs 1-12 **15. PLAN MAINTENANCE AND MONITORING** Implementation Through Existing Programs 12-3		
ELEMENT C: REQUIRED REVISIONS				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (Applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))		N/A Original HMP		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))		N/A – Original HMP		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))		N/A – Original HMP		
ELEMENT D: REQUIRED REVISIONS				
ELEMENT E. PLAN ADOPTION				
E1. Does the plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))		**SECTION 17 PLAN APPROVAL DOCUMENTATION** 17-1 TO BE INSERTED		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))		N/A		
ELEMENT E: REQUIRED REVISIONS				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (Optional for State Reviewers only; not to be completed by FEMA)				

F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			