REVISED 2/18/2022

Finance & Management
Services Division

East Bay Regional Park District

Request for Proposals

The East Bay Regional Park District (EBRPD) is soliciting proposals to update EBRPD's Local Hazard Mitigation Plan (LHMP) and conduct FEMA Cost Benefit Analysis for EBRPD projects on an as needed basis. EBRPD last updated its LHMP in 2017, see attached. Also, please find attached the BCA for a recent EBRPD project.

OPTIONAL PRE-PROPOSAL ZOOM MEETING

9:00 AM, February 18, 2022
East Bay Regional Park EBRPD
2950 Peralta Oaks Court
Oakland, CA 94605
Zoom Meeting Link: https://ebparks.zoom.us/j/82405104737

PROPOSAL SUBMITTAL PROCESS

Please submit proposals via e-mail to Jrasmussen@ebparks.org, **no later than 5:00 PM, March 4, 2022** Late proposals will not be considered.

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SCOPE OF SERVICES AND DELIVERABLES

The consultant's responsibilities will be fulfilled when FEMA notifies EBRPD of plan approval. The Consultant shall perform all services necessary to complete the plan including, but not limited to the following:

Community Profile:

- Community location, geographic characteristics and population
- Name of each community/jurisdiction participating

Planning Process:

- Public outreach and involvement process
- Review and incorporation of existing plans, studies, reports (e.g., General plan, capital improvement plan, fire plan)

Risk Assessment:

- The type, location, and extent of hazards. Include previous occurrences (repetitive loss) and the probability of future events
- Vulnerability to identified hazards. Includes an overall summary of each hazard and its effect on the community, including a general description of types of structures affected by each hazard
- Should describe types and numbers of existing and future structures and facilities and an estimate of potential dollar losses
- General description of land uses and development trends

Mitigation Strategy:

- Description of mitigation goals and objectives to reduce or avoid long-term vulnerabilities to the identified hazards.
- Identification and analysis of a comprehensive range of specific mitigation actions considered.
- Description of prioritization, implementation, and administration process of mitigation activities.

Plan Maintenance:

- Describe method and schedule of monitoring, evaluating, and updating the plan within the 5-year cycle.
- Describe process of incorporating the mitigation plan elements into other planning mechanisms such as the General Plan or Capital Improvement Plan.
- Discuss how the public will continue to participate in the planning process.

Work Schedule:

- Include a schedule for completing the above tasks.
- Allow at least six months for Cal OES and FEMA review and for incorporating any revisions required by FEMA.

Plan Updates:

- A description of why the update is necessary and how the update will build on the existing approved mitigation plan
- Discussion of process limitations that will be addressed
- A comprehensive discussion of data deficiencies that will be addressed
- A demonstration of progress in local mitigation efforts
- A description of how the previous plan was implemented.

Benefit Cost Analysis

- A description of how the previous plan was implemented.

PARK EBRPD RESPONSIBILITIES

In their proposal, the Consultant shall define information, services and expertise needs from the EBRPD for the implementation of this project.

OTHER REQUIREMENTS

1. Work product format: Draft and final deliverable work products shall be provided to EBRPD via electronic files containing all text, exhibits, data, calculations and referenced documents supporting conclusions.
2. Other format requirements: All text, exhibits and supporting data shall be submitted in a form that is editable by EBRPD. Microsoft Word format shall be included with all text submittals. Proposal shall include consultant's proposed graphic and other software to be used to complete the project.
3. Cost summary: An itemized cost proposal based on the tasks and subtasks outlined in the above scope of services shall be included with the proposal. Work items to be performed by subcontract shall be noted and any proposed mark-up of sub-consultant costs shall be identified. A schedule of hourly labor rates and material rates shall also be provided. Any known or anticipated adjustments to billing rates shall be disclosed to EBRPD in the proposal.
4. Schedule: A preliminary project schedule shall be included in Consultant's proposal. The purpose of the schedule is to describe the anticipated duration of the tasks identified in the proposed scope of work. Consultant shall assume an July 1, 2016, start date for purposes of preparing the proposed schedule.
5. Qualifications: Proposals shall include a brief summary of up to four recent reference projects that best demonstrate consultant team's relevant experience. Project summary shall provide sufficient information for EBRPD to evaluate the specific contributions individual project team members had in completing deliverable items associated with a referenced project. A sample of a deliverable item shall be provided to EBRPD upon request. Please keep the length of project summaries to one page.
6. Ownership of work: All work products prepared by Consultant shall become the property of EBRPD. There shall be no restrictions on EBRPD's use, distribution or modification of work products.

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7. Acceptance of terms and conditions: The proposal shall include a statement of Consultant's willingness to accept the terms and conditions of EBRPD's standard Contract for Services, a copy of which is attached as (Exhibit B). Prospective consultants shall review the Contract for Services, note any items to which it takes exception provide alternate proposed wording and show levels of insurance coverage in each category and return the marked up copy with the proposal.
8. Conflict of Interest: Throughout the term of any agreement resulting from the RFP, Consultant will not accept any employment or engage in any work which creates a conflict of interest with the EBRPD or in any way compromises the work to be performed under this RFP or any agreement resulting from this RFP.

COMMUNICATIONS

Questions regarding this RFP shall be submitted up to 5-days before the submission date in writing to Jeff Rasmussen at jrasmussen@ebparks.org. We request that consultants notify the EBRPD (via email) of their interest in submitting a proposal for this project. The EBRPD responses to substantive questions will be shared with all consultants that notify the EBRPD.

~~PROPOSAL SUBMITTAL PROCESS~~

~~Please submit three hard copies and one CD of the proposal. Proposals must be received by the EBRPD by no later than 2:00 p.m. on July 1, 2016. Late proposals will not be considered. Please deliver proposals to the following address:~~

~~EBRPD's Administration Building, Reception Desk~~
~~Attention: Jeff Rasmussen, Assistant Finance Officer~~
~~East Bay Regional Park EBRPD~~
~~2950 Peralta Oaks Court~~
~~Oakland, CA 94605~~
~~Phone: (510) 544-2014~~
~~Email: jrasmussen@ebparks.org~~

REJECTION RIGHTS

The selection of a consultant for this project and any agreements for services resulting from this Request for Proposals is dependent upon the approval of the East Bay Regional Park EBRPD Board of Directors. EBRPD reserves the right to reject any or all proposals or to re-solicit this Request for Proposals.

COST OF RESPONSE PREPARATION

The Park EBRPD will make no reimbursement for any cost incurred by a prospective Consultant for the preparation of a response to this Request for Proposals.

CONSULTANT SELECTION PROCESS

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All proposals submitted by the required deadline will be reviewed for adequacy, completeness, content, project approach, qualifications and other criteria developed during the review process. Consultants who have submitted proposals which pass the initial review may be invited for interviews approximately two weeks after submittal.

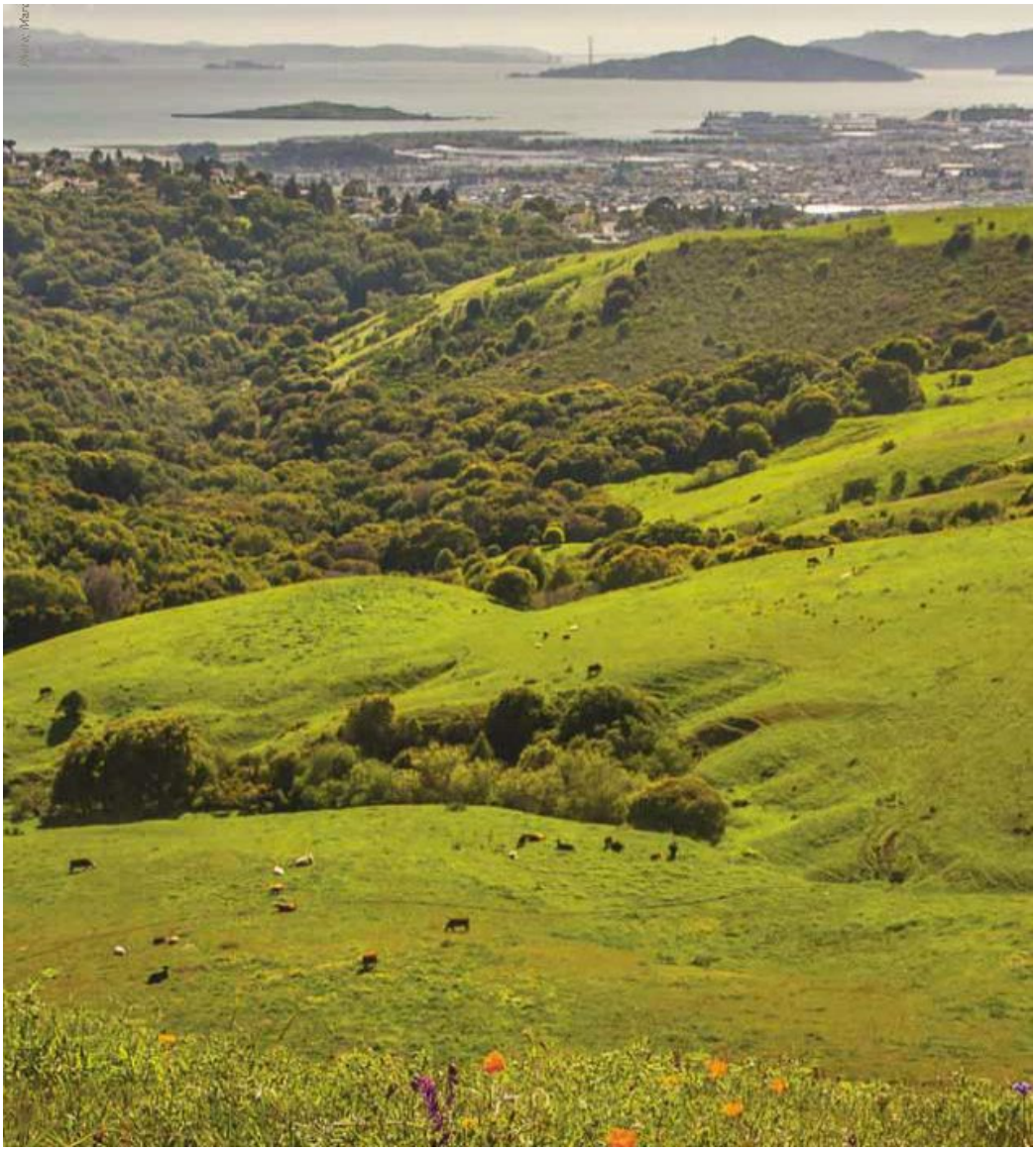
EXHIBITS

Exhibit A	EBPRD 2017 LHMP
Exhibit B	Previously Completed BCA
Exhibit C	CONTRACT FOR SERVICES (Licensed Professionals)

Exhibit A

HAZARD MITIGATION PLAN

EAST BAY REGIONAL PARK DISTRICT



June 20, 2017

East Bay Regional Park District
2950 Peralta Oaks Court
Oakland, California 94605

Cover Photo: Wildcat Canyon Regional Park

The 2017 East Bay Region Park District's Hazard Mitigation Plan is a living document which will be reviewed and updated periodically.

Comments, suggestions, corrections, and additions are enthusiastically encouraged from all interested parties.

Please send comments and suggestions to:

Jeff Rasmussen
Assistant Finance Manager
East Bay Regional Park District
2950 Peralta Oaks Court
Oakland, California 94605
jrasmussen@ebparks.org

EXECUTIVE SUMMARY

The East Bay Regional Park District Hazard Mitigation Plan covers each of the major natural hazards that pose significant threats to the District.

The mission statement of the East Bay Regional Park District Hazard Mitigation Plan is to:

> **Proactively facilitate and support district-wide policies, practices, and programs that make the East Bay Regional Park District more disaster resistant and disaster resilient.**

Making the East Bay Regional Park District more disaster resistant and disaster resilient means taking proactive steps and actions to protect life safety, reduce property damage, minimize economic losses and disruption, and shorten the recovery period from future disasters. This plan is an educational and planning document that is intended to raise awareness and understanding of the potential impacts of natural hazard disasters and to help the District deal with natural hazards in a pragmatic and cost-effective manner.

Completely eliminating the risk of future disasters in the East Bay Regional Park District is neither technologically possible nor economically feasible. However, substantially reducing the negative consequences of future disasters is achievable with the implementation of a pragmatic Hazard Mitigation Plan.

Mitigation simply means actions that reduce the potential for negative consequences from future disasters. That is, mitigation actions reduce future damages, losses, and casualties. Effective mitigation planning will help the East Bay Regional Park District deal with natural hazards realistically and rationally. That is, to identify where the level of risk from one or more hazards may be unacceptably high and then to find cost effective ways to reduce such risk. Mitigation planning strikes a pragmatic middle ground between unwisely ignoring the potential for major hazard events on one hand and unnecessarily overreacting to the potential for disasters on the other hand.

This mitigation plan focuses on the hazards that pose the greatest threats to the District's facilities and people: earthquakes, wildland/urban interface fires, droughts, floods (including sea level rise) and landslides. Other natural hazards that pose lesser threats are addressed briefly in the final chapter.

TABLE OF CONTENTS

Executive Summary	**i**
1.0 Introduction	**1-1**
1.1 What is a Hazard Mitigation Plan?	1-1
1.2 Why is Mitigation Planning Important for the Park District?	1-2
1.3 The East Bay Regional Park District Mitigation Plan	1-2
1.4 Key Concepts and Definitions	1-3
1.5 The Mitigation Process	1-7
1.6 The Role of Benefit-Cost Analysis in Mitigation Planning	1-9
1.7 Hazard and Risk Synopsis	1-10
2.0 East Bay Regional Park District Profile	**2-1**
2.1 Park District Overview	2-1
2.2 Mission and Vision	2-5
2.3 The Special Role of Regional Parks	2-6
2.4 District Facilities	2-8
2.5 Significant Recent Projects and Upgrades	2-10
2.6 Impacts of a Changing Climate	2-10
2.7 Recent and Potential Development	2-12
3.0 Mitigation Planning Process	**3-1**
3.1 Overview	3-1
3.2 Mitigation Planning Team	3-1
3.3 Mitigation Planning Team Meetings	3-2
3.4 Stakeholder Outreach in the Mitigation Planning Process	3-3
3.5 Public Meetings	3-9
3.6 Appendix	3-11
3.6.1 Planning Team Meetings	3-12
3.6.2 Stakeholder Outreach and Notifications	3-18
3.6.3 Public Workshops	3-24
4.0 Goals, Objectives and Action Items	**4-1**
4.1 Overview	4-1
4.2 Mission Statement	4-2
4.3 Mitigation Plan Goals and Objectives	4-2
4.4 Status of 2010 Action Items	4-4
4.5 Park District Hazard Mitigation Plan Action Items	4-7

5.0 Mitigation Plan Adoption, Implementation and Maintenance	**5-1**
5.1 Overview	5-1
5.2 Plan Adoption	5-1
5.3 Implementation	5-3
5.3.1 Overview	5-3
5.3.2 Integration of Mitigation into Existing Programs and Policies	5-4
5.3.3 Capability Assessment: Personnel and Financial Resources	5-6
5.4 Prioritization of Mitigation Projects	5-7
5.4.1 Mission Statement and Goals	5-8
5.4.2 Cost Effectiveness of Mitigation Projects	5-8
5.4.3 STAPLEE Methodology	5-9
5.5 Plan Maintenance and Periodic Updating	5-11
5.5.1 Periodic Monitoring, Evaluating and Updating	5-11
5.5.2 Continued Public Involvement and Participation	5-12
6.0 Earthquakes	**6-1**
6.1 Introduction	6-1
6.2 Earthquake Severity	6-1
6.2.1 Earthquake Magnitude	6-1
6.2.2 Intensity of Earthquake Ground Shaking	6-2
6.3 Bay Area Earthquake Faults	6-4
6.4 Historic Bay Area Earthquakes	6-6
6.5 Probability of Future Earthquakes	6-8
6.6 Earthquake Hazard Maps	6-10
6.6.1 Probabilistic Hazard Maps	6-10
6.6.2 Site Class: Soil and Rock Types	6-11
6.6.3 Earthquake Scenarios	6-13
6.7 Other Aspects of Seismic Hazards	6-19
6.7.1 Surface Rupture	6-19
6.7.2 Liquefaction, Settlement and Lateral Spreading	6-22
6.7.3 Earthquake Induced Landslides	6-26
6.7.4 Dam, Levee and Reservoir Failures	6-28
6.7.5 Tsunamis and Seiches	6-28
6.7.6 Fire Following Earthquakes	6-31

6.8 Seismic Risk Assessment for Park District Facilities	6-32
6.8.1 Overview	6-32
6.8.2 Earthquake Damage in Past Events	6-32
6.8.3 Earthquake Risk Assessment	6-33
6.9 Earthquake Mitigation Action Items	6-36
6.10 References	6-37
7.0 Wildland-Urban Interface Fires	**7-1**
7.1 Introduction	7-1
7.2 Historical Wildland-Urban Interface Fires	7-1
7-3 Probability of Future Wildland-Urban Interface Fires	7-4
7-4 Fire Hazard Mapping and Hazard Assessment	7-5
7-5 Park District's 2010 Fuels Management	7-9
7-6 Wildland-Urban Interface Fire Risk Assessment	7-12
7.6.1 Overview	7-12
7.6.2 Fire Frisk for the Park District	7-15
7-7 Mitigation Action Items for Wildland-Urban Interface Fires	7-15
7.7.1 Mitigation Goals	7-15
7.7.2 Existing Ongoing Mitigation Activities	7-15
7.7.3 Updated Mitigation Action Items	7-16
7.8 References	7-18
8.0 Droughts	**8-1**
8.1 Introduction	8-1
8.2 Drought Impacts on the East Bay Regional Park District	8-3
8.3 Water Conservation and Drought Mitigation	8-5
9.0 Floods	**9-1**
9.1 Introduction	9-1
9.2 Flood Hazard and Risk Assessment	9-3
9.2.1 FEMA-Mapped Floodplains	9-3
9.2.2 Flooding Outside of FEMA-Mapped Floodplains	9-3
9.3 Historical Floods Affecting the Park District	9-6
9.4 Sea Level Rise	9-7
9.4.1 Overview	9-7
9.4.2 Sea Level Rise Effects on the Park District	9-8

9.5 National Flood Insurance Program (NFIP) Insured Structures	9-11
9.6 Damage Estimates for Future Floods	9-11
9.7 Mitigation for Flood Hazards	9-12
9.8 References	9-15
10.0 Landslides	**10-1**
10.1 Introduction	10-1
10.2 Types of Landslides	10-1
10.3 Landslide Susceptibilty	10-4
10.4 Historical Landslides	10-4
10.5 Landslide Hazard Mapping and Risk Assessment	10-6
10.6 Mitigation for Landslides	10-9
10.7 References	10-12
11.0 Other Natural Hazards	**11-1**
11.1 High Winds	11-1
11.2 Snow and Ice Storms	11-1
11.3 Extreme Temperatures	11-2
11.4 Volcanic Hazards	11-2
11.5 Mitigation Action Items	11-3

1.0 INTRODUCTION

1.1 What is a Hazard Mitigation Plan?

The East Bay Regional Park District's Hazard Mitigation Plan focuses on natural hazards and covers each of the major natural hazards that pose significant threats to the Park District. The plan reviews hazard data for each hazard, evaluates the vulnerability of the Park District to each hazard and includes mitigation Action Items to gradually reduce the risks to the Park District from natural hazards.

The effects of potential future disaster events on the District might be minor – such as a very shallow localized flooding event – or major – such as large earthquake or a wildland/urban interface fire with extensive damages as well deaths and injuries.

The mission statement of the East Bay Regional Park District Hazard Mitigation Plan is to:

> **Proactively facilitate and support district-wide policies, practices and programs that make the Park District more disaster resistant and disaster resilient.**

Making the Park District more disaster resistant and disaster resilient means taking proactive steps and actions to protect life safety, reduce property damage, minimize economic losses and disruption, and shorten the recovery period from future disasters.

This plan is an educational and planning document that is intended to raise awareness and understanding of the potential impacts of natural hazard disasters and to help the Park District deal with natural hazards in a pragmatic and cost-effective manner. It is important to recognize that the Hazard Mitigation Plan is not a regulatory document and does not change existing zoning, building codes, nor other ordinances that apply to the Park District.

Completely eliminating the risk of future disasters in the Park District is neither technologically possible nor economically feasible. However, substantially reducing the negative consequences of future disasters is achievable with the implementation of a pragmatic Hazard Mitigation Plan.

Mitigation simply means actions that reduce the potential for negative consequences from future disasters. That is, mitigation actions reduce future damages, losses and casualties.

The Park District's mitigation plan has several key elements:

1. Each hazard that might significantly affect the Park District's lands and facilities is reviewed to estimate the probability (frequency) and severity of likely hazard events.

2. The vulnerability of the Park District to each hazard is evaluated to determine the level or risk from each hazard.

3. A range of mitigation actions are evaluated to identify those with the greatest potential to reduce future damages and losses to the Park District and that are desirable from the community's political and economic perspectives.

1.2 Why is Mitigation Planning Important for East Bay Regional Park District?

Effective mitigation planning will help the Park District realistically and rationally deal with natural hazards. That is, to identify where the level of risk from one or more hazards might be unacceptably high and then to find cost effective ways to reduce such risk. Mitigation planning strikes a pragmatic middle ground between unwisely ignoring the potential for major hazard events on one hand and unnecessarily overreacting to the potential for disasters on the other hand.

Furthermore, the Federal Emergency Management Agency (FEMA) requires each local public entity to adopt a multi-hazard mitigation plan to remain eligible for future pre- or post-disaster FEMA mitigation funding. Thus, an important objective in developing this plan is to maintain eligibility for FEMA funding and to enhance the Park District's ability to garner future FEMA mitigation funding.

Further information about FEMA mitigation grant programs is given in Appendix 1: FEMA Mitigation Grant Programs.

1.3 The East Bay Regional Park District Hazard Mitigation Plan

This East Bay Regional Park District Hazard Mitigation Plan is built is upon quantitative or qualitative assessments of each of the major hazards that might significantly affect the Park District, including their frequency, severity, and the locations and facilities most likely to be affected. This assessment draws heavily on hazard data developed by local, state, and federal agencies and on additional district-specific data.

These evaluations of the hazards and the vulnerability of the Park District to the hazards are the foundation of the Park District's mitigation plan. From these assessments, the greatest threats to the District's lands and facilities are identified. These high risk situations then become priorities for future mitigation actions to reduce the negative consequences of future disasters affecting the Park District.

The Park District's Hazard Mitigation Plan realistically and rationally deals with hazards and strikes a balance between suggested physical mitigation actions to eliminate or reduce the negative consequences of future disasters and planning

measures that better prepare the community to respond to and recover from disasters for which physical mitigation actions are not possible or not economically feasible.

1.4 Key Concepts and Definitions

The central concept of mitigation planning is that mitigation reduces risk. **Risk** is defined as the threat to people and the built environment posed by the hazards being considered. That is, risk is the potential for damages, losses, and casualties arising from the impact of hazards on the built environment. The essence of mitigation planning is to identify lands and facilities in the Park District that are at high risk from one or more natural hazards and to evaluate ways to mitigate (reduce) the effects of future disasters on these high risk facilities.

The level of risk at a given location, building or facility depends on the combination of **hazard** frequency and severity plus the **exposure,** as shown in Figure 1 below.

Figure 1.1
Hazard and Exposure Combine to Produce Risk

Risk is generally expressed in dollars (estimates of potential damages and other economic losses) and in terms of casualties (numbers of deaths and injuries).

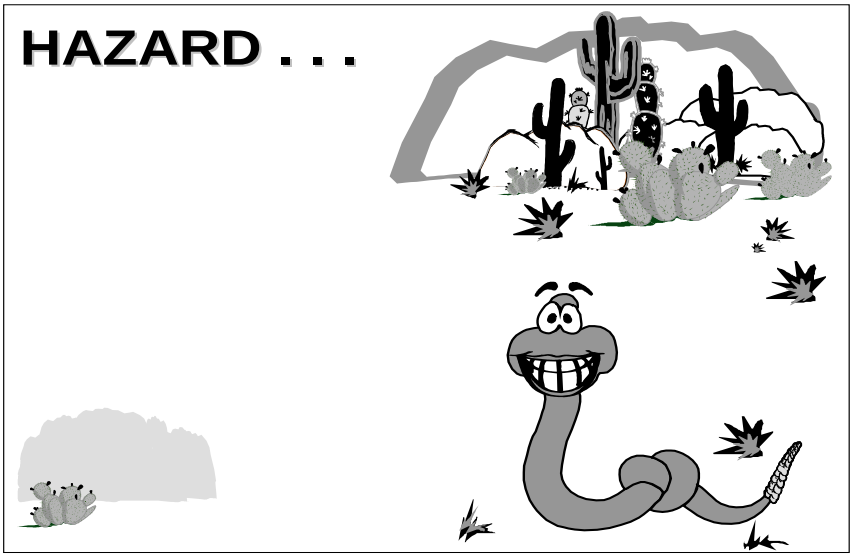
There are four key concepts that govern hazard mitigation planning: hazard, exposure, risk, and mitigation. Each of these key concepts is addressed in turn.

HAZARD refers to natural events that might cause damages, losses, or casualties, such as earthquakes, tsunamis, and floods. Hazards are characterized by their frequency and severity and by the geographic area affected. Each hazard is characterized differently, with appropriate parameters for the specific hazard. For example, earthquakes are characterized by the probable severity and duration of ground motions while tsunamis are characterized by the areas inundated and by the depth and velocity of the tsunami inundations.

A hazard event, by itself, might <u>not</u> result in any negative effects on a community. For example, a flood-prone five-acre parcel might typically experience several shallow floods per year, with several feet of water expected in a 50-year flood event. However, if the parcel is wetlands, with no structures or infrastructure, then there is

no risk. That is, there is no threat to people or the built environment and the frequent flooding of this parcel does not have any negative effects on the community. Indeed, in this case, the very frequent flooding (the high hazard) might be environmentally beneficial by providing wildlife habitat, recreational opportunities, and so on.

Figure 1.2
Hazard Alone Does Not Produce Risk



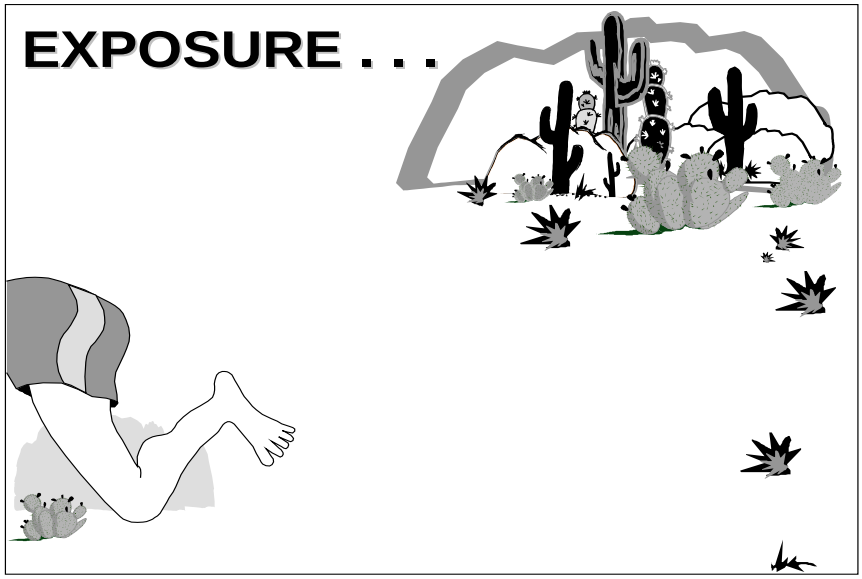
An important point is that natural hazards do not necessarily produce risk to people and property, unless there is vulnerable inventory exposed to a natural hazard. Risk to people, buildings, infrastructure, and the natural environment occurs only when hazards are combined with inventory.

EXPOSURE is the quantity, value and vulnerability of the built environment (inventory of people, buildings, and infrastructure) and the natural environment in a particular location subject to one or more hazards. Inventory is described by the number, size, type, use, and occupancy of buildings and by the infrastructure present, including trails, roads, bridges, and utilities. For the Park District the "inventory" of concern also includes the natural environment with park lands, especially environmentally sensitive areas.

For the Park District, the inventory of concern is both the Park District's lands and facilities and the adjacent areas that might be impacted by hazard events such as wildland/urban interface fires.

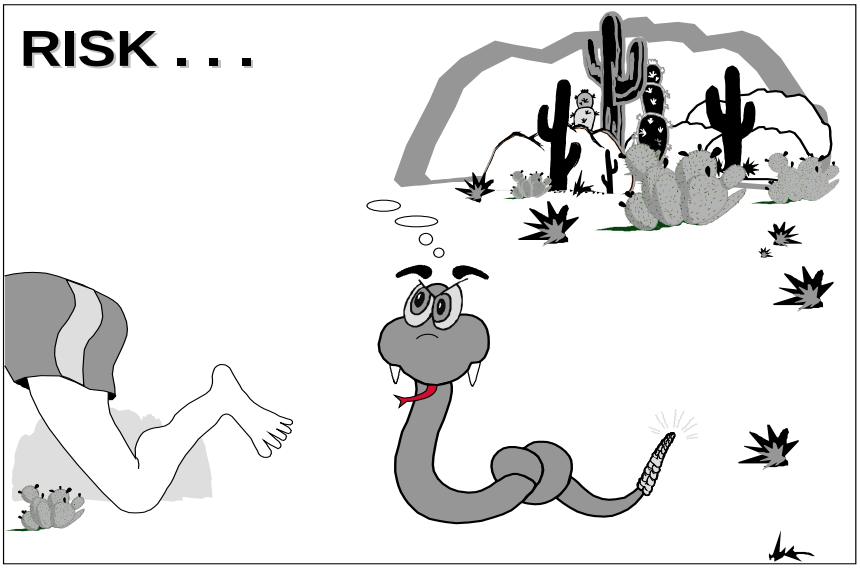
For hazard mitigation planning, inventory must be characterized not only by the quantity and value of buildings or infrastructure present but also by its vulnerability to each hazard under evaluation. For example, a given facility might or might not be particularly vulnerable to flood damages or earthquake damages, depending on the details of its design and construction. Depending on the hazard, different engineering measures of the vulnerability of buildings and infrastructure are used.

Figure 1.3
Exposure (Quantity, Value and Vulnerability of Inventory)



RISK is the threat to people and the built environment - the potential for damages, losses and casualties arising from hazards. Risk results only from the combination of Hazard and Exposure as discussed above and as illustrated schematically in Figure 1.4.

Figure 1.4
Risk Results from the Combination of Hazard and Exposure



Risk is the potential for future damages, losses or casualties. A disaster event happens when a hazard event is combined with vulnerable inventory (that is when a hazard event strikes vulnerable inventory exposed to the hazard). The highest risk in

a community occurs in high hazard areas (frequent and/or severe hazard events) with large inventories of vulnerable buildings or infrastructure.

However, high risk can also occur with only moderately high hazard, if there is a large inventory of highly vulnerable inventory exposed to the hazard. Conversely, a high hazard area can have relatively low risk if the inventory is resistant to damages (such as strengthened to minimize earthquake damages).

MITIGATION means actions to reduce the risk due to hazards. Mitigation actions reduce the potential for damages, losses, and casualties in future disaster events. Repair of buildings or infrastructure damaged in a disaster is not mitigation. Hazard mitigation projects might be proactively initiated – before a disaster, or after a disaster has already occurred. In either case, the objective of mitigation is always is to reduce future damages, losses or casualties.

A few common types of mitigation projects are shown in Table 1.1.

Table 1.1
Examples of Mitigation Projects

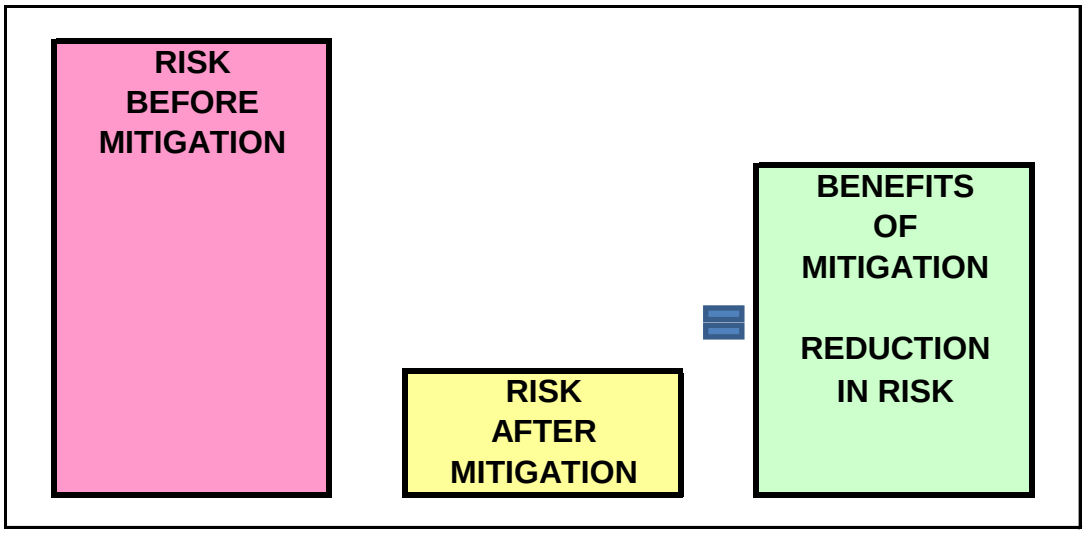
Hazard	Common Mitigation Projects
Earthquake	Structural or nonstructural retrofits for buildings
	Replace existing building with new, current-code building
	Retrofits or replacement of infrastructure
Wildland/Urban Interface Fires	Fuel reduction measures
	Enhance defensible space around buildings
	Improve fire resistance of existing buildings
Floods	Upgrade levees
	Elevate or floodproof at risk buildings
	Demolish or relocate buildings at high risk
Landslides	Stabilize slopes with improved drainage and/or retaining walls.
	Relocate buildings or infrastructure out of landslide hazard areas
Drought	Enhance water conservation measures
	Increase water storage
	Enhance removal of dead or dying trees
Multi-Hazard	Expand education/outreach to improve community understanding of natural hazards

The mitigation project list above is not comprehensive; mitigation projects can encompass many other actions to reduce future damages, losses, and casualties.

1.5 The Mitigation Process

The key element for all hazard mitigation projects is that they reduce risk. The benefits of a mitigation project are the reductions in risk (for example, the avoided damages, losses, and casualties attributable to the mitigation project). Benefits are the difference in expected damages, losses, and casualties before mitigation (as-is conditions) and after mitigation. These important concepts are illustrated on the following page.

Figure 1.5
Mitigation Projects Reduce Risk



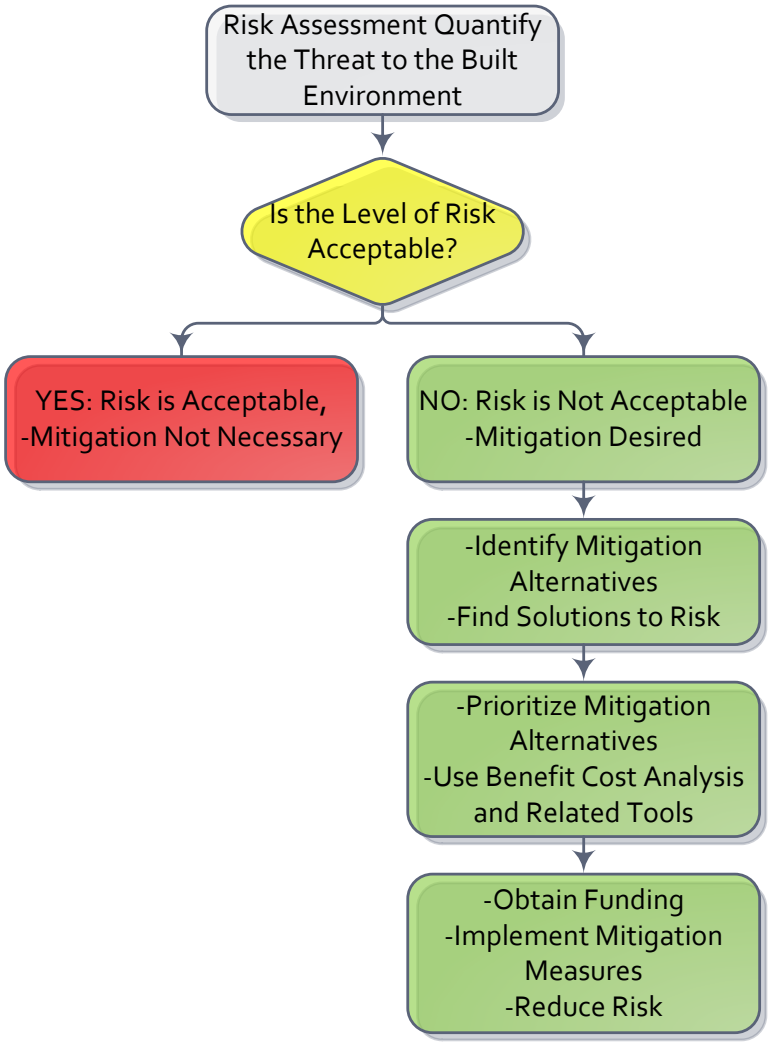
Quantifying the benefits of a proposed mitigation project is an essential step in hazard mitigation planning and implementation. Only by quantifying benefits is it possible to compare the benefits and costs of mitigation to determine whether or not a particular project is worth doing (for example, whether it is economically feasible). Real world mitigation planning almost always involves choosing between a range of possible alternatives, often with varying costs and varying effectiveness in reducing risk.

Quantitative risk assessment is centrally important to hazard mitigation planning. When the level of risk is high, the expected levels of damages and losses are likely to be unacceptable to the community and mitigation actions have a high priority: the greater the risk, the greater the urgency of undertaking mitigation.

Conversely, when risk is moderate both the urgency and the benefits of undertaking mitigation are reduced. It is neither technologically possible nor economically feasible to eliminate risk completely. Therefore, when levels of risk are low and/or the cost of mitigation is high relative to the level of risk, the risk might be deemed acceptable (or at least tolerable). Therefore, proposed mitigation projects that address low levels of risk or where the cost of the mitigation project is large relative to the level of risk are generally poor candidates for implementation.

The overall mitigation planning process is outlined in Figure 1.6 which shows the major steps in hazard mitigation planning and implementation for the East Bay Regional Park District.

Figure 1.6
The Mitigation Planning Process



The first steps are quantitative evaluation of the hazards (frequency and severity) affecting the Park District and of the inventory (people, facilities and lands) exposed to these hazards. Together these hazard and exposure data determine the level of risk for specific locations, buildings, facilities, or lands in the Park District.

The next key step is to determine whether or not the level of risk posed by each of the hazards affecting the Park District is acceptable or tolerable. If the level of risk is deemed acceptable or at least tolerable, then mitigation actions are not necessary or at least not a high priority. There is no absolute universal definition of the level of risk that is tolerable or not tolerable. Each entity has to make its own determination.

If the level of risk is deemed not acceptable nor tolerable, then mitigation actions are desired. In this case, the mitigation planning process moves on to more detailed evaluation of specific mitigation alternatives, prioritization, funding, and implementation of mitigation actions. As with the determination of whether or not the level of risk posed by each hazard is acceptable or not, decisions about which mitigation projects should be undertaken can only be made by the Park District.

1.6 The Role of Benefit-Cost Analysis in Mitigation Planning

Entities, such as the East Bay Regional Park District that are considering whether or not to undertake mitigation projects must answer questions that do not always have obvious answers, such as:

What is the nature of the hazard problem?

How frequent and how severe are hazard events?

Do we want to undertake mitigation actions?

What mitigation actions are feasible, appropriate, and affordable?

How do we prioritize between competing mitigation projects?

Are our mitigation projects likely to be eligible for FEMA funding?

Benefit-cost analysis (BCA) is a powerful tool that can help communities provide solid, defensible answers to these difficult socio-political-economic-engineering questions. Benefit-cost analysis is <u>required</u> for all FEMA-funded mitigation projects, under both pre-disaster and post-disaster mitigation programs. However, regardless of whether or not FEMA funding is involved, benefit-cost analysis provides a sound basis for evaluating and prioritizing possible mitigation projects for any natural hazard. Chapter 5 includes other approaches to prioritizing mitigation measures.

1.7 Hazard and Risk Synopsis

The following chapters cover each of the natural hazards that pose significant threats to the East Bay Regional Park District:

Chapter 6 Earthquakes

Chapter 7 Wildland/Urban Interface Fires

Chapter 8 Drought

Chapter 9 Floods

Chapter 10 Landslides

Chapter 11 Other Natural Hazards

A brief synopsis of each of these hazards is given below. The two natural hazards that pose the greatest threats to the Park District are earthquakes and wildland/urban interface fires.

The entire Park District is subject to earthquakes. The level of earthquake hazard varies with location with the highest hazard areas including locations nearest to the active faults, especially the Hayward Fault, or located on soils subject to liquefaction or in locations subject to surface rupture. Key mitigation measures for earthquakes include:

- Retrofit or replace the Peralta Oaks Building,
- Develop a Park District policy for the desired level of seismic performance for critical and important buildings and infrastructure,
- Replace the Public Safety Office, Service Yard Office and Fire Station #1 with new current seismic code buildings, and
- Evaluate and retrofit historically important buildings including the Temescal Beach House, Tilden Carousel and Brazil Room.

Much of the Park District is subject to wildland/urban interface fires. Locations with the highest risk include locations with high fuel loads, especially in hilly areas with limited access and limited water supplies. A key mitigation measure for wildland/urban interface fires is:

- Complete the remaining fuel reduction projects in the Fuels Plan, and expand the Fuels Plan to other high risk areas.

The entire Park District is subject to drought, which primarily affects vegetation, although prolonged drought might also affect buildings and infrastructure from ground settlement. The risk from wildland/urban fires is especially high during periods of prolonged drought. Key mitigation measures for drought include:

- Continue and enhance water conservation measures, and

- Evaluate possible increases in water storage, including cisterns for fire suppression, and implement if feasible.

Parts of the Park District are subject to several types of floods, including storm surge and tsunami flooding for locations adjacent to San Francisco Bay. In addition, portions of the Park District are subject to flooding from streams and/or from localized storm water drainage flooding and/or flooding from failures of dams or reservoirs. Key mitigation measures for floods include:

- Evaluate the adequacy of existing levees for floods, including storm surge, tsunamis and sea level rise, and
- Implement flood risk reduction measures for shoreline facilities including levees at Hayward Shoreline, shoreline protection for other shoreline locations, and Lake Del Valle.

Parts of the Park District are subject to landslides, including debris flows, mudslides and deep-seated landslides, especially areas with steep slopes. Landsides are most likely to occur during or after prolonged periods of heavy rainfall or from earthquakes. Key mitigation measures for landslides include:

- Compile an inventory of sites with a history of landslides and develop prioritized mitigation actions.
- Locate new facilities outside of areas with significant landslide risk, whenever possible.

There are also other natural hazards that might affect the Park District, including high winds, extreme temperature and volcanic ash falls. The impacts of other natural hazards are generally less than those from the major natural hazards and/or have much lower probabilities of occurring. Key mitigation measures for high winds include:

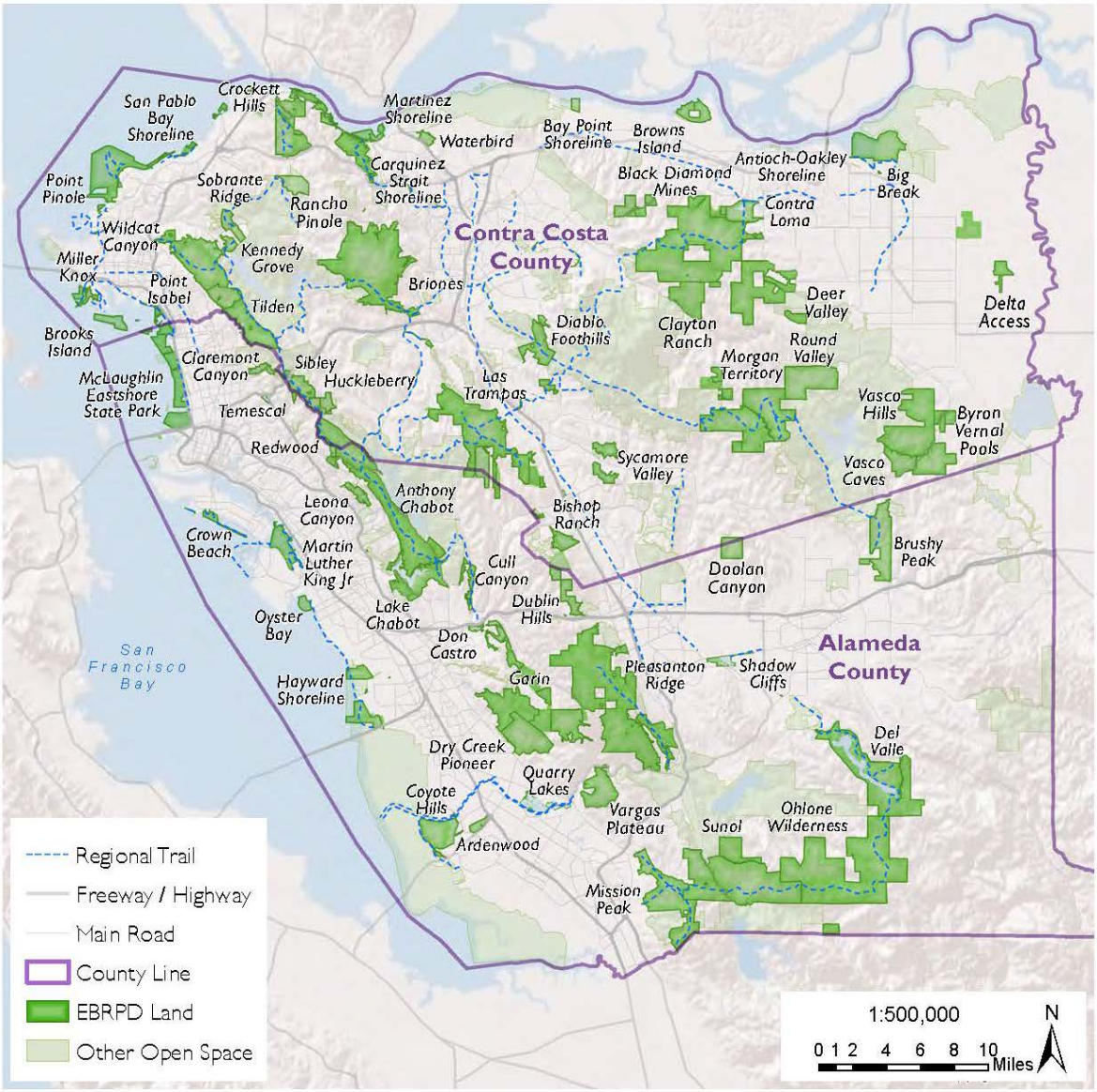
- Continue and enhance the Park District's hazardous tree mitigation program, and
- Evaluate critical infrastructure, including communications towers, and buildings possibly vulnerable to high winds.

2.0 East Bay Regional Park District Profile

2.1 Park District Overview

The East Bay Regional Park District owns and manages regional parks and open spaces for Alameda and Contra Costa counties, a 1,400 square mile area that is home to 2.6 million people and forms the eastern shoreline of San Francisco Bay. The Park District owns and operates 65 regional parks and over 1,200 miles of trails on over 120,000 acres of land. These parks and regional trails are shown in Figure 2.1.

Figure 2.1 East Bay Regional Park District Parks



The Park District was formed under the California Public Resources Code (Article 2, 5500 series), which states that the Park District has the power to:

"…acquire land…to plan…develop…and operate a system of public parks, playgrounds, golf courses, beaches, trails, natural areas, ecological and open space preserves, parkways, scenic drives, boulevards and other facilities for public recreation, for the use and enjoyment of all the inhabitants of the District…to conduct programs and classes in outdoor science education and conservation education…to employ a police force…prevent and suppress fires…and to do all other things necessary or convenient to carry out the purposes of the District."

Awareness if this broad mandate is essential to understanding the Park District's complex responsibilities to its constituents.

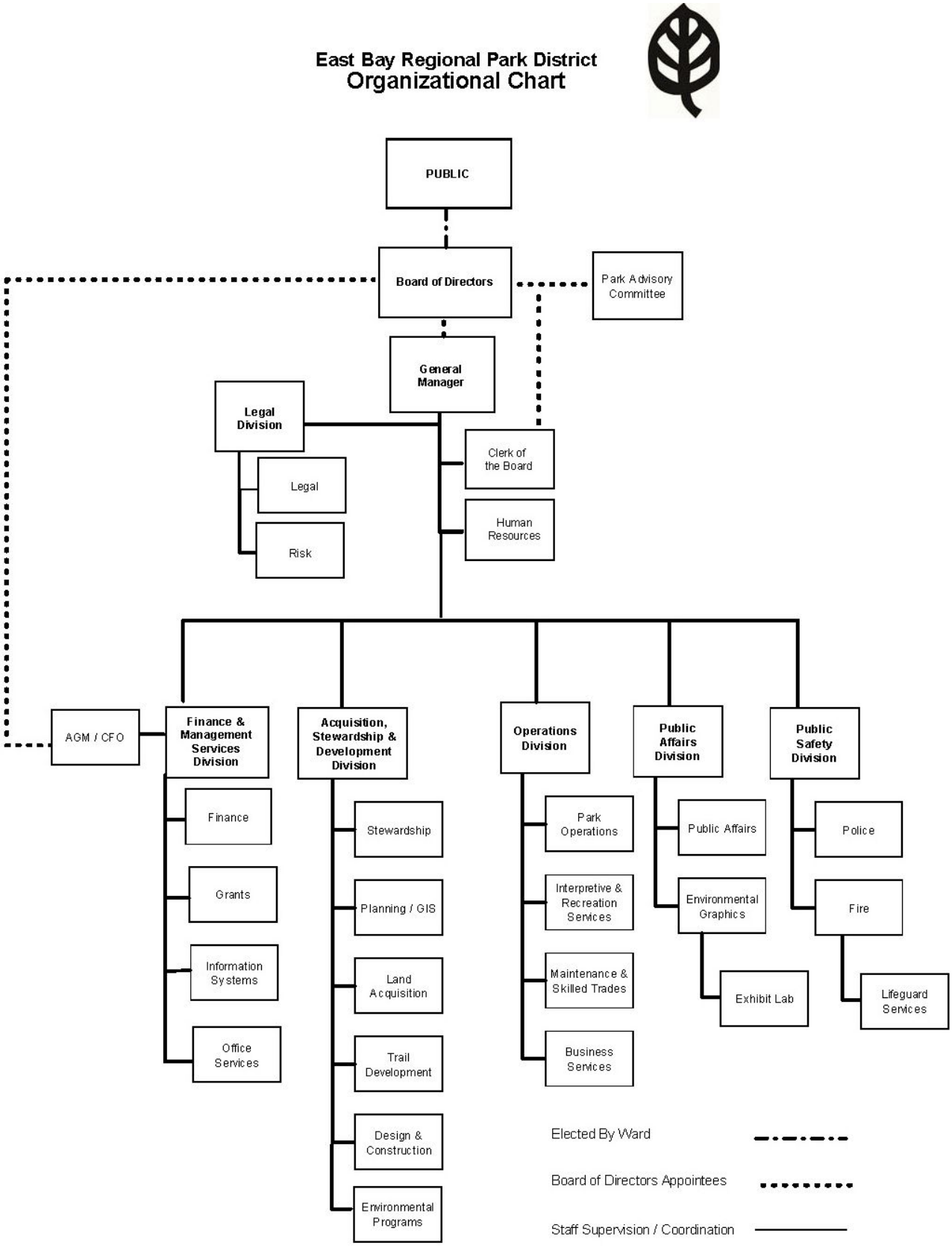
More than 25 million people visit the parks each year to walk, bike and horseback ride on the trails, fish, boat and swim in the lakes and beaches, bird watch, camp, picnic, play and learn. A publicly elected board of Directors governs the Park District; board members are elected representing seven wards within the jurisdiction of the Park District. The Park District's administrative headquarters are located in Oakland, California.

The District employs over 780 people organized into five divisions:

1. Finance and Management Services Division, which supports program staff through office services and grants.
2. Acquisition, Stewardship and Development Division which acquires land, plans its development, seeks permits, designs and constructs capital improvements and manages biological resources and restoration projects.
3. Operations Division, which includes park supervisors and staff, interpretive and recreation services, and skilled trades maintenance staff.
4. Public Affairs Division, which communicates with the community at large and designs and distributes outreach material.
5. Public Safety Division, which houses the Park District's fire and police departments.

Figure 2.2 on the following page shows Park District's organizational chart.

Figure 2.2: Park District's Organizational Chart



History of the Park District

The first regional parks in the East Bay were established on watershed land purchased from the East Bay Municipal Utility District (EBMUD). In 1928, EBMUD declared surplus some 10,000 acres of land in the East Bay hills. This announcement provided the impetus for a concerted effort by East Bay community leaders, who advocated opening these lands to the public as regional parklands. A vigorous lobbying effort culminated in the passage in 1933 of AB 1114, which authorized establishment of a regional park district and a board to govern it.

Then in 1934, during the depths of the Great Depression, a ballot measure to establish the East Bay Regional Park District and a tax for its operation was placed on the ballot in seven cities—Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont and San Leandro. It passed by a resounding 71 percent and the first regional park agency in the nation was created.

District Profile

- Founded in 1934
- 120,931 acres
- 1,250 miles of trails
- 65 parks
- 55 miles of accessible shoreline
- 10 lakes
- 10 visitor centers
- 781 employees
- 25 million visits per year
- $210 million annual budget
- Largest regional park system in the United States
- Serves 2.6 million residents across two counties

The Hayward area joined the Park District in 1956. Fremont voters approved annexation in 1958. Most of Contra Costa County joined the Park District in 1964, the Pleasanton area in 1966, East Contra Costa in 1981, and finally the Livermore area in 1992, resulting in a full two-county jurisdiction.

The Park District's subsequent history has been one of increased service, as its constituency has become more populous, complex, and culturally diverse. Gradually at first, then more rapidly, the Park District acquired more parklands and expanded its area of jurisdiction, along with new programs directed at a diverse and growing population.

2.2 Mission and Vision

The Mission statement defines the essential role of the Park District:

> **The East Bay Regional Park District preserves a rich heritage of natural and cultural resources and provides open space, parks, trails, safe and healthful recreation and environmental education. An environmental ethic guides the District in all of its activities.**

The Vision Statement sets the direction, values and objectives of the Park District:

> **The District envisions an extraordinary and well-managed system of open space parkland in Alameda and Contra Costa counties, which will forever provide the opportunity for a growing and diverse community to experience nature nearby.**

The Park District achieves its vision in the following ways:

- Provide a diversified system of regional parklands, trails and related services that will offer outstanding opportunities for creative use of outdoor time.

- Acquire and preserve significant biologic, geologic, scenic and historic resources within Alameda and Contra Costa counties.
- Manage, maintain, and restore the parklands so that they retain their important scenic, natural, and cultural values.
- Interpret the parklands by focusing educational programs on the visitor's relationship to nature, natural processes, ecology, the value of natural conditions, and the history of the parklands.
- Balance environmental concerns and outdoor recreational opportunities within regional parklands.
- Support the development and retention of well-trained, dedicated and productive employees.
- Improve access to and use of the parks by members of groups that are underrepresented, such as persons with disabilities, the economically disadvantaged and elderly park visitors.
- Provide recreational development that fosters appropriate use of parklands while preserving their remoteness and intrinsic value.
- Create quality programs that recognize the cultural diversity represented in the region.
- Participate in partnerships with public agencies, nonprofit organizations, volunteers and the private sector to achieve mutual goals.
- Provide leadership to help guide land use decisions of East Bay governments that relate to the Park District.
- Ensure open and inclusive public processes.
- Pursue all appropriate activities to ensure the fiscal health of the Park District.
- Monitor the effects of climate change on Park District resources and use adaptive management techniques to adjust stewardship methods and priorities to preserve the natural, cultural and scenic values of the parks and trails.

2.3 The Special Role of Regional Parks

Politically defined as a special district, the Park District has a unique role to play amongst the various city, state and national parks that exist in the San Francisco Bay Area. The Park District essentially takes the place of a county park system for Alameda and Contra Costa counties, bridging the gap between the locally accessible and recreation-oriented city parks and the more remote state park system.

The Park District's goal is to preserve and provide access to the best remaining natural open lands in the East Bay through a connected system of regional parklands that preserve water resources, native plants, wildlife habitat, traces of the history of human occupation and use of the area. Most of the parklands are large, undeveloped open

space areas where the ridges and peaks afford panoramic views of nearby urban and undeveloped areas. The valleys, canyons, large expanses of open space and shoreline areas provide seclusion and escape from the hustle and bustle of the surrounding urban environment. The substantial amount of natural habitat preserved by these parklands supports a healthy ecosystem for plants and wildlife. The parks also preserve traces of the historic legacy of the American farm period, the Spanish rancho lands going back over 200 years, and Indian habitation for some 13,000 years.

In the regional effort to foster sustainable and green communities in the East Bay area, the Park District plays the important role of providing nearby open space that separates and buffers developed areas from each other. The lands of the Park District also physically reduce the East Bay's carbon footprint by removing approximately 300,000 metric tons of carbon per year from the air; an amount equal to the emissions produced by 60,000 vehicles a year. Non-vehicular access to and within these parklands is encouraged and accommodated through an extensive trail system: 1,250 miles of trails within the parks and 200 miles of paved trails. The public can travel these trails by foot, horseback or bicycle, in the process improving their own health and well-being while using a sustainable and green mode of transportation. The regional parklands also provide opportunities to offset urban development impacts by preserving and enhancing dedicated projects deemed appropriate by the Board of Directors.

2.4 District Facilities

Critical Facilities

The Park District's administrative headquarters building is located in Oakland, California. The main emergency operations center is located at Lake Chabot in Castro Valley. Sub-stations are located at the EBMUD San Pablo Reservoir in Orinda and Contra Loma Regional Park in Antioch, and at the Park District's Air Support Unit at the Hayward Municipal Airport.

Recreational Facilities

The District's recreational and support facilities include pedestrian, bicycle and horse trails, roads for access and fire response, and buildings and bridges, including:

- 11 freshwater swimming areas, boating and/or stocked fishing lakes and lagoons and a disabled-accessible swimming pool,
- 40 fishing docks,
- 3 bay fishing piers,
- 235 family campsites,
- 42 youth camping areas,
- 2 golf courses,
- 2,082 family picnic tables,
- 1,707 group picnic tables,
- 10 interpretive and education centers,
- 18 children's play areas, and
- Wedding, meeting, and banquet facilities.

Visitor and Interpretive centers

Visitor and interpretive centers are located at Ardenwood Historic Farm, Big Break Regional Shoreline, Black Diamond Mines Regional Preserve, Coyote Hills Regional Park, Crab Cove Visitor Center, Del Valle Regional Park, Garin Regional Park, Sunol-Ohlone Regional Wilderness, Tidewater Boating Center, Tilden Regional Park, and Tilden Nature Area.

Special Facilities

The Park District owns and operates a number of special facilities that offer unique recreational opportunities, appeal to diverse interests, and are a treasured part of the region. These special facilities include, for example, equestrian centers, a boating center, meeting and conference areas, a botanical garden, golf courses, archery and marksmanship ranges, a hang gliding area, model boat and train areas, a historic

merry-go-round, and two historic farms.

Cultural Facilities

The lands managed by the East Bay Regional Park District have a rich history and diverse cultural background. Cultural resources include archaeological, historical, and scientifically valuable sites, areas, and objects. The follow parks contain significant cultural resources:

- Coyote Hills Regional Park
  An original Ohlone shellmound and reconstructed village site. Interpretive exhibits of original native inhabitants and their way of life, including tule reed boats, clothing, baskets, and tools. Site of the annual gathering of the Ohlone people.
- Point Pinole Regional Shoreline
  Site of Ohlone coastal villages; later part of the Rancho San Pablo (Francisco Maria Castro). Between 1892 and 1960, Point Pinole was the town site of the Giant Powder Company, which manufactured dynamite there.
- Black Diamond Mines Regional Preserve
  Located in the territories of the Chupcan, Volvon, and Ompin (Bay Miwok) tribes. From 1850 to1900, this was the site of the largest coal mining operation in California, and the five towns where miners lived. The Rose Hill cemetery is the final resting place of inhabitants of these towns, many of whom died in epidemics and mining accidents. Underground visitor center in the Hazel Atlas Mine, where sand was mined for the manufacture of glass from the 1920s to1940s.
- Ardenwood Historic Farm
  Site of the original Patterson Ranch—one of the largest working farms in Alameda County in the late 19th century. The original Patterson house and outbuildings with typical 19th century farm equipment are on display, along with farm animals and a horse-drawn railway.
- Vasco Caves Regional Preserve
  The area around Vasco Caves was an important cultural crossroads for trade and ceremony for the Ohlone, Bay Miwok, and Yokut peoples. The cultural sites of Vasco Caves Regional Preserve contain Indian rock art, part of a complex that reaches back more than 10,000 years.

2.5 Significant Recent Projects and Upgrades

The Park District enjoys strong support for its mission from its constituents, and they have shown a repeated willingness to tax themselves in order to maintain and improve high-quality regional park system.

Thanks to Measure WW, passed by voters in 2008, the Park District awarded more than $9.8 million in 2015 to East Bay park and recreation projects. The measure extended Measure AA, approved in 1988, to help the Park District meet the increasing demand to preserve open space for recreation and wildlife habitat. A few projects approved in 2015 include the Larkey Pool Renovation and Splash Pad in Walnut Creek, San Lorenzo Community Park improvements, public artwork and other upgrades in De Fremery Park in Oakland, and new sports fields at Rumrill Park in San Pablo.

Funds from Measure CC, a $12-per-year parcel tax passed by voters in western Alameda and Contra Costa counties in 2004, allowed the Park District to continue to make progress on fuels management in the East Bay fills, extend the Bay Trail, and enhance habitats. This measure also funded the creation of the 2010 Wildfire Hazard Reduction and Resource Management Plan, which guides the Park District's fuels management program.

In the area of public safety, the improved radio communications with an updated radio transmitter on Mount Diablo, and upgraded the 911 system in the parks has enhanced the Park District's emergency response capabilities.

2.6 Impacts of a Changing Climate

Global climate change, the limitations of fossil fuel energy, and the need to nurture sustainable community development have become widely recognized issues that need to be addressed by the cities of the East Bay area. The Park District is also impacted by these issues in its long-term operations and has an important role to play in contributing to the sustainability of the region. Complicating this situation is the realization that climate change might affect California's and The Bay Area's ecosystems in ways that are still too complex to fully understand. This plan is developed to address the natural hazards as they exist today and to plan for the ways in which the hazards we face will change as a result of climate change:

- A projected rise in sea level of between 15 and 55 inches will impact the Park District's 55 miles of Bay-Delta shoreline through increased sand and bank erosion as well as the loss of land, directly affecting the Bay Trail, piers, levees, boat launches, developed wetland areas, and other shoreline facilities. Although much of the Park District's shoreline ownership is off-shore wetlands, this protected open space serves an essential function as a buffering mechanism for adjacent communities and vital infrastructure against storm damage and tidal flooding. The Park District is already facing major expenses for beach replacement at Crown Beach and levee repair to protect marsh habitat along the Hayward Shoreline.
- As sea level rises, so will the groundwater table and salinity levels, which can impact the vegetation and habitat in shoreline parks, increase the areas subject to liquefaction in earthquakes and require the use of pumping of stormwater for flood management, increasing both operations and maintenance costs.
- Higher average temperatures and longer dry periods over a longer fire season, as well as changes in vegetation will lead to more frequent and more intense wildfires, exacerbate their rate of spread, and can lead to a lengthened fire season. Wildfires will consume more property, homes, and vegetation and will reduce the carbon sequestration benefits of maintaining native open space. It is becoming increasingly difficult to cost-effectively manage vegetation to reduce wildfire hazards, and greater amounts of time and resources might be required to respond to increasingly larger and more frequent fires. An increase in wildland fires will also increase the amount of carbon released from fires.
- While climate change is not expected to significantly alter future annual rainfall totals in the Bay Area, variability of rainfall from season to season is expected to increase and the region might experience a compressed winter with more rain falling during fewer months leading to an increase in the likelihood of landslides and flooding within the Park District. Additionally, as more of the Park District's land is burned during summer wildfires, removing protective vegetation and increasing storm runoff, the likelihood for more landslides and floods will also increase.
- Increased fuel and energy costs and a limited supply of potable water will impede the Park District's 124,000 acre, two-county, 65-park operation, making the reuse and recycling of resources essential, and the investigation into alternative energy sources, such as solar and biomass, and adoption of recycled water and water efficient technology vital to developing a sustainable operational program.
- The vegetation in the park acts as a "carbon sink", helping to offset the carbon dioxide generated by automobile traffic and urban/industrial uses. The Park District completed a carbon sequestration study update in 2016 to demonstrate the value of the Park District's lands in climate regulation and its role in supporting California's aggressive goals for greenhouse gases (GHGs) reduction set forth in recent legislation, namely the Global Warming Solutions Act of 2006. The average amount of CO_2 equivalents annually sequestered by the Park District's lands is estimated to be 300,000 tonnes. This number represents

an equivalent of 60,000 vehicles being removed from road each year.

The Park District has continued to make progress to adapt and prepare for climate change by:

- Embarking on a $5 million, 1.2 megawatt solar project at Shadow Cliffs Recreation Area that will generate enough power to offset electricity use throughout the entire Park District, and pay for itself within 14 to 17 years.
- Restoring wetlands to protect shorelines and prepare for sea level rise,
- Taking numerous steps to adapt to severe drought and El Niño by replacing lawns with native plants and cut back water use by 34 percent.

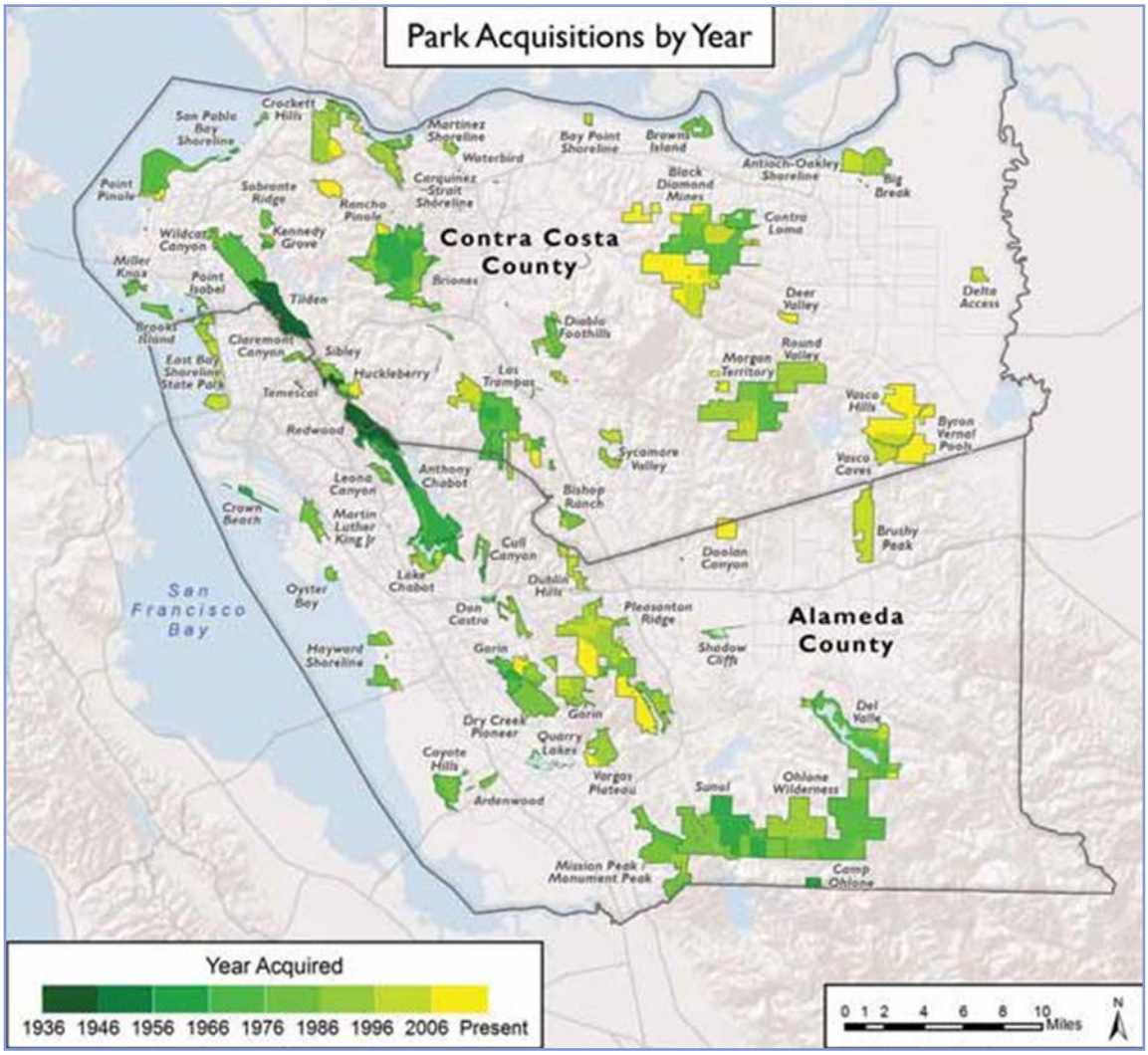
2.7 Recent and Potential Development

The Park District acquires land or the right to operate land through purchases, gifts, bequests, or dedication (as part of a land development or subdivision approval). It

acquires rights to use land owned by others through easements, license agreements, operating agreements, special permits, or any other mutually agreed upon arrangement that permits the Park District to carry out its policies and programs in keeping with the Master Plan.

Figure 2.3 shows the park land that has been acquired by year over the District's history.

Figure 2.3 Park Acquisitions by Year



In 2015, the Park District acquired or optioned more than 2,200 acres of parkland and open space, including:

- 990 acres in the Hayward hills, expanding Garin/Dry Creek Pioneer Regional Parks.
- 646 acres near Knightsen, providing a key link between Big Break Regional Shoreline and the future Delta Access Recreation Area.
- 362 acres in Norris Canyon, connecting Bishop Ranch Open Space Regional Preserve and Dublin Hills Regional Park.
- 262 acres near Mt. Diablo to expand Morgan Territory Regional Preserve.
- 3 acres in Alameda to expand Crown Memorial State Beach, saving the property from commercial development.

In 2016, the Park District acquired an additional 1,040 acres, including:

- 645 acres in Delta Access,
- 199 acres in Vasco Hills.
- 76 acres in Deer Valley,
- 241 acres in Black Diamond Mine,
- 20 acres in Port Pinole,
- 27 acres in Hayward Shoreline, and
- 10 acres in Coyote Hills.

Table 2.1 on the following page lists future, and potential parks by regional classification.

Table 2.1: Future and Potential Parks by Regional Classification

	Future	Potential
Regional Parks A spacious land area with outstanding natural features and sufficient size to support many outdoor recreational opportunities	Deer Valley Vargas Plateau	Concord Hills
Regional Preserves An area with outstanding natural or cultural features that are protected for their intrinsic value and for the enjoyment and education of the public.	Byron Vernal Pools Clayton Ranch Doolan Canyon Vasco Hills	Cedar Mountain Duarte Canyon Tesla
Regional Recreation Areas An area that will provide a variety of outdoor recreational experiences on a site that is particularly well suited to the type of recreational activities that the Park District provides.	Delta Access	Bethany Reservoir Chain of Lakes Delta Recreation Dumbarton Quarry
Regional Shorelines An area that provides significant recreational, interpretive, natural, or scenic values on land, water, and tidal areas along the San Francisco Bay, San Pablo Bay, and Sacramento/San Joaquin Delta		Alameda Point (Naval Air Station) Alvarado Wetlands North Richmond Shoreline Oakland Shoreline Pittsburg Wetlands Point Edith Wetlands Point Molate East Bay Gateway

3.0 MITIGATION PLANNING PROCESS

3.1 Overview

The East Bay Regional Park District's mitigation planning process was supported by a FEMA mitigation planning grant. The planning process began in earnest in July 2016, with the notice to proceed from FEMA via the California Office of Emergency Services.

3.2 Mitigation Planning Team

The District's mitigation planning team included the following members:

Name	Title	Division
Paul Ferrario	Acting Risk Manager	Legal
Alan Love	Police Lieutenant	Public Safety
Kelly Barrington	Chief of Maintenance and Skilled Trades	Operations
Mark Ragatz	Chief of Operations	Operations
Matt Graul	Chief of Stewardship	Acquisition, Stewardship and Development
Tiffany Margulici	Grants Manager	Finance and Management Service
Aileen Theile	Fire Captain	Public Safety
Ed Liu	Civil Engineer	Acquisition, Stewardship and Development
Sandra Hamlat	Senior Planner	Acquisition, Stewardship and Development
Jeff Rasmussen	Assistant Finance Manager	Finance and Management Service
Alternates		
Jessica Lau	Administrative Analyst II	Finance and Management Services
James Grabowski	Police Officer	Public Safety
Anna Fong	Administrative Analyst II	Legal
Dania Stoneham	Unit Manager	Operations

The mitigation planning team's roles and responsibilities were defined as follows:

- Participate actively in planning team meetings,
- Provide local perspectives regarding natural hazards and the threats that they pose to the Park District's facilities and people.
- Help to identify existing plans, studies, reports, and technical information for inclusion or reference in the mitigation plan.
- Forge consensus on mitigation action items and their priorities.
- Help to facilitate the public outreach actions during the mitigation planning process, and
- Provide review comments on draft materials during development of the East Bay Regional Park District Hazard Mitigation Plan.

Technical Support for the Park District's mitigation planning effort was provided by the following consultants:

- Kenneth A Goettel, Goettel & Associates Inc.
- Danielle Hutchings Mieler, A3GEO Inc.
- John Eidinger, G&E Engineering Systems Inc.
- Donald Duggan, G&E Engineering Systems Inc.
- Carol Rice, Wildland Resource Management Inc.

Goettel and Mieler provided technical support for the overall mitigation planning effort. Eidinger and Duggan provided technical support for earthquake and landslide issues and completed a seismic evaluation of the Park District's headquarters building. Rice provided technical support for wildland/urban interface fires and expanded the Park District's fuels management plan.

3.3 Mitigation Planning Team Meetings

Mitigation planning team meetings were held on the following dates:

- July 28, 2016,
- September 7, 2016,
- November 17, 2016,
- December 7, 2016, and
- January 4, 2017.

Attendance lists and meeting summaries for each of the above planning team meetings are provided in the Appendix at the end of this chapter.

3.4 Stakeholder Outreach in the Mitigation Planning Process

The Park District took robust efforts to involve the public and stakeholders throughout the mitigation planning process, including the following actions:

- Postings on the Park District's website,
- Postings on social media, including Twitter and Facebook,
- Posting in the Park District Newsletter,
- Announcements in three local newspapers – East Bay Times, The Independent and the Martinez News-Gazette.
- Distributing the notice via e-mail to a wide audience of stakeholders,

Copies of the above notices and the distribution lists are included in the Appendix at the end of this chapter.

In addition to widely distributed public notices as summarized above, the Park District sent targeted notices to two groups of important stakeholders:

- Public and private sector agencies with roles in disaster preparation, disaster response and mitigation planning. This group of stakeholders is listed on the following pages.
- An additional e-mail list of more than 500 people involved in disaster related activities. This list is not published, for privacy reasons.

East Bay Regional Parks District LHMP
Stakeholder Identification

FEMA requirement Element A2: *The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process.*

Alameda County and Cities

Jurisdiction	Name	Department
Alameda County	Teresa Langdon	Emergency Services
Alameda County	Michael Cadrecha	GSA
Alameda County	David Rocha	Fire Department
City of Alameda	Erin Smith	Public Works
City of Alameda	Sharon Oliver	Fire Department
City of Albany	Lance Calkins	Fire Department
City of Berkeley	Timothy Burroughs	Resilience
City of Berkeley	Gil Dong	Fire Department
City of Dublin	Roger Bradley	Assistant to the City Manager
City of Emeryville	Lori Elefant	Human Resources
City of Fremont	Rachel DiFranco	Sustainability Office
City of Hayward	Laurel James	City Manager's Office
City of Hayward	Don Nichelson	Fire Department
City of Livermore	Ruben Torres	Fire Department
City of Newark	Terrance Grindall	City Manager's Office
City of Oakland	Devan Reiff	Planning Department
City of Oakland	Genevieve Pastor-Cohen	Emergency Services
Town of Piedmont	Warren (Bud) McLaren	Fire Department
City of Pleasanton	Ruben Torres	Fire Department
City of San Leandro	Heidi DeRespini	Emergency Services
City of Union City	Joan Malloy	ECD Director

Contra Costa County and Cities

Jurisdiction	Name	Department
Contra Costa County	Rich Lierly	Floodplain/Watershed
Contra Costa County	Susan Roseberry	Emergency Services
City of Antioch	Rick Marchoke	Police Lieutenant
City of Brentwood	Ben Tolero	Police Lieutenant
City of Clayton	Charlie Mullen	Community Development Director
City of Concord	Victoria Walker	Comm. Econ. Dev. Dir
Town of Danville	Greg Gilbert	Emergency Services Manager
City of El Cerrito	Michael Bond	Battalion Chief/Fire Marshall
City of Hercules	Holly Myth	Planning Director
City of Lafayette	Niroop K. Srivatsa	Planning & Building Director
City of Martinez	Tim Tucker	City Engineer
Town of Moraga	Jay Ingram	Parks and Recreation Director
City of Oakley	Dan Gomex	Police Chief
Town of Orinda	Emmanuel Ursu	Planning Director
City of Pinole	Jim Parrott	Fire Chief
City of Pittsburg	Kristin Pollot	Planning Manager
City of Pleasant Hill	Roderick Wui	Planner
City of Richmond	Richard Mitchell	Director of Planning and Building
City of San Pablo	Ronalyn Nanato	Assistant Engineer
City of San Ramon	Steven Spedowfski	Senior Analyst
City of Walnut Creek	Steve Waymire	Planner

Regional Agencies

Agency	Name	Title
Association of Bay Area Governments	Dana Brechwald	Resilience Planner
Bay Conservation and Development Commission	Lindy Lowe	Planning Director
Bay Trail	Laura Thompson	Program Manager

Fire Districts

Agency	Name	Title
Contra Costa County Fire Protection District	Rich Grace	Assistant Fire Chief
East Contra Costa Fire Protection District	Brian Helmmick	Battalion Chief
Kensington Fire Protection District	Michael Bond	Fire Marshall
Rodeo-Hercules Fire Protection District	Alan Biagi	Battalion Chief
San Ramon Valley Fire Protection District	Mike Piccard	Battalion Chief
Moraga-Orinda Fire District	Stephen Healy	Fire Chief

Water and Flood Control Districts

Agency	Name	Title
Contra Costa Water District	Jerry Brown	General Manager
East Bay MUD	Scott Hill	Watershed and Recreation Manager
Contra Costa County Flood Control and Water Conservation District	Paul R. Detjens	Senior Civil Engineer
Alameda County Flood Control and Water Conservation District	Daniel Woldesenbet	General Manager

Parks and Recreation Districts

Agency	Name	Title
Pleasant Hill Recreation and Park District	Bob Bergen	General Manager
Hayward Area Recreation and Park District	Paul McCreary	General Manager
Livermore Area Recreation and Parks District	Timothy Barry	General Manager

State and Federal Agencies

Agency	Name	Title
California Coastal Conservancy	Matt Gerhart	SF Bay Regional Manager
California Department of Fish and Wildlife	Scott Wilson	SF Bay Regional Manager
Regional Water Resources Control Board	Keith Lichten	Engineer, Watershed Management
State Lands Commission	Brian Bugsch	Chief, Land Management
California Department of Fish and Wildlife	Scott Wilson	Bay Delta Regional Manager
Cal Fire – Sunol	Mike Martin	Battalion Chief
U.S. Army Corps of Engineers	Patrick O'Brien	Hydrologist

Non-governmental Organizations

Agency	Name	Title
Hills Emergency Forum	Cheryl Miller	Staff Support
EBRPD Park Advisory Committee	Sharon Clay	Secretary
Regional Parks Foundations	William Yarborough	President
Diablo Fire Safe Council	Cheryl Miller	Executive Director
Oakland Fire Safe Council		
Bay Area Ridge Trail	Janet McBride	Executive Director

Sources:

Alameda County LHMP

Contra Costa County LHMP

ABAG LHMP workshop attendees

Preserving Shoreline Parks in the Face of Climate Change, Adapting to Rising Tides, 2015

EBRPD website

EBRPD Municipal Service Review, Alameda County LAFCO

3.5 Public Meetings

Public meetings were announced via the modes listed above and held on the following dates:

- December 13, 2016 – mitigation plan drafting in-process
- January 23, 2017 – mitigation plan 95% draft
- TBD presentation to the Board for comments before it goes to OES/FEMA for review

Attendance lists and meeting summaries for each of the above public meetings are provided in the Appendix at the end of this chapter.

Review and Comment on Mitigation Plan Drafts

Mitigation plan drafts were posted on the Park District's website for review. Notices of the Park District's requests for comments being solicited from all interested parties were made via the notices previously itemized and made available at the public meetings. Key inputs received during the review and comment periods included the following:

1. A resident emphasized the negative impacts of herbicide use as part of the Park District's fuels reduction projects designed to reduce the risk of major wildland or wildland/urban interface fires.
2. A resident criticized a perceived focus of the Park District's fuels reduction projects on non-native trees such as eucalyptus and objected to localized clear cutting of mature trees as unnecessary to reduce the risk of wildland or wildland/urban interface fires.
3. The SF Bay Regional Water Quality Board provided comments that included the following main points..
    a. The Water Board supports the EBRPD's efforts to mitigate the fire hazard risk on District-owned lands in the East Bay's wildland-urban interface to an acceptable level in a way that does not negatively impact nearby waterbodies. Additionally, we are fully supportive of the mitigation goals presented in Chapter 7 of the Hazard Plan, including maintaining and enhancing ecological values for plant and wildlife habitat consistent with fire reduction goals and providing a cost-effective, environmentally sustainable vegetation management plan. As noted in Hazards Plan, there are approximately 1,550 acres identified in the Wildlife Hazard Reduction and Resource Management Plan (Fuels Plan) that remain untreated. We request that the EBRPD approaches treating the remaining 1,550 acres while being cognizant of the effect that overgrazing and tree removal can have on soil erosion. Removing Eucalyptus trees, and other trees identified as fire hazards, is an appropriate action to reduce fire risk. When these types of trees are removed from riparian areas, the removed trees should be replanted with native species that don't pose the same fire hazard risk while also compensating for an equal, or greater, canopy cover. In addition, removing trees from riparian areas can disturb

the underlying soil. When trees need to be removed, erosion control measures should be installed. Implementing grazing is also an effective fire reduction measure, but should be done in a way that minimizes the risk of soil erosion that could cause excessive sedimentation into nearby waterbodies. Therefore, it is our recommendation that you specify how tree removal and grazing techniques will be conducted in a way that minimizes the risk of soil erosion and discharge to receiving waterbodies.

b. Reducing fire load reduction in a way that doesn't pose a risk to listed special status species, or Species of Special Concern, should be included in Chapter 7 of the Hazard Plan. There didn't appear to be a direct reference to listed species within the areas where fuel load reduction would take place. The Water Board requests there be a direct reference to the listed species within the areas where fuel load reduction is implemented, and information about the appropriate incidental take permits for listed species should also be presented in this section.

c. The Water Board commends the EBRPD on moving forward with the Bay Point Regional Shoreline Restoration project and hopes EBRPD will continue to implement projects that restore our marshland and project vulnerable shorelines from sea level rise (SLR). Specifically, we encourage the EBRPD to explore living shorelines and other similar SLR adaptation designs that incorporate habitat creation to combat rising water levels. These creative SLR adaptation strategies are preferred over more traditional shoreline protection such as increasing levee height to meet future SLR projections.

The above suggestions were mostly already addressed by the Park District's ongoing programs and practices. However, To reflect the above comments, an additional mitigation Action Item was added to the wildland fire chapter: Short Term #2: Review and refine the Park District's fuels reduction strategies to maximize the reduction in fire risk, while minimizing possible negative impacts on the natural environment.

3.6 APPENDIX

Planning Team Meetings

Stakeholder Outreach and Notifications

Public Meetings

3.6.1 Planning Team Meetings

Planning Team Meeting #1
Local Hazard Mitigation Plan Update
East Bay Regional Park District
July 28, 2016

Attendees

Name	Title	Division
Anna Fong	Acting Risk Manager	Legal
Larry Tong	Interagency Planning Manager	Acquisition, Stewardship and Development
Kelly Barrington	Chief of Maintenance and Skilled Trades	Operations
Mark Ragatz	Chief of Operations	Operations
Matt Graul	Chief of Stewardship	Acquisition, Stewardship and Development
Tiffany Margulici	Grants Manager	Finance and Management Services
Aileen Theile	Fire Captain	Public Safety
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Agency Staff		
Victoria La Mar-Hass	Senior Emergency Services Coordinator	California Office of Emergency Services
Helen DuBois	Mitigation Planning Specialist	FEMA Region IX
JoAnn Scopdino	Mitigation Planning Specialist	FEMA Region IX
Alison Kearns	Lead Community Planner	FEMA Region IX
Consultant		
Kenneth Goettel	Mitigation Planning Consultant	Goettel & Associates Inc.

Summary:

1. Mitigation Plan Overview
    a. California OES and FEMA attendees provided a detailed summary of the key elements in the mitigation planning process and of FEMA's requirements for approval of the mitigation plan
    b. Discussion about roles and responsibilities for the planning team
2. Next steps
    a. District staff begin data collection
    b. Consulting team begin risk assessment and draft chapters

Planning Team Meeting #2
Local Hazard Mitigation Plan Update
East Bay Regional Park District
September 7, 2016

Name	Title	Division
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Raphael Breines	Senior Park Planner	Acquisition, Stewardship and Development
Matt Graul	Chief of Stewardship	Acquisition, Stewardship and Development
Dania Stoneham	Park Unit Manager	Operations
Jessica Lau	Admin Analyst	Finance and Management Services
David Caulboy	Account Clerk	Finance and Management Services
Ed Liu	Civil Engineer	Acquisition, Stewardship and Development
Kelly Barrington	Chief	Operations
Consultant		
Kenneth Goettel	Mitigation Planning Consultant	Goettel & Associates Inc.

Summary:

1. Mitigation Plan Overview
    a. Consultant described that hazard mitigation planning process and provided summary of the significant natural hazards for the Districts
    b. Discussion about roles and responsibilities for the planning team
    c. Discussion of data needs
2. Next steps
    a. Planning team meeting December 7, 2016
    b. Begin risk assessment and draft chapters

Planning Team Meeting #3
Local Hazard Mitigation Plan Update
East Bay Regional Park District
November 17, 2016

Name	Title	Division
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Paul Ferrario	Acting Risk Manager	Legal
Tiffany Margulici	Grants Manager	Finance & Management Service
Aileen Theile	Fire Captain	Public Safety
Alan Love	Lieutenant	Public Safety
Raphael Breines	Senior Park Planner	Acquisition, Stewardship and Development
Kelly Barrington	Chief	Operations
Alternates		
Becky Tuden	Ecological Services Manager	Acquisition, Stewardship and Development
Consultants		
Kenneth Goettel	Mitigation Planning Consultant	Goettel & Associates Inc.
Donald Duggan	Engineer	G&E Engineering Systems Inc.
Danielle Mieler	Engineer	A3GEO

Summary:

1. Mitigation Plan Overview
    a. Consultant overview of natural hazards affecting the District\Staff asked questions and provided feedback
2. Risk Assessment
    a. Consultant presented results of seismic evaluation of the Headquarters Building with extensive dialog with Planning Team regarding interpretation of the results
3. Next steps
    a. Planning team meeting December 7, 2016
    b. Continue risk assessment and refinement of draft chapters

Planning Team Meeting #4
Local Hazard Mitigation Plan Update
East Bay Regional Park District
December 7, 2016

Name	Title	Division
Jeff Rasmussen	Assistant Finance Officer	Financial and Management Services
Paul Ferrario	Acting Risk Manager	Legal
Matt Graul	Chief of Stewardship	Acquisition, Stewardship and Development
Tiffany Margulici	Grants Manager	Finance and Management Service
Aileen Theile	Fire Captain	Public Safety
Edward Liu	Civil Engineer	Acquisition, Stewardship and Development
Sandra Hamlet	Planner	Acquisition, Stewardship and Development
Alternates		
Becky Tuden	Ecological Services Manager	Acquisition, Stewardship and Development
Consultant		
Danielle Mieler	Engineer	A3GEO

Summary:

1. Mitigation Plan Overview
    a. Consultant described that hazard mitigation planning process and progress to date
    b. Consultant presented the results of the hazard assessment and exposure analysis\Staff asked questions and provided feedback
2. Risk Assessment
    a. Consultant facilitated staff identification of facilities, that if impacted, would be a threat to human safety, prevent staff from carrying out critical tasks, or the District from fulfilling its overall mission
    b. Staff completed facility identification and vulnerability assessment worksheets to provide detailed information about identified critical facilities
    c. Staff provided list of parks subject to repetitive flooding and landslides
3. Next steps
    a. Public meeting December 13, 2016
    b. Complete risk assessment and draft chapters

Planning Team Meeting #5
Local Hazard Mitigation Plan Update
East Bay Regional Parks District
January 4, 2017

Name	Title	Division
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Matt Graul	Chief of Stewardship	Acquisition, Stewardship and Development
Aileen Theile	Fire Captain	Public Safety
Edward Liu	Civil Engineer	Acquisition, Stewardship and Development
Sandra Hamlat	Planner	Acquisition, Stewardship and Development
Steve Castile	Chief of Park Operations	Operations
Becky Tuden	Ecological Services Manager	Acquisition, Stewardship and Development
Alan Love	Field Lieutenant	Public Safety
Consultants		
Ken Goettel	Mitigation Planning Consultant	Goettel & Associates
Danielle Mieler	Engineer	A3GEO

Summary:

1. Data Needs
    a. Consultant reviewed identified data needs for the draft chapters and critical facilities list
    b. Staff provided information or agreed to research and send information to consultants by next week.
2. Past disasters
    a. Staff provided information about parks and facilities that have been impacted by flood or landslides in the past. See list below.
3. Mitigation Actions
    a. Consultant presented draft list of mitigation actions and prioritization based on risk assessment
    b. Staff provided input and agreed to review and provide any further comments by next week
4. Next steps
    a. Public meeting January 23, 2017
    b. Jeff to send final draft to all staff for review when public draft is posted on the website

Parks and facilities prone to floods:

- Del Valle – flooding of infrastructure when lake level rises
- Garin – Meyers Estate
- Iron Horse Trail
- Bay Trail
- Crown Beach – Crab Cove

Parks and facilities prone to landslides:

- Wildcat Canyon
- Mission Peak
- Bishop Ranch
- Lake Chabot – East shore trail, helipad
- Las Trampas
- Claremont Canyon – Gelston Residence
- Briones – Spring Hill Rd
- Alhambra Valley Staging Area
- Sunol Park – Geary Rd
- Shadow Cliffs – Stanley Blvd
- Lafayette-Moraga Trail

3.6.2 Stakeholder Outreach and Notifications

Notice Sent to Stakeholder List:

FEMA Local Hazard Mitigation Plan – Fact Sheet – November 30, 2016

The East Bay Regional Park District is developing a Local Hazard Mitigation Plan (LHMP). This plan is an educational and planning document that is intended to raise awareness and understanding of the risk and potential impacts of natural hazards and to help guide the District in its mitigation priorities in a pragmatic and cost-effective manner.

Making the District more disaster resistant and disaster resilient means taking proactive steps and actions to protect life safety, reduce property damage, minimize economic losses and disruption, and shorten the recovery period from future disasters. Additionally, the Federal Emergency Management Agency (FEMA) now requires each special district to adopt a multi-hazard mitigation plan or annex to an anchor plan to remain eligible for future pre- or post-disaster FEMA mitigation funding. Thus, an important objective in developing this plan is to maintain eligibility for FEMA funding and to enhance the District's ability to garner future FEMA mitigation funding.

The District has convened an internal planning team and retained a local hazard mitigation expert to assist in the plan development. We will be posting regular plan updates on this website and will welcome comments, suggestions, and other inputs from everyone with an interest in making the District as disaster resistant and disaster resilient as possible. The District will also have public meetings on dates to be announced for community feedback during preparation of the LHMP.

If you or your group want to be listed as a stakeholder to receive progress and plan updates, please let us know and we will add you to the list. The draft LHMP is schedule to be submitted to FEMA in early 2017 with final approval and adoption by the EBRPD Board of Directors by April 2017. For more information please contact Assistant Finance Officer, Jeff Rasmussen, at 510-544-2130 or JRasmussen@ebparks.org

Public Workshop #1:
7:00 pm to 8:30 pm
December 13, 2016
Trudeau Training Center
11500 Skyline Blvd
Oakland, CA 94619

Public Workshop #2:
10:00 am to 12:00 pm
January 23, 2017
Trudeau Training Center
11500 Skyline Blvd
Oakland, CA 94619

Press Release:

News

Public Input Sought for Park Emergency Plan

By EBRPD Public Affairs

December 16, 2016

The East Bay Regional Park District is seeking the public's comments and suggestions to help create a Local Hazard Mitigation Plan, a long-term guide to preparation for earthquakes, wildfires, floods, landslides, drought and other natural disasters within the 120,000-acre Park District.

The plan, funded through a $100,000 grant from the Federal Emergency Management Agency, will address ways to protect District assets such as the Tilden Carousel, visitor centers, drinking water systems, the Temescal dam, Tidewater Boating Center, shellmound sites and other structures.

The next public workshop will be:
10 a.m. to noon
Jan. 23, 2017
Trudeau Training Center
11500 Skyline Blvd.
Oakland, CA 94619

If you or your group want to be listed as a stakeholder to receive progress and plan updates, please let us know and we will add you to the list. The draft Local Hazard Mitigation Plan is scheduled to be submitted to FEMA in early 2017 with final approval and adoption by the Park District Board of Directors by April 2017. For more information, please go to http://www.ebparks.org/about/planning#FEMA-Local or contact Assistant Finance Officer, Jeff Rasmussen, at (510) 544-2130 or JRasmussen@ebparks.org.
The East Bay Regional Park District is a system of beautiful public parks and trails in Alameda and Contra Costa counties east of San Francisco Bay, established in 1934. The system comprises 120,000 acres in 65 parks including over 1,250 miles of trails for hiking, biking, horseback riding and nature learning.
For information, please contact Carolyn Jones, Public Information Supervisor, (510) 544-2217, cjones@ebparks.org.

Contact:
Carolyn Jones, Public Information Supervisor
(510) 544-2217
cjones@ebparks.org

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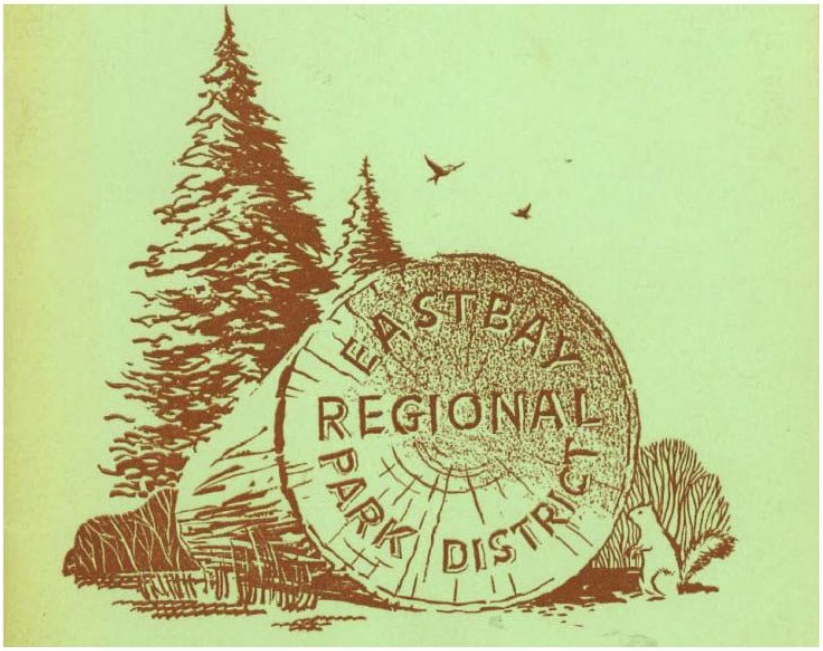
Twitter Post:

East Bay Times Newspaper:

Community News

Oakland: Regional park district seeks input on disaster management plan

The plan is "a long-term guide to preparation for earthquakes, wildfires, floods, landslides, drought and other natural disasters within the 120,000-acre park district."



Oakland: Regional park district seeks input on disaster management plan

By **CHRIS TREADWAY** | ctreadway@bayareanewsgroup.com
PUBLISHED: December 23, 2016 at 1:56 pm | UPDATED: December 23, 2016 at 2:14 pm

The East Bay Regional Park District is seeking public comments and suggestions as it creates "a long-term guide to preparation for earthquakes, wildfires, floods, landslides, drought and other natural disasters within the 120,000-acre park district."

The Local Hazard Mitigation Plan "will address ways to protect district assets such as the Tilden Carousel, visitor centers, drinking water systems, the Temescal dam, Tidewater Boating Center, shellmound sites and other structures."

The plan is funded through a $100,000 Federal Emergency Management Agency grant.

A public workshop will be held from 10 a.m. to noon Jan. 23 at the Trudeau Training Center, 11500 Skyline Blvd. in
Oakland.

The draft plan is scheduled to be submitted to FEMA in early 2017, with final approval and adoption by the park district board set for April 2017.

For more details visit http://www.ebparks.org/about/planning#FEMA-Local or contact Assistant Finance Officer Jeff Rasmussen at 510-544-2130 or JRasmussen@ebparks.org.

The Independent Newspaper:

Hazardous Mitigation Plan

Story Share Print Font Size:

Posted: Thursday, December 22, 2016 12:00 am

The East Bay Regional Park District is seeking the public's comments and suggestions to help create a Local Hazard Mitigation Plan, a long-term guide to prepare for earthquakes, wildfires, floods, landslides, drought and other natural disasters within the 120,000-acre Park District.

The plan, funded through a $100,000 grant from the Federal Emergency Management Agency, will address ways to protect District assets such as the Tilden Carousel, visitor centers, drinking water systems, the Temescal dam, Tidewater Boating Center, shellmound sites and other structures.

A public workshop will be held from 10 a.m. to noon on Jan. 23 at the Trudeau Training Center, 11500 Skyline Blvd., Oakland.

The draft Local Hazard Mitigation Plan is scheduled to be submitted to FEMA in early 2017 with final approval and adoption by the Park District Board of Directors by April 2017. For more information, go to www.ebparks.org/about/planning#FEMA-Local or contact Assistant Finance Officer, Jeff Rasmussen, at (510) 544-2130 or JRasmussen@ebparks.org.

Martinez News-Gazette:

Comments sought on park district hazard mitigation plan

Donna Beth Weilenman | December 21, 2016 | 0 Comments

Share

The East Bay Regional Park District wants to hear from the public as it creates a long-term guide to preparation for earthquakes, wildfires, floods, landslides, drought and other natural disasters.

Called a Local Hazard Mitigation Plan, the guide will help the park deal with those emergencies within the 120,000 acres it governs.

The plan will be underwritten by a $100,000 Federal Emergency Management Agency grant. It will address ways to protect District assets, such as the Tilden Carousel, visitor centers, drinking water systems, the Temescal dam, Tidewater Boating Center, shell mound sites and other structures.

The public initially was able to speak on the plan Dec. 13. The next opportunity will be at 10 a.m. to noon Jan. 23 at the Trudeau Traning Center, 11500 Skyline Blvd., Oakland.

Those who want to be listed as stakeholders and receive progress and plan updates may contact the district to be added to its listings.

The draft Local Hazard Mitigation Plan is scheduled to be submitted to FEMA in early 2017. Final approval and adoption by the Park District Board of Directors needs to take place by April 2017.

Those interested may visit www.ebparks.org/about/planning#FEMA-Local or contact Assistant Finance Officer Jeff Rasmussen at (510) 544-2130 or JRasmussen@ebparks.org.

Tags: East Bay Regional Park District, hazard mitigation plan

Category: General News

East Bay Park District News:

JANUARY 2017

East Bay Regional Park District news

Your monthly EBRPD news & updates

Jump into the new year with volunteer and job opportunities, the Trails Challenge, and activities throughout the Regional Parks. Learn what the Park District is doing to address climate change, emergency preparedness and other issues.

Visit our Website

Adapting to Climate Change

The Park District's top priority is keeping our parks, shorelines, lakes and trails safe and well-maintained. A big part of that responsibility is preparing for the future: Taking steps now to adapt to a changing climate, and a rising San Francisco Bay.

Continue to letter from EBRPD General Manager Robert E. Doyle

Public Input Sought for EBRPD Emergency Plan

The Park District seeks public comments and suggestions to help create a Local Hazard Mitigation Plan, a long-term guide to preparation for earthquakes, wildfires, floods, landslides, drought and other natural disasters within the 120,000-acres Park District.

The next public workshop will be held Jan. 23, 2017, 10 a.m. to noon, at the Trudeau Training Center, 11500 Skyline Blvd., Oakland CA 94619.

January 19, 2017

E-mail reminders send to the stakeholders identified previously, reminding them of the January 23rd Public Meeting, again providing the link to the Draft Mitigation Plan posting on the Park District's website and soliciting comments. Names and e-mails not included here because of privacy issues.

E-mail reminder to all Park District staff with the same information as summarize above. The e-mail also solicited historical information about past flood events and information on damage from the 1989 Loma Prieta earthquake.

3.6.3 Public Workshops

Public Workshop #1
Local Hazard Mitigation Plan Update
East Bay Regional Park District
December 13, 2016

Name	Title	Division
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Tiffany Margulici	Grants Manager	Finance and Management Services
Kenneth Goettel	Mitigation Planning Consultant	Goettel & Associates Inc.
Danielle Hutchings Mieler	Engineer	A3GEO Inc.

Stakeholders

Katie Gluck, Kensington Public Safety Council

Peter Liddell, Kensington Public Safety Council

Synopsis:

1. Mitigation Plan Overview
    a. Consultants and District staff described the hazard mitigation planning process and provided a summary of the significant natural hazards for the District

2. Stakeholder Feedback
    a. The two stakeholders present expressed the most concern about earthquakes and wildland/urban interface fire. They also expressed the importance of a seismic retrofit for the emergency shelter for the Kensington community and asked about FEMA mitigation grants
    b. The consultants and District staff provided guidance re: FEMA and other grant possibility

3. Next steps
    a. Public Workshop on January 23, 2017

Public Workshop #2
Local Hazard Mitigation Plan Update
East Bay Regional Parks District
January 23, 2017

Name	Title	Division (EBRPD Only)
Jeff Rasmussen	Assistant Finance Officer	Finance and Management Services
Tiffany Margulici	Grants Manager	Finance and Management Services
Dee Rosario	Director	EBRPD Board of Directors
Barbara Sacks	Ambassador	
Denise Blackman	Resident	
Erin Smith	City of Alameda	
Christopher Glenn	Langon Engineering	
Brenda Buxton	California Coastal Conservancy	
Marla Schmalle	Resident	
Kate Bernier	Resident	
Roger Wong	Resident	
Ken Goettel	Mitigation Planning Consultant	Goettel & Associates
Danielle Mieler	Engineer	A3GEO

Synopsis:

1. KCBS TV interviewed Kenneth Goettel and Jeff Rasmussen about the purpose and content of the Park District's Hazard Mitigation Plan
2. Mitigation Plan Overview. Kenneth Goettel described the hazard mitigation planning process and provided a summary of the significant natural hazards for the District.
3. Erin Smith reported that the City of Alameda is completing detailed flood modeling for part of the Bay shoreline and is disputing FEMA's draft floodplain maps. The refined flood modeling is applicable to Park District facilities
4. The attendees were most concerned about wildland/urban interface fires and discussions were held about the Park District's progress in fuels management and the Park District's approaches and priorities for fuels management.
5. Kenneth Goettel presented a summary of the draft mitigation action items and requested that attendees submit suggestions by e-mail.

Public Workshop #3
Local Hazard Mitigation Plan Update
East Bay Regional Parks District
February 21, 2017

The third public meeting was held as an agenda item on the regularly scheduled East Bay Regional Park District's regularly scheduled Board of Directors meeting on February 21, 2017.

This meeting was widely announced by the methods documented previously. In addition, notices of Board of Directors meetings are widely distributed to an even broader audience of Park District stake holders. The audience for the Board of Directors meeting included approximately 40 people.

A summary of the East Bay Regional Park District Hazard Mitigation Plan was presented by Jeff Rasmussen (Assistant Finance Manager) and Kenneth Goettel (consultant) as the third item on the Board of Directors meeting Agenda: Finance and Management Services Divisions – Approval to submit draft of the East Bay Regional Park District Hazard Mitigation Plan to CalOES and FEMA. The plan was identified in the Agenda as applying District-wide.

The presentation outlined the purpose and goals of the mitigation plan, presented a synopsis of the major hazards that affect the Park District with GIS maps for each hazard and reviewed the key, high priority mitigation Action Items included in the plan. The Board members had no edits or additions to the Draft Plan.,

The Board of Directors voted unanimously to approve submittal of the mitigation plan to CalOES and FEMA.

4.0 GOALS, OBJECTIVES AND ACTION ITEMS

4.1 Overview

The purpose of the East Bay Regional Park District's Hazard Mitigation Plan is to reduce the impacts of future natural disasters on the Park District's lands, facilities and people, including park users and Park District staff. In other words, the purpose is to make the Park District more disaster resistant and disaster resilient, by reducing the vulnerability to disasters and enhancing the capability to effectively respond to and quickly recover from future disasters. An important aspect of the planning process is also to raise awareness and understanding of natural hazards that pose threats to the Park District and adjacent urban areas.

Completely eliminating the risk of future disasters in the Park District is neither technologically possible nor economically feasible. However, substantially reducing the negative impacts of future disasters is achievable with the adoption of this pragmatic Hazard Mitigation Plan and ongoing implementation of risk reducing action items. Incorporating risk reduction strategies and action items into the Park District's existing programs and decision making processes will facilitate moving the Park District toward a safer and more disaster resistant future.

The Park District's Hazard Mitigation Plan is based on a four-step framework that is designed to help focus attention and action on successful mitigation strategies: Mission Statement, Goals, Objectives and Action Items.

Mission Statement. The mission statement states the purpose and defines the primary function of the Park District's Hazard Mitigation Plan. The mission statement is an action-oriented summary that answers the question "Why develop a hazard mitigation plan?"

Goals. Goals identify priorities and specify how the Park District intends to work toward reducing the risks from natural and human-caused hazards. The goals represent the guiding principles toward which the Park District's efforts are directed. Goals provide focus for the more specific issues, recommendations, and actions addressed in objectives and action items.

Objectives. Each goal has objectives that specify the directions, methods, processes, or steps necessary to accomplish the Park District's Hazard Mitigation Plan's Goals. Objectives lead directly to specific action items.

Action Items. Action Items are specific well-defined activities or projects that work to reduce risk. That is, the Action Items represent the specific, implementable steps necessary to achieve the Park District's Mission Statement, Goals and Objectives.

4.2 Mission Statement

The mission statement for the Park District's Hazard Mitigation Plan is to:

> **Proactively facilitate and support Park District-wide policies, practices, and programs that make the Park District more disaster resistant and disaster resilient.**

Making the Park District more disaster resistant and disaster resilient means taking proactive steps and actions to:

- Protect life safety,
- Reduce damage to Park District facilities,
- Minimize economic losses and disruption, and
- Shorten the recovery period from future disasters.

4.3 Mitigation Plan Goals and Objectives

The following Goals and Objectives serve as guideposts and checklists to begin the process of implementing mitigation Action Items to reduce identified risks to the Park District's lands, facilities and people from natural hazard events.

Goal 1: Reduce Threats to Life Safety for Visitors, Staff and Residents Adjacent to the Park District's Parks

Reducing threats to life safety is the highest priority for the Park District.

Objectives:

A. Enhance life safety by retrofitting existing facilities, replacing them with new current-code facilities or relocating them out of high hazard areas.

B. Locate new facilities outside of high hazard areas whenever possible and design them to minimize life safety risk from future disaster events.

C. Continue and enhance the Park District's ongoing fuel management programs.

D. Develop robust disaster response and evacuation plans and conduct frequent practice drills.

E. Enhance life safety by improving public awareness of wildland/urban interface fires, earthquakes and other natural hazards that pose substantial life safety risk to the Park District's facilities and people.

Goal 2: Reduce Damage to the Park District's Lands and Facilities and Adjacent Areas in Future Natural Hazard Events

Objectives:

A. Retrofit, replace or relocate existing facilities with a high vulnerability to one or more natural hazards to reduce damage, economic loss and disruption in future disaster events.

B. Ensure that new facilities are adequately designed for hazard events and located outside of mapped high hazard zones to minimize damage and loss of function in future disaster events, to the extent practicable.

C. Continue and enhance the Park District's ongoing fuel management programs.

Goal 3: Protect Environmentally Important Lands and Facilities and Sites with Historical/Cultural Significance

Objectives:

A. Manage, maintain and restore park lands so that they retain their important scenic, natural and cultural values.

B. Maintain, acquire and preserve significant biologic, geologic, scenic and historic resources within Alameda and Contra Costa counties.

C. Minimize threats to important lands, facilities and sites from future natural hazard events, to the extent practicable.

Goal 4: Enhance Emergency Planning, Disaster Response and Post-Disaster Recovery

Objectives:

A. Enhance collaboration and coordination between the Park District, local governments, utilities, businesses and citizens to prepare for and recover from future natural disaster events.

B. Enhance emergency planning to facilitate effective response and rapid recovery from future natural disaster events.

Goal 5: Increase Awareness and Understanding of Natural Hazards and Mitigation

Objectives:

A. Implement education and outreach efforts to increase awareness of natural hazards throughout the Park District, including staff, visitors and the entire communities served by the Park District.

B. Create, maintain and publicize a natural hazards page on the Park District's website with links to more information about natural hazards and mitigation activities to reduce risks from natural hazards.

4.4 Status of 2010 Action Items in the Park Districts 2010 Local Hazard Mitigation Plan Annex

The Park District's 2010 Local Hazard Mitigation Plan is an Annex to the Association of Bay Area Government's Multi-Jurisdictional Mitigation Plan (Taming Natural Disasters) for seven counties (Alameda, Contra Costa, Marin, San Mateo, Santa Clara, Solano and Sonoma), dozens of cities and dozens of special districts. This plan included over 400 mitigation Action Items.

The mitigation Action Items in the Park District's 2010 mitigation plan included three high Action Items that were Park District specific and 12 Action Items adopted from the Association of Bay Area Government's Plan. The status of the Park District's 2010 Action Items is summarized below.

The status of the three Park District specific Action Items are summarized below:

1. Fuels Management Program. This program is partially completed, is continuing and will be continued until fully completed. This multi-year program for the East Bay Hills identified numerous areas were fuels reduction projects are desired to reduce the risk of wildland fires spreading into adjacent developed areas. The study area covered about 19,000 acres. The plan outlined high risk areas totaling approximately 3,000 acres where fuels reduction is desired.
    a. Through 2015, fuels reduction projects covering 812 acres were completed.
    b. In 2016, fuels reduction projects covering an additional 51 acres were completed in the Miller-Knox, Sibley and Tilden parks.
    c. In 2017, the Park District anticipates completing fuels reduction projects for an additional 64 acres in the Claremont Canyon, Huckelberry, Sibley and Wildcat Canyon parks.
    d. The remaining projects for about 2,070 acres will be completed as funding becomes available.

2. Interoperable Radio System. This action has been completed, with upgrades to the radio communications system to enable better communications with other jurisdictions' emergency response communications systems. The District's police and fire departments are capable of communicating with outside jurisdictions thorough the East Bay Regional Communications System Authority (EBRCSA). Each vehicle is equipped with this radio and the District has two dispatch consoles able to dispatch through EBRCSA.

3. Participate in the Hills Emergency Forum. This activity is ongoing. The District has participated in the Hills Emergency Forum since it began after the 1991 Tunnel Fire and will continue to participate.

The 12 Action Items from the Association of Bay Area Governments mitigation plan that were adopted by the Park District were existing, on-going Park District practices and programs that were continued between 2010 and the present and will be continued in the future. These Action Items include:

1. *Encourage the formation of a community- and neighborhood-based approach to wildfire education and action through local Fire Safe Councils and the Fire Wise Program.* The Park District continues to work closely with Fire Safe Councils, local communities and neighborhood groups on wildfire education and action. Through the Hills Emergency Forum, the Park District works closely with the Diablo Fire Safe Council and local communities to support wildlife education and action. In addition, Park District works with volunteers throughout the wildland urban interface and neighborhood groups particularly in the Claremont Canyon and Wildcat Canyon on wildfire education and action.

2. *Develop unused or new pedestrian rights-of-way as walkways to serve as additional evacuation routes (such as fire roads in park lands.* The Park District continues to develop new pedestrian rights-of-way as walkways to serve as additional evacuation routes. Over the past five years, the Park District has developed access routes between Martinez and Port Costa, connected neighborhoods on Hercules, pedestrian access to the Dublin-Pleasanton BART station and acquired trail right of way between Oakland and Castro Valley.

3. *Pre-position emergency power generation capacity (or have rental/lease agreements for these generators) in critical buildings of cities, counties, and special districts to maintain continuity of government and service*s. The Park District has emergency power generation capacity at both its Police Headquarters building in Castro Valley and its Main Office building in Oakland.

4. *Ensure adequate fire equipment road or fire road access to developed and open space areas.* The Park District has a regular program of fire equipment road or fire road access maintenance and improvement. Fire equipment roads are mowed or graded annually as needed. As EBRPD acquires new lands, the existing fire equipment roads or fire road access is improved and maintained to insure safe management of the land.

5. *Comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or significantly remodeling government-owned facilities*. The Park District will continue to comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or significantly remodeling government-owned facilities. Recent projects include the construction of the Big Break Visitor Center in Oakley and the Tidewater Boating Center in Oakland.

6. *Develop a plan for short-term and intermediate-term sheltering of your employees.* The Park District has protocols and procedures for sheltering employees in place and has developed and maintains emergency equipment, supplies and provisions for sheltering employees during an emergency.

7. *Periodically assess the need for new or relocated fire or police stations and other emergency facilities. The Park District has conducted and continues to assess the need for new or relocated fire or police stations and other emergency facilities.* The Park District has determined that seismic retrofit of the Public Safety Office (police headquarters) and Fire Station #1 is not feasible. The Park District will replace these buildings with new current code buildings, as funding becomes available.

8. *Maintain command vehicles for use a mobile command/EOC vehicles.* The Park District has maintained command vehicles for this purpose and will continue to do so in the future.

9. *Maintain the local government's emergency operations center in a fully functional state of readiness.* The Park District does not have a permeant emergency operations center, but does support the emergency operations centers in Alameda County and Contra Costa counties. When necessary, such as during the 2009 Dubai Star Oil Spill, EBRPD opened a temporary emergency operations center for the incident.

10. *Continue to participate not only in general mutual-aid agreements, but also in agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes and other disasters*. The Park District has formal mutual aid agreements with fire and police departments in Alameda and Contra Costa counties. For disaster emergencies, a formal request for mutual aid would go through the Regional Coordinator for Region 2, which is the Alameda County Sheriff's Office.

11. *Monitor weather during times of high fire using, for example, weather stations tied into police and fire dispatch centers.* During fire season, which is announced by the state, Public Safety Dispatch announces the fire weather levels including: burn index (BI) relative humidity (RH) and temperatures expected twice a day, at 11 am and 4pm. Our Dispatch center gets this information from the Weather Information Management System or (WIMS). Four District owned Remote Automatic Weather Stations (RAWS) located throughout the two county area along with additional RAWS owned by other cooperative agencies report data to WIMS via satellite. This data is collected at these local sites and historical data are stored.

12. *Increase local patrolling during periods of high fire weather.* The Park District has done this as a standard operating procedure and will continue to do so in the future.

4.5 Park District Hazard Mitigation Plan Action Items

Mitigation Action Items may include a wide range of measures, including the categories below and many others:

- Retrofit, replacement or relocating facilities at high risk from one or more natural hazards.
- Implementation of constructive measures to reduce threats from natural hazards including:
    - Fuels management, defensible space, and fire-safe building design or retrofits for wildland/urban interface fires,
    - Improving levees or flood proofing facilities for floods,
    - Stabilization of slopes subject to landslides,
    - Increased water storage and enhanced water conservation measures for droughts.
- Additional data collection about natural hazards affecting specific parks and additional data collection about the Park District's lands, facilities and infrastructure to refine risk assessments and priorities for mitigation
- Refinements to the Park District's policies, programs and practices.
- Increased cooperation, coordination and partnership building with other agencies and stakeholders.
- Enhancements to emergency planning.
- Increased efforts to raise awareness and understanding of natural hazards.

The East Bay Regional Park District's 2017 Hazard Mitigation Plan Action Items are summarized on the following pages.

Table 4.1: Park District Mitigation Action Items

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Multi-Hazard Mitigation Action Items									
Long-Term #1	Integrate the findings and action items in the mitigation plan into ongoing programs and practices for the Park District.	Ongoing	District	Risk	X	X	X	X	X
Long-Term #2	Review and enhance emergency and evacuation planning, including the adequacy of back-up generators, using hazard and risk information in the mitigation plan	Ongoing	District	Risk	X	X		X	X
Long-Term #3	Consider natural hazards and site new facilities outside of high hazard areas whenever possible.	Ongoing	District	Design	X	X	X	X	X
Long-Term #4	Ensure that new facilities are adequately designed to minimize risk from natural hazards.	Ongoing	District	Design	X	X	X	X	X
Long-Term #5	Systematically track natural hazard events that result in damage to Park District facilities to help target mitigation actions.	Ongoing	District	GIS	X	X	X	X	X
Long-Term #6	Pursue mitigation grants from FEMA's pre- and post-disaster programs and from other sources.	Ongoing	District	Grants	X	X	X		X
Long-Term #7	Pursue FEMA Public Assistance grants if Park District facilities suffer damage in a FEMA declared disaster and include mitigation measures in addition to repairs.	Ongoing	District	Grants	X	X	X		X
Long-Term #8	Enhance and complete the Park District's inventory of facilities to more accurately evaluate risks from natural hazards	Ongoing	District	Finance	X	X	X	X	X
Long-Term #9	Increase awareness and understanding of natural hazards by creating a natural hazards page on the Park District's website with links to more information.	Ongoing	District or Grants	Public Affairs	X		X	X	X
Long-Term #10	Keep the Park District's mitigation plan on the website and encourage comments from stakeholders for the periodic review and update of the mitigation plan.	Ongoing	District	Public Affairs	X		X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Earthquake Mitigation Action Items									
Short-Term #1	Retrofit or replace the Park District's Peralta Oaks headquarters building, as funding becomes available.	2-5 Years	District	Design	X	X		X	X
Short-Term #2	Develop a Park District policy for the desired level of seismic performance for critical and important facilities.	1 Year	District	Design	X	X		X	X
Short-Term #3	Complete seismic evaluations of important buildings including Tilden, Sunol and Crab Cove Visitor Centers, Temescal Beach House, Tilden Carousel, and Brazil Room.	1-3 Years	District	Design	X	X			X
Short Term #4	Complete evaluations of critical infrastructure include the Del Valle sewage ponds and the District owned dams.	1-3 Years	District	Design	X	X	X	X	X
Short-Term #5	Evaluate nonstructural seismic vulnerabilities in Park District facilities and mitigate components that pose significant life safety or loss of function risks.	1-5 Years	District or Grants	Design	X	X			X
Short-Term #6	Complete and update the Park District's inventory of facilities, including data necessary to evaluate seismic risk.	Ongoing	District	Finance	X	X			X
Long-Term #1	Replace the Public Safety Office, Service Yard Office and Fire Station #1 with new current-code buildings, as funding becomes available.	Ongoing	District or Grants	Design	X	X	X	X	X
Long-Term #2	Retrofit or replace critical and important facilities with significant seismic deficiencies, as identified by the evaluations in Short Term #2, as funding becomes available.	Ongoing	District or Grants	Design	X	X			X
Long-Term #3	Enhance emergency planning for earthquakes including duck, cover and hold drills and evacuation drills.	Ongoing	District or Grants	Risk & Fire	X			X	X
Long-Term #4	Locate new facilities outside of high earthquake hazard areas including sites subject to liquefaction, surface rupture, earthquake-induced landslides, or in close proximity to faults, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Wildland/Urban Interface Fire Mitigation Action Items									
Short-Term #1	Complete the remaining fuel reduction projects identified in the Fuels Plan, as funding becomes available.	Ongoing	District	Fire	X	X	X	X	X
Short-Term #2	Continue to review and refine the Park District's fuels reduction strategies to maximize the reduction in fire risk, while minimizing possible negative impacts on the natural environment.	1 Year	District	Fire	X	X	X	X	X
Short-Term #3	Review and refine emergency response and evacuation planning for locations with high risk for wildland and/or wildland/urban interface fires.	1 Year	District	Fire	X	X	X	X	X
Short-Term #4	Expand the Park District's existing Fuels Plan Park to other high wildland fire risk areas.	Ongoing	District	Fire	X	X	X	X	X
Long-Term #1	Pursue additional grants for fuels management and other fire risk reduction projects from FEMA and other agencies including Calfire, US Forest Service and California Fire Safe Council.	Ongoing	District	Grants	X	X	X	X	X
Long-Term #2	Evaluate and implement mitigation measures to reduce fire risk, including enhancing defensible space around buildings, fuel reduction measures near important facilities and upgrading building elements with materials designed to be fire-resistant, as funding becomes available.	Ongoing	District or Grants	Fire	X	X	X	X	X
Long-Term #3	Continue and expand the Park District's hazardous tree abatement programs as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #4	Locate new facilities outside of areas with significant wildland/urban interface fire risk, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Drought Mitigation Action Items									
Short-Term #1	Continue and enhance the Park District's water conservation measures, including xeriscaping.	Ongoing	District	Operations		X	X	X	X
Short-Term #1	Evaluate possible increases in water storage, including cisterns to provide emergency water for fire suppression and implement if feasible, as funding becomes available.	Ongoing	District	Operations	X	X	X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Flood Mitigation Action Items									
Short-Term #1	Evaluate the adequacy of existing levees for floods, including storm surge, tsunamis and sea level rise and develop prioritized mitigation actions.	1-3 Years	District	Planning	X	X	X	X	X
Short-Term #2	Compile and maintain an inventory of sites with a history of overbank flooding or localized stormwater drainage flooding and develop prioritized mitigation actions.	1-3 Years	District	GIS	X	X	X	X	X
Short-Term #3	Enhance emergency planning, including flood response actions including flood fighting via temporary barriers, for sites with significant flood risk.	1-2 Years	District	Operations	X	X	X	X	X
Long-Term #1	Implement flood risk reduction measures for shoreline facilities or sites with high flood risk, including levees at Hayward Shoreline, shoreline protection along the Bay and recreational facilities at Lake Del Valle, as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #2	Implement flood risk reduction measures for facilities or sites with high flood risk from overbank or stormwater drainage flooding, as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #3	Locate new facilities outside of areas with significant flood risk, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Landslide Mitigation Action Items									
Short-Term #1	Develop a Park District policy for closure of sites with high landslide risk during periods of heavy rainfall.	1 Year	District	Risk	X			X	X
Short-Term #2	Consult with an engineering geologist or geotechnical engineer regarding landslide risk for sites with important facilities with a history of landslides and/or apparent high risk.	1-3 Years	District or Grants	Design	X	X	X	X	X
Short-Term #3	Compile and maintain an inventory of sites with a history of landslides and develop prioritized mitigation actions.	Ongoing	District	Finance	X	X	X	X	
Long-Term #1	Implement landslide mitigation measures at high landslide hazard sites with important facilities including Wildcat Canyon, Lake Chabot and the other parks listed in this chapter, as funding becomes available.	Ongoing	District or Grants	Design	X	X	X	X	X
Long-Term #2	Locate new facilities outside of areas with significant landslide risk, whenever possible.	Ongoing	District	Design	X	X	X	X	X

Table 4.1: Park District Mitigation Action Items – Continued

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Other Natural Hazards Mitigation Action Items									
Short-Term #1	Review and update the Park District's emergency operations plan to include high wind events, snow or ice storms, and extreme temperatures.	1-2 Years	District	Risk	X	X		X	X
Short-Term #2	Continue and enhance the Park District's hazardous tree mitigation programs, as funding becomes available.	Ongoing	District/ Grants	Fire	X	X	X	X	X
Short-Term #3	Evaluate infrastructure and buildings possibly vulnerable to high winds, including communications towers.	1-3 Years	District	Design	X	X		X	X
Long-Term #1	Implement tie downs or other measures to mitigate infrastructure and buildings vulnerable to high winds, as funding becomes available.	Ongoing	District/ Grants	Risk	X	X		X	X

5.0 MITIGATION PLAN ADOPTION, IMPLEMENTATION AND MAINTENANCE

5.1 Overview

For a hazard mitigation plan to be effective, it has to be implemented gradually over time, as resources become available. An effective plan must also be continually evaluated and periodically updated. The mitigation action items included in the East Bay Regional Park District's Hazard Mitigation Plan will be accomplished effectively through a process that routinely incorporates pragmatic thinking about hazards, cost-effective mitigation, and lessons learned into ongoing decision making and capital improvement spending.

The following sections depict how the Park District has adopted and will implement and maintain the vitality of the Park District's Hazard Mitigation Plan.

5.2 Plan Adoption

The 2017 updated of the East Bay Regional Park District Hazard Mitigation Plan became effective on June 20, 2017, the date of adoption by the Park District's Board. The Board adopted the Park District's Hazard Mitigation Plan following FEMA's approval of the Park District's submitted plan. The Board's adoption resolution is shown on the following page.

Per FEMA's regulations, the mitigation plan needs to be updated by five years from the date of Board adoption.

EAST BAY REGIONAL PARK DISTRICT

RESOLUTION NO.: 2017- 06 - 167

June 20, 2017

APPROVAL AND ADOPTION OF EAST BAY REGIONAL PARK DISTRICT
HAZARD MITIGATION PLAN: DISTRICT-WIDE

WHEREAS, the Bay Area is subject to various hazards such as ground shaking, liquefaction, land sliding, fault surface rupture, tsunamis wildfires, floods, and landslides; and

WHEREAS, the District recognizes that disasters do not recognize city, county, or special district boundaries; and

WHEREAS, the District is committed to increasing the disaster resistance of the infrastructure, health, housing, economy, government services, education, environment, and land use systems in the District, as well as in the Bay Area as a whole; and

WHEREAS, in order to receive disaster mitigation funding from the Federal Emergency Management Agency (FEMA), the federal Disaster Mitigation Act of 2000 requires all cities, counties, and special districts to have updated and adopted a Local Hazard Mitigation Plan (LHMP); and

WHEREAS, after public comment and review by staff, the Board approved submittal of the draft plan to FEMA (2017-02-044) and on May 19, 2017, FEMA approved the plan with only minor changes, the final plan is available on the District website at www.ebparks.org or by contacting the Clerk of the Board;

NOW, THEREFORE, BE IT RESOLVED that the East Bay Regional Park District Board of Directors adopts and approves the East Bay Regional Park District (EBRPD) Hazard Mitigation Plan, District-wide as the District's Local Hazard Mitigation Plan (LHMP).

NOW, THEREFORE, BE IT FURTHER RESOLVED that the EBRPD commits to and the General Manger is authorized to continuing to take those actions and initiating further actions, as appropriate, as identified in the East Bay Regional Park District (EBRPD) Hazard Mitigation Plan, District-wide as the District's Local Hazard Mitigation Plan (LHMP).

Moved by Director Corbett, seconded by Director Waespi, and adopted this 20th day of June 2017 by the following vote:

FOR:	Ellen Corbett, Colin Coffey, Whitney Dotson, Beverly Lane, Dee Rosario, Dennis Waespi, Ayn Wieskamp.
AGAINST:	None.
ABSTAIN:	None.
ABSENT:	None.

Beverly Lane

Beverly Lane, Board President

CERTIFICATION

I, Yolande Barial Knight, Clerk of the Board of Directors of the East Bay Regional Park District, do hereby certify that the above and foregoing is a full, true and correct copy of Resolution No. 2017-06-167 **adopted by the Board of Directors at a regular meeting held on** June 20, 2017

Sharon Clay

Acting Clerk

5.3 Implementation

5.3.1 Overview

The General Manager, will have the lead responsibility for implementing the East Bay Regional Park District Hazard Mitigation Plan, with ongoing support from the following divisions:

- Finance and Management Services,
- Acquisition, Stewardship and Development,
- Operations,
- Public Affairs, and
- Public Safety.

The 2017 update of the Park District's Hazard Mitigation Plan has raised the Park District's awareness and knowledge about natural hazards. The updated hazard and risk information in the plan has also increased understanding of natural hazards for stakeholders throughout Alameda and Contra Costa counties.

Furthermore, recent earthquakes and other natural disasters worldwide have contributed to maintaining a high level awareness of natural hazards and interest in evaluating and mitigating risks from all natural hazards. For the Park District's service area, the memory of the 1989 Loma Prieta earthquake and the United States Geological Survey's updated probabilities for major earthquakes in the San Francisco Bay area have kept the level of interest in earthquake mitigation at a high level. Similarly, the memory of the 1991 East Bay Hills fire and numerous smaller wildland/urban interface fires since then have kept the level of awareness of fire risk and interest in fire mitigation at a high level.

The East Bay Regional Park District will use the full range of its capabilities and resources and those of the community to ensure efficient, effective, and timely implementation of the identified mitigation action items. The Park District's goal is to implement as many of the elements of its mitigation strategy (action items) over the next five years as possible, commensurate with the extent of funding that becomes available.

Consideration of natural hazards will be included in decisions about locations for new facilities and the design of new facilities, as well as incorporated into ongoing maintenance and periodic renovations of existing facilities. For example, in evaluating a possible remodeling or modernization of buildings, the Park District will consider including retrofits to reduce the vulnerability to natural hazards as well as considering other alternatives such as replacement with a new building, when the retrofit is very expensive or a site has substantial risks from natural hazards that cannot be mitigated on the existing site. Furthermore, when future natural hazard

events damage existing facilities, the Park District will incorporate mitigation measures concurrently with repairs, whenever possible.

5.3.2 Integration of Mitigation into Existing Programs and Policies

The East Bay Regional Park District has a more focused mission than do cities and counties. The Park District's responsibilities are largely limited to acquiring land, constructing and maintaining its facilities, stewardship of the parklands, and providing recreational opportunities, and educational activities for more than 25 million annual visitors. The Park District also provides police and fire service.

The Park District's activities, related to hazard mitigation planning include:

- Restoration of wetlands and other critical green infrastructure along the shoreline
- Design, construction and maintenance of buildings, roads, trails, bridges, and utilities (water and wastewater)
- Maintenance of parklands, including habitat preservation and enhancement, preservation of historically or culturally important buildings and sites, fuel management and other proactive activities to reduce wildland/urban interface fire risk, hazardous tree abatement, and others?

The Park District has several important planning documents that guide the Park District's operations and prioritize improvements, many of which are relevant for increasing the Park District's resistance and resiliency vis-à-vis future natural hazard events. The important plans and programs include the following:

- Master Plan,
- Adapting to Rising Tides Program: Preserving Shoreline Parks in the Face of Climate Change: Alameda County and Contra Costa County.
- Climate Change Strategy
- Wildfire Hazard Reduction Plan,
- Community Wildfire Protection Plans for Alameda County and Contra Costa County,
- Capital Improvement Plan,
- Hazardous Tree Program,
- Emergency Operations Plan, and
- Catastrophe Risk Assessment

The Park District's Master Plan outlines the mission and vision for the Park District and thus provides the guiding principles for all of the Park District's programs, policies and functions. The Master Plan emphasizes reserving and protecting the District's lands and facilities, which necessarily includes consideration of natural

hazards. The Master Plan specifically addresses climate change for flooding of shoreline lands and facilities and for the increased risks for wildland and wildland/urban interface fires arising from the ongoing severe drought.

The Adapting to Rising Tides Program addresses the need to protect marshes and other sensitive shoreline habitats and shoreline facilities from increased flooding from sea level rise.

The Climate Change Strategy includes several mitigation measures including:

- Tracking and monitoring the effects of climate change on the Park District's resources,
- Mitigating the effects of climate change by endeavoring to conserve and connect habitat for native species through its acquisition and planning processes.
- Mitigating some climate change impacts by providing low-carbon options for the public to access parklands,
- Addressing the expected increase threats from wildfire and ensuring that the Park District's fuels management plan adequately addresses these threats

The Wildfire Hazard Reduction Plan includes evaluation and prioritization of fuel reduction measures for locations that have high vegetative fuel loads, concentrations of developed areas nearby, and other factors the increase the risk of major wildland/urban interface fires.

The Capital Improvement Plan includes prioritized projects, including fuels management projects for wildland/urban interface fires and other projects for mitigation of natural hazards.

The Hazardous Tree Program systematically trims or removes trees at risk of failure that would pose life safety risks and/or damage buildings or infrastructure, especially during winter storms or other high wind events. This program also removes dead or dying trees that exacerbate wildland or wildland/urban interface fire hazards.

The Emergency Operations Plan draws on the hazard and risk analyses in the mitigation plan and also identifies critical facilities that might become targets for mitigation actions in the mitigation plan.

The mitigation plan's hazard, vulnerability and risk evaluations, and mitigation action items will continue to be integrated into the ongoing programs summarized above, including Park District activities such as facility maintenance, periodic remodeling or modernization of facilities and future siting, design, and construction of new facilities.

5.3.3 Capability Assessment: Personnel and Financial Resources

The East Bay Regional Park District has the necessary human resources to ensure that the mitigation plan continues to be an actively used planning document. Key Park District staff members with management-level positions in the divisions most involved in mitigation have been active in the preparation of the plan, including: Finance and Management Services; Acquisitions, Stewardship and Development; Operations; Public Safety; and Public Affairs. These key staff have gained a thorough understanding of the mitigation planning process and understand the importance of integrating the plan into ongoing programs and capital budget planning. Through this linkage, the Park District's hazard mitigation plan will be kept active and provide pragmatic guidance for implementing mitigation measures.

Park District staff has broad experience with maintaining existing lands and facilities, planning new facilities and new parks, as well as facilitation of community inputs. This broad experience is directly applicable to hazard mitigation planning and to implementation of mitigation projects. Furthermore, if specialized expertise is necessary for a particular mitigation project, the Park District contracts with subject matter experts on an as-needed basis.

The Park District relies on several sources of funding to acquire, develop, operate and maintain the regional parklands. Eighty percent (80%) of the Park District's operating budget is from property tax revenues that are provided to the Park District in accordance with tax sharing agreements with both Alameda and Contra Costa Counties. The Park District received funds from eastern Alameda County through another tax sharing agreement with the Livermore Area Parks and Recreation District, and in eastern Contra Costa County through a Landscaping and Lighting District that was established to provide a funding source for Park District.

The Park District also collects revenue from parking and entry fees, fees for interpretive and recreational services and other miscellaneous items based upon the Park District fee schedule. Revenue from these charges for services provides over 7 percent of the operating budget.

Property-related assessments and a special excise tax are collected to fund approximately 5 percent of the cost of operations. These include two Landscape and Lighting Districts, multiple Zones of Benefits, and Measure CC.

- In 1991 and 1993, respectively, the Park District established the East Contra Costa County and the Alameda/Contra Costa County Regional Trails Landscape and Lighting Benefit Assessment Districts. Both Assessment Districts were reaffirmed by the electorate in 1996 with a positive vote of 67 percent and 78 percent, respectively. These assessments augment funding for servicing parks and trails located within these geographic locations.
- Zones of Benefit are formed to provide operating resources for specific park properties located in close proximity to assessed parcels.

- In 2004, two-thirds of the voters in the western portion of the Park District approved Measure CC, which provides approximately $3.3 million in annual revenue for listed Park District projects in the area from Oakland through Richmond. The funds provide both operational and project funding through 2020.

Other operating revenues include investment income, property usage, inter-agency agreements and donations. In 1998, voters approved the $225 million Measure AA general obligation bond, the proceeds of which were to be used for Park District property acquisition and park development.

In 2008, voters approved an additional $500 million general obligation bond for property acquisition and park development by supporting the Regional Open Space, Wildlife, Shoreline and Park Bond (Measure WW). The Park District has funded significant acquisitions and park construction through the Measure WW bond program that will continue through the final sale of bonds, anticipated to be after 2020.

In 2012, $25 million of limited obligation bonds were issued by the Park District to fund Field and Administrative Facility Replacement and Renovation.

Many of these sources of funding summarized above are restricted to defined types of projects and activities. However, mitigation measures have been funded from many of these revenue sources and the hazard and risk information in the mitigation plan helps the Park District avoid building new facilities in high hazard areas whenever possible.

In addition to the Park District's internal financial resources, the Park District has been very successful in obtaining grants to support mitigation activities. Over the past 30+ years, the Park District has secured over $15 million in FEMA post-disaster repair and mitigation grants. Many of these grants have been for winter storm damage including localized flooding, culvert washouts, and erosion or slope failures. However, the Park District has also received FEMA grants for fuels management and other risk reduction projects for wildland/urban interface fires.

In addition to FEMA grants, the Park District has obtained numerous grants from federal, state, and local governments as well as from private non-profit and for profit entities. These grants included those ones that will mitigation elements in part or in total, including fuel reduction projects for wildland/urban interface fires.

5.4 Prioritization of Mitigation Projects

Prioritization of future mitigation projects within the East Bay Regional Park District requires flexibility because of varying types of projects, Park District needs, and availability funding sources. Prioritized mitigation action items developed during the mitigation planning process are summarized in Chapter 4. Additional mitigation

action items or revisions to the initial action items are likely in the future. The East Bay Regional Park District Board will make final decisions about implementation and priorities with inputs from Park District staff, the mitigation planning team, the public, and other stakeholders.

The East Bay Regional Park District's prioritization of mitigation projects will include the following factors:

1. The mission statement and goals in the East Bay Regional Park District Hazard Mitigation Plan.
2. Benefit-cost analysis to ensure that mitigation projects are cost effective, with benefits exceeding the costs.
3. The STAPLEE process to ensure that mitigation action items under consideration for implementation meet the needs and objectives of the Park District, its communities, and citizens, by considering the social, technical, administrative, political, economic, and environmental aspects of potential projects.

5.4.1 Mission Statement and Goals

The mission statement is:

> Proactively facilitate and support district-wide policies, practices, and programs that make the Park District more disaster resistant and disaster resilient.

The Goals are:

> Goal 1: Reduce Threats to Life Safety for Visitors, Staff, and Residents Adjacent to the Park District's Lands
>
> Goal 2: Reduce Damage to the Park District's Lands and Facilities and Adjacent Areas in Future Natural Hazard Events
>
> Goal 3: Protect Environmentally Important Lands and Facilities and Sites with Historical/Cultural Significance
>
> Goal 4: Enhance Emergency Planning, Disaster Response, and Post-Disaster Recovery
>
> Goal 5: Increase Awareness and Understanding of Natural Hazards and Mitigation

5.4.2 Cost Effectiveness of Mitigation Projects

As the East Bay Regional Park District considers whether or not to undertake specific mitigation projects or evaluate how to decide between competing mitigation projects, they must address questions that do not always have obvious answers, such as:

> What is the nature of the hazard problem?

How frequent and how severe are the hazard events of concern?

Do we want to undertake mitigation measures?

What mitigation measures are feasible, appropriate, and affordable?

How do we prioritize between competing mitigation projects?

Are our mitigation projects likely to be eligible for FEMA funding?

The East Bay Regional Park District recognizes that benefit-cost analysis is a powerful tool that can help provide solid, defensible answers to these difficult socio-political-economic-engineering questions. Furthermore, benefit-cost analysis is required for most FEMA-funded mitigation projects, under both pre-disaster and post-disaster mitigation programs.

However, regardless of whether or not FEMA funding is involved, benefit-cost analysis provides a sound basis for evaluating and prioritizing possible mitigation projects for any natural hazard. Thus, the Park District will use benefit-cost analysis and related economic tools, such as cost-effectiveness evaluation, to the extent practicable in prioritizing and implementing mitigation actions.

5.4.3 STAPLEE Methodology

The East Bay Regional Park District will also use the STAPLEE methodology to evaluate projects based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) considerations and opportunities for implementing particular mitigation action items in the Park District. The STAPLEE approach is helpful for doing a quick analysis of the feasibility of proposed mitigation projects.

The following paragraphs outline the Park District's STAPLEE Approach

Social:

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical:

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other goals?

Administrative:

- Is the action implementable?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political:

- Is the action politically acceptable?
- Is there public support both to implement and maintain the project?

Legal: Include legal counsel, land use planners, and risk managers in this discussion.

- Who is authorized to implement the proposed action?
- Is there a clear legal basis or precedent for this activity?
- Will the Park District be liable for action or lack of action?
- Will the activity be challenged?

Economic:

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the Park District?
- What burden will this action place on the tax base or economy?
- What are the budget and revenue effects of this activity?

Environmental:

- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet state and federal regulatory requirements?
- Are endangered or threatened species likely to be affected?

5.5 Plan Maintenance and Periodic Updating

5.5.1 Periodic Monitoring, Evaluating, and Updating

Monitoring the East Bay Regional Park District Hazard Mitigation Plan is an ongoing, long-term effort. An important aspect of monitoring is a continual process of ensuring that mitigation action items are compatible with the goals, objectives, and priorities established during the development of the Park District's Mitigation Plan. The Park District has developed a process for regularly reviewing and updating the Hazard Mitigation Plan. As noted previously, the General Manager, will have the lead responsibility for implementing the East Bay Regional Park District's Hazard Mitigation Plan and for periodic monitoring, evaluating and updating of the plan. There will be ample opportunities to incorporate mitigation planning into ongoing activities and to seek grant support for specific mitigation projects.

The East Bay Regional Park District Hazard Mitigation Plan will be reviewed annually as well as after any significant disaster event affecting the Park District. These reviews will determine whether there have been any significant changes in the understanding of hazards, vulnerability and risk or any significant changes in goals, objectives, and action items. These reviews will provide opportunities to incorporate new information into the Mitigation Plan, remove outdated items and document completed action items. This will also be the time to recognize the success of the Park District in implementing action items contained in the plan. Annual reviews will also focus on identifying potential funding sources for the implementation of mitigation action items.

The periodic monitoring, evaluation, and updating will assess whether or not, and to what extent, the following questions are applicable:

1. Do the plan's goals, objectives, and action items still address current and future expected conditions?
2. Do the mitigation action items accurately reflect the Park District's current conditions and mitigation priorities?
3. Have the technical hazard, vulnerability, and risk data been updated or changed?
4. Are current resources adequate for implanting the Park District's Hazard Mitigation Plan? If not are there other resources that might be available?
5. Are there any problems or impediments to implementation? If so, what are the solutions?
6. Have other agencies, partners, and the public participated as anticipated? If no, what measures can be taken to facilitate participation?
7. Have there been changes in federal and/or state laws pertaining to hazard mitigation in the Park District?
8. Have the FEMA requirements for the maintenance and updating of hazard mitigation plans changed?

9. What can the Park District learn from declared federal and/or state hazard events in other special districts that share similar characteristics to the East Bay Regional Park District, such as vulnerabilities to earthquakes and tsunamis?
10. How have previously implemented mitigation measures performed in recent hazard events? This might include assessment of mitigation action items similar to those contained in the Park District's Mitigation Plan, but where hazard events occurred outside of the Park District.

The Finance and Management Services Division will review the results of these mitigation plan assessments, identify corrective actions, and make recommendations, if necessary, to the East Bay Regional Park Board for actions that might be necessary to bring the Hazard Mitigation Plan back into conformance with the stated goals and objectives. Any major revisions of the Hazard Mitigation Plan will be taken to the Board for formal approval as part of the Park District's ongoing mitigation plan maintenance and implementation program.

The Finance and Management Services Division will also have lead responsibility for the formal updates of the Hazard Mitigation Plan every five years. The formal update process will be initiated at least one year before the five-year anniversary of FEMA approval of the East Bay Regional Park District Hazard Mitigation Plan, to allow ample time for robust participation by stakeholders and the public and for updating data, maps, goals, objectives, and action items.

5.5.2 Continued Public Involvement and Participation

The 2017 East Bay Regional Park District Hazard Mitigation Plan will be available on the Park District's website along with contact information so that stakeholders can direct comments, suggestions, and concerns to the appropriate staff at any time.

Implementation of the mitigation actions identified in the plan must continue to engage the entire community. Continued public involvement will be an integral part of the ongoing process of incorporating mitigation into land use planning, zoning, capital improvement plans, and related activities within the communities served by the Park District. In addition, the Park District will expand communications and joint efforts between the Park District and emergency management activities in Alameda and Contra Costa Counties, as well as the cities and other agencies in these counties.

The East Bay Regional Park District is committed to directly involving the public in the ongoing review and updating of the Hazard Mitigation Plan. This public involvement process will include public participation in the monitoring, evaluation, and updating processes outlined in the previous section. Public involvement will intensify as the next 5-year update process is begun and completed.

The Park District will publicize periodic reviews and updates by press releases, notices via web postings, social media and newsletters, as well as by e-mail

notifications to the approximately 500 identified stakeholders. This process will provide the public with accessible and effective means to express their concerns, opinions, ideas about any updates/changes that are proposed to the Mitigation Plan.

6.0 EARTHQUAKES

6.1 Introduction

Every location in the Bay Area has some level of earthquake hazard, but the level of earthquake hazard varies substantially by location across the region. Historically, awareness of seismic risk in the Bay Area has generally been high, among both the public and public officials, because of the Bay Area's long history of major earthquakes with significant damage to buildings and infrastructure, as well as casualties. This awareness in based to a great extent on the many significant earthquakes that have occurred within San Francisco Bay Area, including the M6.8-M7.0 1868 Hayward Fault, the M7.8 1906 San Francisco, the M7.1 1989 Loma Prieta earthquakes, and many others.

The technical information in the following sections provides a basic understanding of earthquake hazards, which is an essential foundation for making well-informed decisions about earthquake risks and Mitigation Action Items for the East Bay Regional Park District's facilities and parks.

6.2 Earthquake Severity

The severity of an earthquake can be measured in terms of its magnitude and intensity. Magnitude is a measure of the total energy released by an earthquake. Intensity is a measure of the severity of ground shaking at a site and can be expressed in terms of felt intensity on the Modified Mercalli Scale or measured Peak Ground Acceleration at a particular location.

6.2.1 Earthquake Magnitude

The size of an earthquake is described by its magnitude (M). The most common magnitude is called the "moment magnitude," which is calculated from two factors – 1) the amount of slip (movement) on the fault causing the earthquake and 2) the area of the fault surface that ruptures during the earthquake. Moment magnitudes are roughly similar to the Richter magnitude, which was used for many decades but has now been replaced.

In evaluating earthquakes, it is important to recognize that the earthquake magnitude scale is not linear, but rather logarithmic (based on intervals corresponding to orders of magnitude). Each one step increase in magnitude, such as from M7 to M8, corresponds to an increase in the amount of energy released by the earthquake of a factor of about 30, based on the mathematics of the magnitude scale.

Thus, a M7 earthquake releases about 30 times more energy than a M6, while a M8 releases about 30 times more energy than a M7. A great M9 earthquake releases nearly 1,000 times more energy than a large earthquake of M7 and nearly 30,000 times more energy than a M6 earthquake.

People often assumes that the larger the magnitude of an earthquake, the “worse” it is. That is, the “big one” is a M9 earthquake and smaller earthquakes such as M6 or M7 are not the “big one”. However, this is true only in very general terms. Higher magnitude earthquakes do affect larger geographic areas, with more widespread damage than smaller magnitude earthquakes. However, for a given site, the magnitude of an earthquake is not a good measure of the severity of the earthquake at that site, because sites closer to the epicenter will experience much stronger earthquake ground shaking than those farther away.

6.2.2 Intensity of Earthquake Ground Shaking

For most locations, the best measure of the severity of an earthquake is the intensity of ground shaking. For some sites, ground failures and other possible consequences of earthquakes, which are discussed later in this chapter (see Section 6.7), might substantially increase the severity.

For any earthquake, the intensity of ground shaking at a given site depends on four main factors:

- Earthquake magnitude,
- Earthquake epicenter, which is the location on the Earth’s surface directly above the point of origin of an earthquake,
- Earthquake depth, and
- Soil or rock conditions at the site, which might amplify or de-amplify earthquake ground motions.

The amount of earthquake damage and the size of the geographic area affected generally increase with earthquake magnitude. An earthquake will generally produce the strongest ground motions near the epicenter (the point on the ground above where the earthquake initiated) with the intensity of ground motions diminishing with increasing distance from the epicenter. The intensity of ground shaking at a given location depends on the four factors listed above. Thus, for any given earthquake, there will be contours of varying intensity of ground shaking versus distance from the epicenter. The intensity will generally decrease with distance from the epicenter, and often in an irregular pattern, not simply in perfectly shaped concentric circles. This irregularity is caused by soil conditions, the complexity of earthquake fault rupture patterns, and possible directionality in the dispersion of earthquake energy.

There are several measures of the intensity of earthquake ground motions. The Modified Mercalli Intensity scale (MMI) is a descriptive, qualitative scale that relates severity of ground motions to the types of damage experienced. MMIs range from I to XII. In recent years, correlations have been developed that relate this qualitative intensity measure to more modern, quantitative intensity scales.

Modern intensity scales use terms that can be physically measured with seismometers (instruments that measure motions of the ground), such as acceleration, velocity, or displacement (movement). The intensity of earthquake ground motions can also be measured in spectral (frequency) terms, as a function of the frequency of earthquake waves propagating through the earth. In the same sense that sound waves contain a mix of low-, moderate- and high-frequency sound waves, earthquake waves contain ground motions of various frequencies. The behavior of buildings and other structures substantially depends on the natural vibration frequencies of the building or structure versus the spectral content of earthquake waves. Earthquake ground motions also include both horizontal and vertical components.

A common physical measure of the intensity of earthquake ground shaking, and the one used in this mitigation plan, is Peak Ground Acceleration (PGA). PGA is a measure of the intensity of shaking, relative to the acceleration of gravity (g). For example, an acceleration of 100 percent g PGA is an extremely strong ground motion that occurs near the epicenter of large earthquakes. With a vertical acceleration of 100 percent g, objects are thrown into the air. With a horizontal acceleration of 100 percent g, objects accelerate sideways at the same rate as if they had been dropped from the ceiling. 10 percent g PGA means that the ground acceleration is 10 percent that of gravity, and so on.

Table 6.1 on the following page table provides generalized qualitative interpretations about the perceived level of earthquake shaking and the likely extent of buildings damages from earthquakes with various levels of ground shaking intensity.

However, it is important to recognize that actual levels of damage for specific buildings or infrastructure components at any given level of earthquake ground shaking will vary substantially depending on the design and condition of each building or infrastructure component.

Table 6.1: MMI Intensity and Ground Shaking Comparison

MMI	PGA (% g)	Perceived shaking	Potential Damage
I	<0.17	Not felt	None
II-III	0.17 – 1.4	Weak	
IV	1.4 – 3.9	Light	
V	3.9 – 9.2	Moderate	Very light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate *Considerable damage in poorly built or badly designed structures.*
VIII	34 - 65	Severe	Moderate to Heavy *Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.*
IX	65 - 124	Violent	Heavy *Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.*
X or higher	124+	Extreme	Very Heavy *Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations.*

Source: (Wald, Quitoriano, Heaton, & Kanamori, 1999); (USGS, 1989)

6.3 Bay Area Earthquake Faults

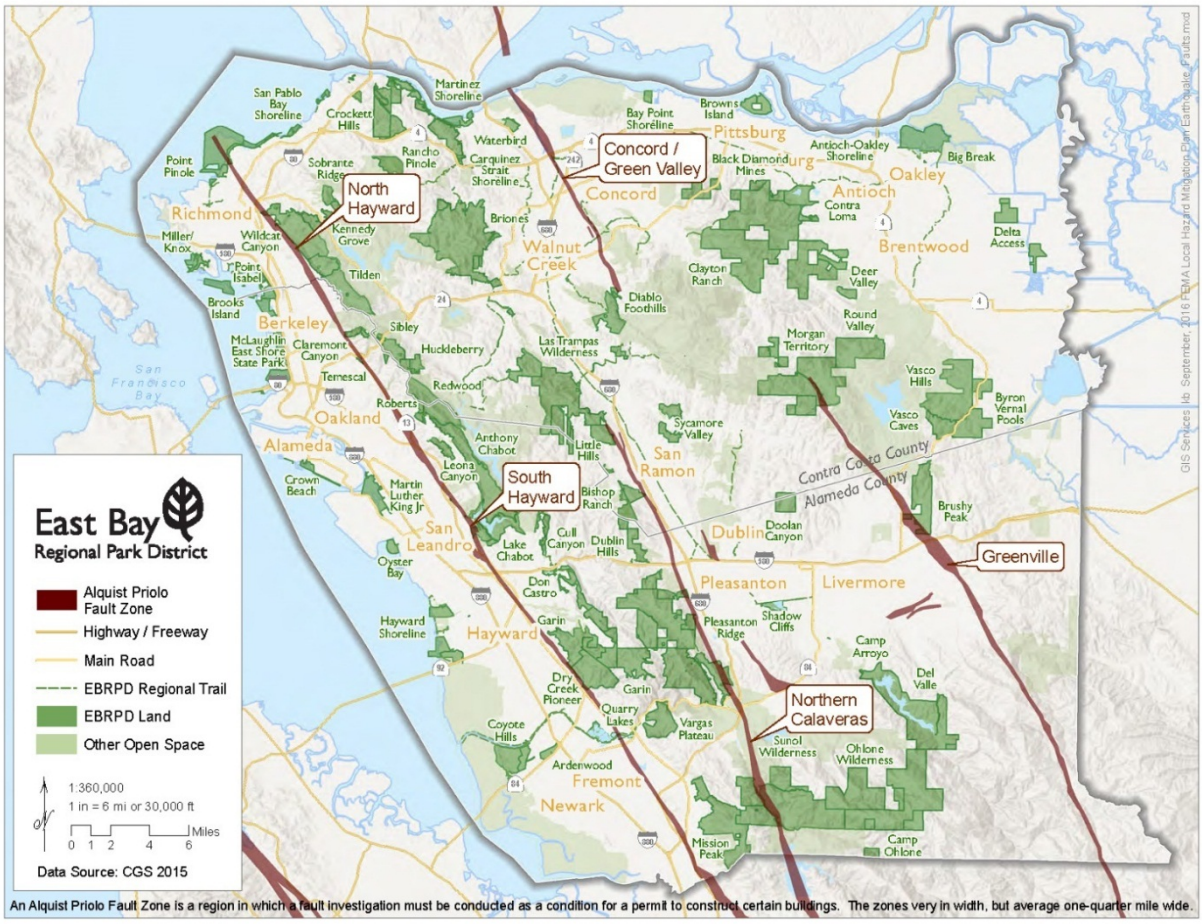
Earthquakes in California and worldwide occur predominantly because of plate tectonics – the relative movement of plates of oceanic and continental rocks that make up the rocky surface of the Earth. As the plates move past each other, they tend to not slide smoothly and can become “locked”, building up stress and strain along the fault. Earthquakes occur when the plates suddenly release and the stored energy is released as seismic waves that radiate from the point of release, the epicenter.

The San Francisco Bay Area is transected by a series of parallel faults that together accommodate the relative motion between the Pacific and North American plates over a width of more than 50 miles. The major fault zones that comprise this system include the San Andreas, Hayward, Calaveras, Concord-Green Valley, Greenville, Rodgers Creek, and San Gregorio Faults. These major faults are near vertical and generally exhibit right-lateral strike-slip movement (which means that the movement is predominantly horizontal and when viewed from one side of the fault, the opposite side of the fault is displaced to the right).

Earthquakes occur not only on faults mapped as active or potentially active, but also on unknown faults. Many significant earthquakes in the United States have occurred on previously unknown faults. Based on the historical seismicity in California and comparisons to other geologically similar areas, small to moderate crustal earthquakes up to about M5 or M5.5 are possible almost any place in the Bay Area. There is also the possibility of larger crustal earthquakes in the M6+ range on unknown faults, although the probability of such events is likely to be low.

Figure 6.1 below shows the major earthquake faults in the East Bay. The Alquist-Priolo Fault Zones map the areas along the faults that are subject to surface rupture in future earthquakes.

Figure 6.1 Alquist-Priolo Fault Zones (Surface Rupture)



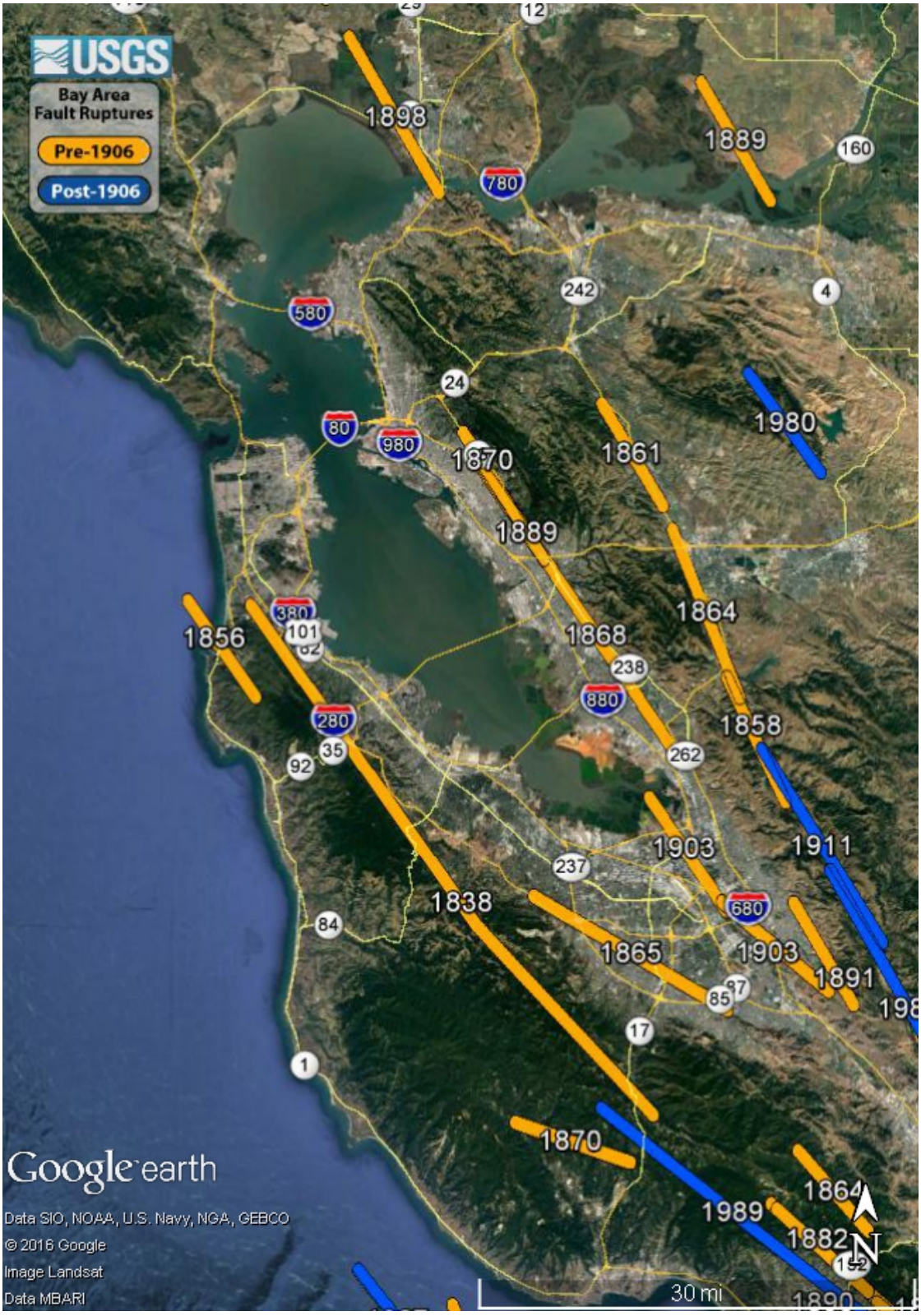
The most important Park District facility within Alquist-Priolo Zones is the Peralta Oaks headquarters building. See further details in Section 6.7.1.

6.4 Historic Bay Area Earthquakes

Since 1836, eight earthquakes of magnitude 6.0 or greater have occurred in the region (Bakun, 1999, California Office of Emergency Services, CalOES, 2013). These earthquakes are shown in Figure 6.2 on the following page, along with several smaller earthquakes. Note: this map does not show the 1906 San Francisco earthquake.

From 1838 to 1903, there were 18 significant earthquakes in the greater San Francisco Bay Area, about one every four years. Seismologists believe that the 1906 M7.8 San Francisco earthquake significantly relieved stress on faults across the whole Bay Area. Since 1906, there was one significant earthquake in 1911, then none until the 1984 M6.4 Morgan Hill earthquake. Despite the 1989 M7.1 Loma Prieta and the 2015 M6.0 South Napa earthquakes, the level of seismic activity in the Bay Area has not yet returned to pre-1906 levels.

Figure 6.2 Historic Bay Area Earthquakes



6.5 Probability of Future Earthquakes

Powerfully damaging earthquakes such as the 1906 or 1989 Loma Prieta earthquakes are relatively infrequent but one or more such large earthquakes have significant probabilities of occurring in the next 30 years. The Working Group on California Earthquake Probabilities (WGCEP) has developed authoritative estimates of the magnitude, location, and frequency of future earthquakes in California, which are published in Uniform California Earthquake Forecast (UCERF) reports.

The most recent forecast (UCERF3) indicates that there is a 72 percent chance of one or more magnitude 6.7 or larger earthquakes in the next 30 years (starting in 2014) on one of the Bay Area's faults (Field, et al., 2013). Smaller magnitude earthquakes are more likely to occur, potentially producing significant local damage, as experienced in the 2014 South Napa earthquake.

The Working Group has also made estimates of the likelihood of earthquakes with magnitude greater than or equal to 6.7 occurring on specific faults. These probabilities are summarized in the table below and on Figure 6.3.

Table 6.2: 30-year Likelihood of one or more earthquake events with M≥6.7

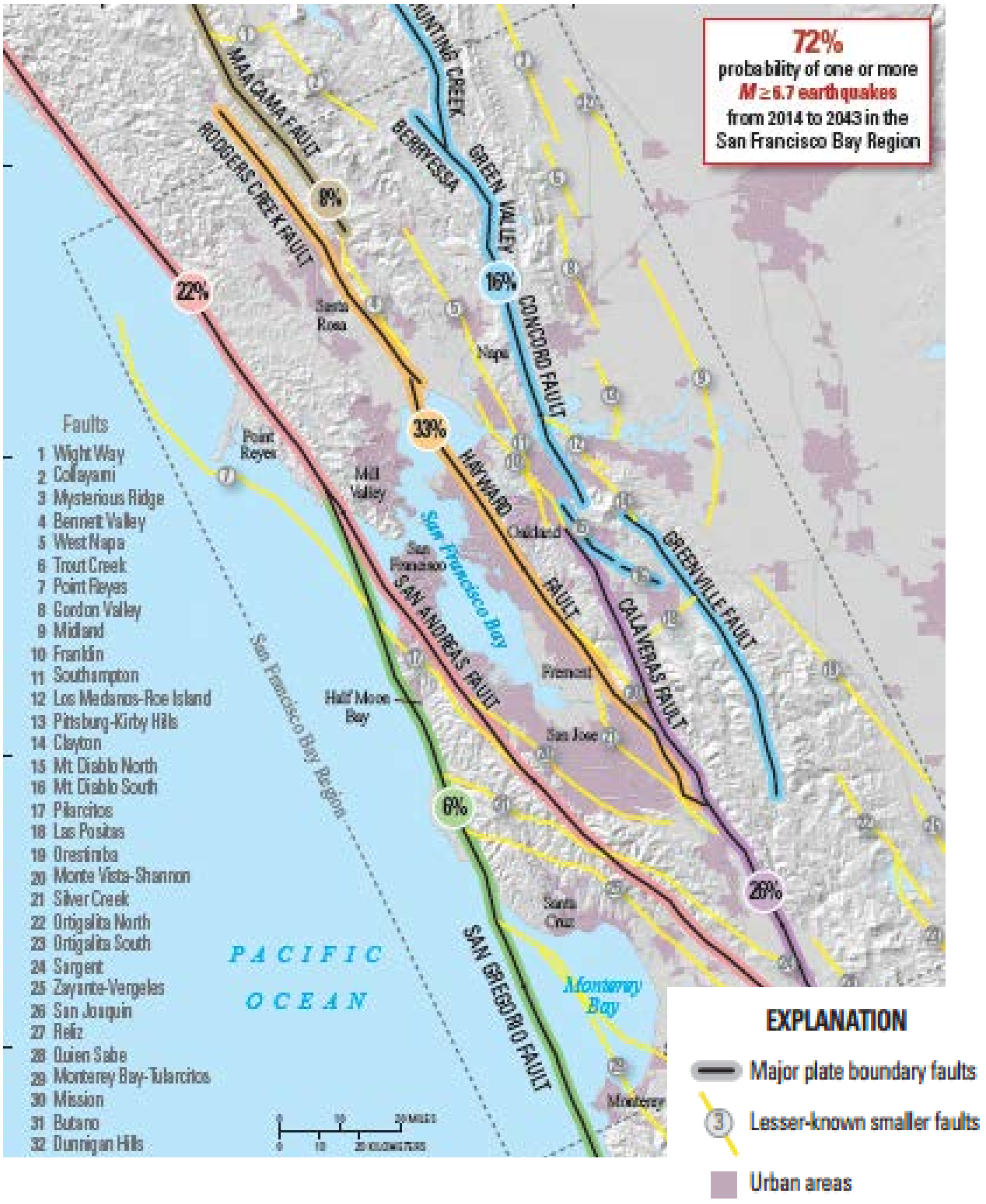
Earthquake Fault	Probability
Hayward - Rodgers Creek	33%
Calaveras	26%
San Andreas	22%
Hunting Creek, Berryessa, Green Valley, Concord, Greenville	16%
Maacama	8%
San Gregorio	6%

Source: (Aagaard, et al., 2016)

For the East Bay Regional Park District, the most damaging earthquakes are those nearest to the Park District's lands, especially the Hayward Fault and the Calavaras Fault, but also the Concord and Greenville Faults. Large earthquakes on the San Andreas fault would affect the Park District, but to a significantly lesser degree than the closer earthquakes because of the greater distance between the fault and the Park District's facilities. The nearby earthquakes also have an increased likelihood of secondary earthquake hazards affecting the Park District, including a surface fault rupture, liquefaction, landslides, and fire following earthquakes.

The most likely major earthquake to affect the Park District is an approximately M7.0 earthquake on the Hayward Fault that has an estimated 33 percent change of occurring in the next 30 years and is closest to areas with high concentrations of the Park District's lands and facilities.

Figure 6.3: Probability of one or more M ≥ 6.7 earthquakes from 2014 to 2043 on Bay Area faults

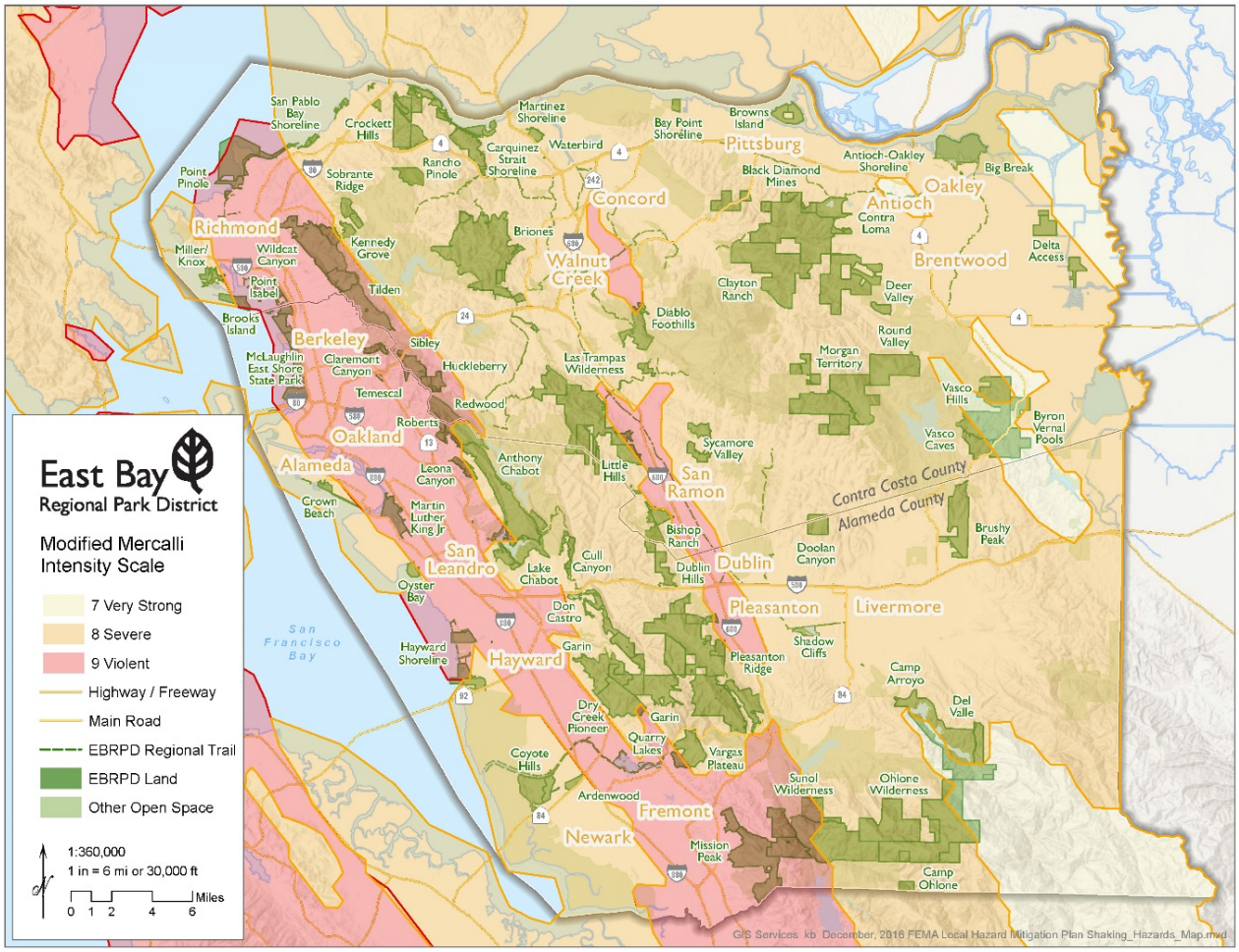


6.6 Earthquake Hazard Maps

6.6.1 Probabilistic Hazard Maps

The current scientific understanding of earthquakes is incapable of predicting exactly where and when the next earthquake will occur. However, the long-term probability of earthquakes is well enough understood to make useful estimates of the probability of various levels of earthquake ground motions at a given location. Figure 6.4 shows the intensity of ground shaking that has a 10% likelihood of exceedance in 50 years.

Figure 6.4: Intensity of earthquake ground shaking - 10% chance of exceedance in 50 years



The areas shown above in pink are in close proximity to the Hayward Fault or the other active faults shown previously in Figure 6.1 and, thus, will have very strong ground shaking when earthquakes occur on these faults. An important caveat on the above map is that the earthquake modeling is time-independent. That is, it does not consider the time interval since the last earthquake on a given fault. As shown previously in Figure 6.3, the probability of strong earthquakes on the faults in the East Bay are significantly higher now than the long-term averages, because of the long intervals since the last major earthquakes.

6.6.2 Site Class: Soil and Rock Types

An important caveat for interpreting earthquake maps is that the 2008 United States Geological Survey (USGS) seismic hazard maps show the level of ground motions for rock sites. The soil or rock type at a given location substantially affects the level of earthquake hazard, because the soil or rock type can amplify or de-amplify ground motions. In general, soil sites, especially soft soil sites amplify ground motions. That is, for a given earthquake, a soil site immediately adjacent to a rock site will experience higher levels of earthquake ground motions than the rock site. Thus, for earthquake hazard analysis at a given site, it is essential to include consideration of the site's soil conditions.

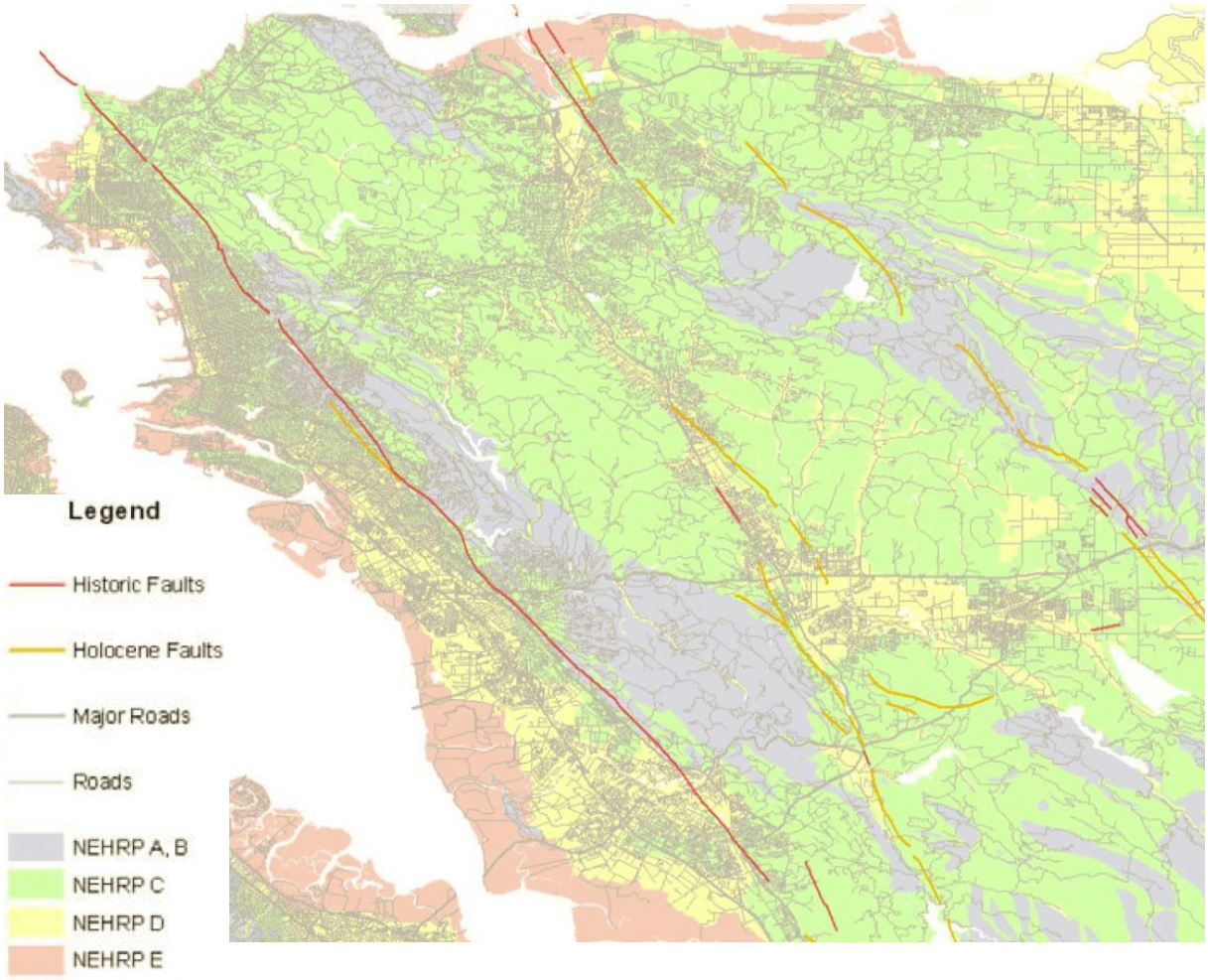
The National Earthquake Hazards Reduction Program (NEHRP) has defined five soil types that contribute to site amplification, presented in Table 6.3 2. The definitions of these soil types have been modified slightly based on studies of earthquake damage in the Bay Area.

Table 6.3: NEHRP Soil Types

NEHRP Soil Type	Class	Description
A	Hard Rock	Unweathered intrusive igneous rock. Occurs infrequently in the bay area. Soil types A and B do not contribute greatly to shaking amplification.
B	Rock	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock common in the Bay Area.
C	Very Dense Soil and Soft Rock	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan élange and serpentinite.
D	Firm Soil	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
E	Soft Soil	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Source: https://earthquake.usgs.gov/regional/nca/soiltype/

Figure 6.5: Soil Type and Earthquake Faults in the San Francisco Bay Area (USGS)



Source: https://earthquake.usgs.gov/regional/nca/soiltype/map/

The areas shown in yellow (Site Class D – Stiff (Firm) Soil) and pink (Site Class E – Soft Soil) amplify earthquake ground motions. For the Park District, soft soils that amplify earthquake ground motions occur along the shorelines of San Francisco Bay, the Carquinez Strait, and the Sacramento–San Joaquin River Delta.

6.6.3 Earthquake Scenarios

The Association of Bay Area Governments (ABAG) and the USGS have also developed several shaking scenario maps that depict shaking intensity for specific, plausible earthquakes scenarios with a given magnitude on a fault. These maps show possible levels of ground shaking throughout the Bay Area in a single likely event, taking into consideration the earthquake magnitude; rupture location and direction; and soil conditions throughout the region.

Scenario maps are helpful to model the expected shaking of an individual event, but they do not depict the likelihood of the event occurring or whether it is the most significant event for a particular location. Probabilistic hazard maps, such as Figure 6.4 shown previously, are more beneficial for those purposes.

Within the Park District's service area in Alameda and Contra Costa County, many different earthquake faults contribute to the overall earthquake hazard, as depicted in Figure 6.6, including the San Andreas, North and South Hayward, Rogers Creek, Calaveras, Mount Diablo, Concord-Green Valley, Greenville, and Great Valley faults.

Figures 6.7 to 6.10 show the shaking intensity for the most significant contributors to the earthquake hazard: the Hayward, Concord-Green Valley, Calaveras and Greenville faults.

The red areas on the maps show what will have the very high intensity of ground shaking because of the proximity to the faults and the effects of amplification on soft soil sites.

The orange and tan areas have lower intensities shaking, primarily because of distance from the faults.

There are also a few brown-shaded areas that would have extremely high levels of ground shaking, because these sites are located very close to the fault and also are soft soil sites.

Figure 6.6: Scenario Earthquake with Greatest Contribution to Seismic Hazard

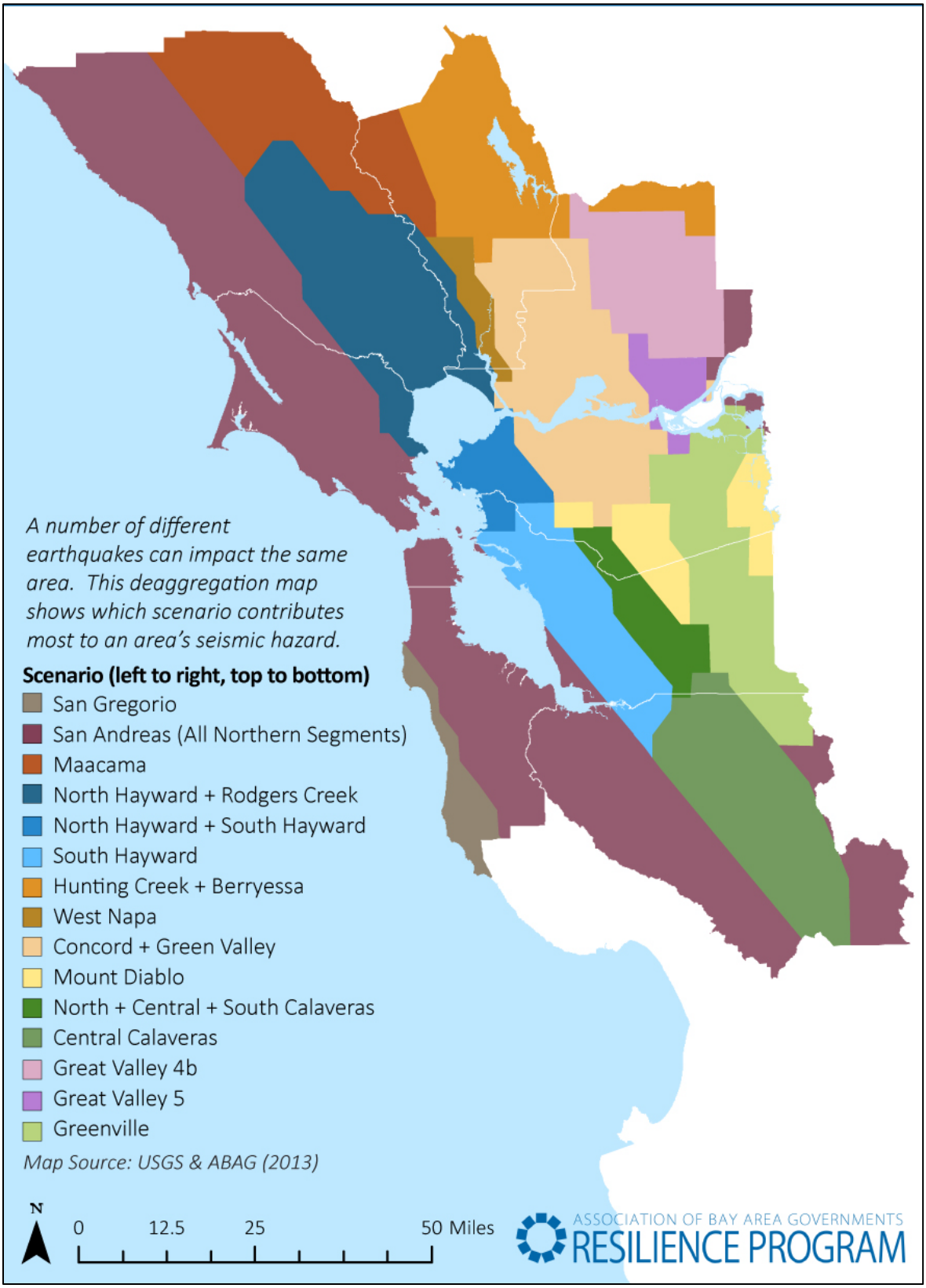


Figure 6.7: Hayward Fault Scenario Earthquake

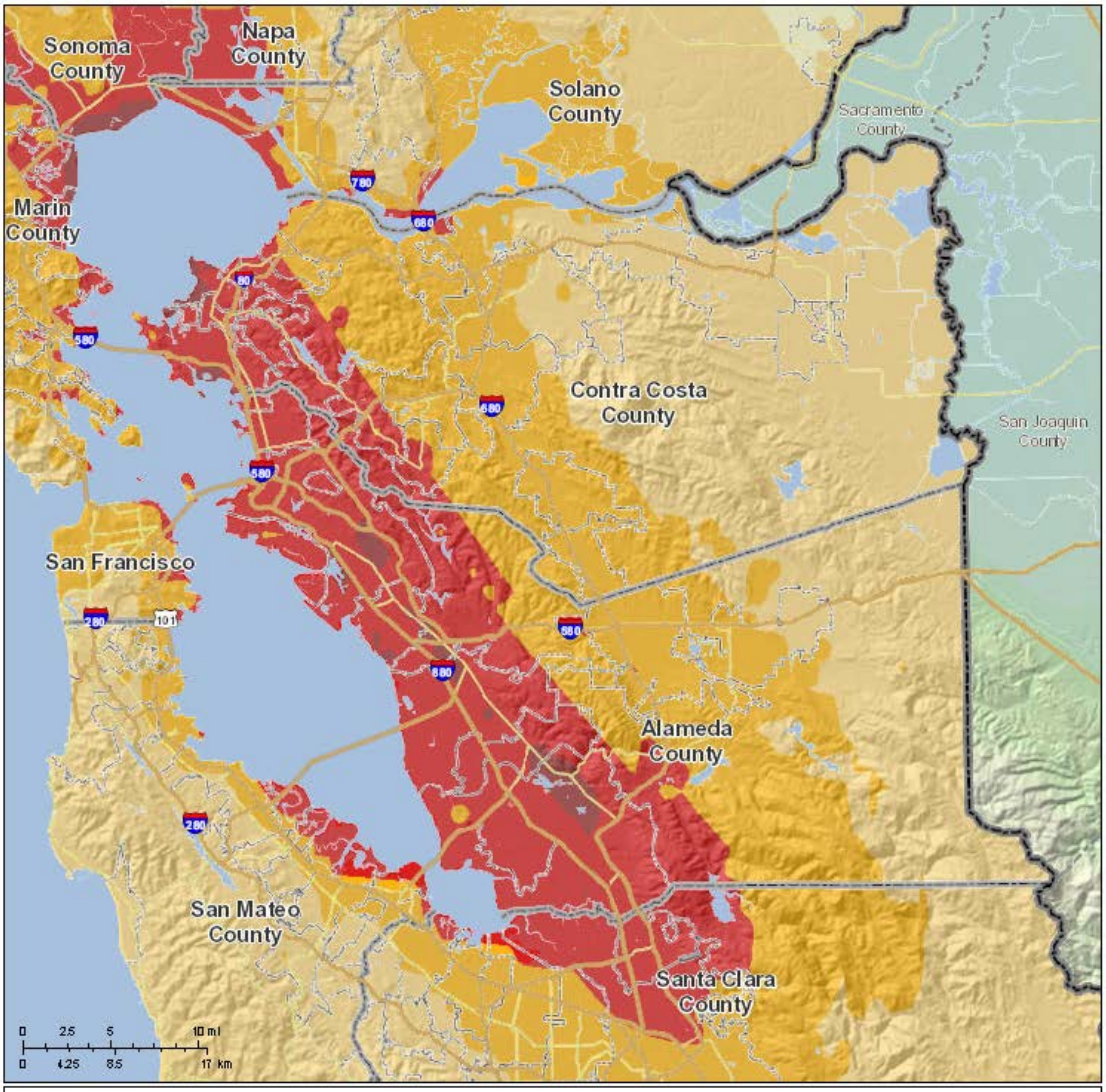
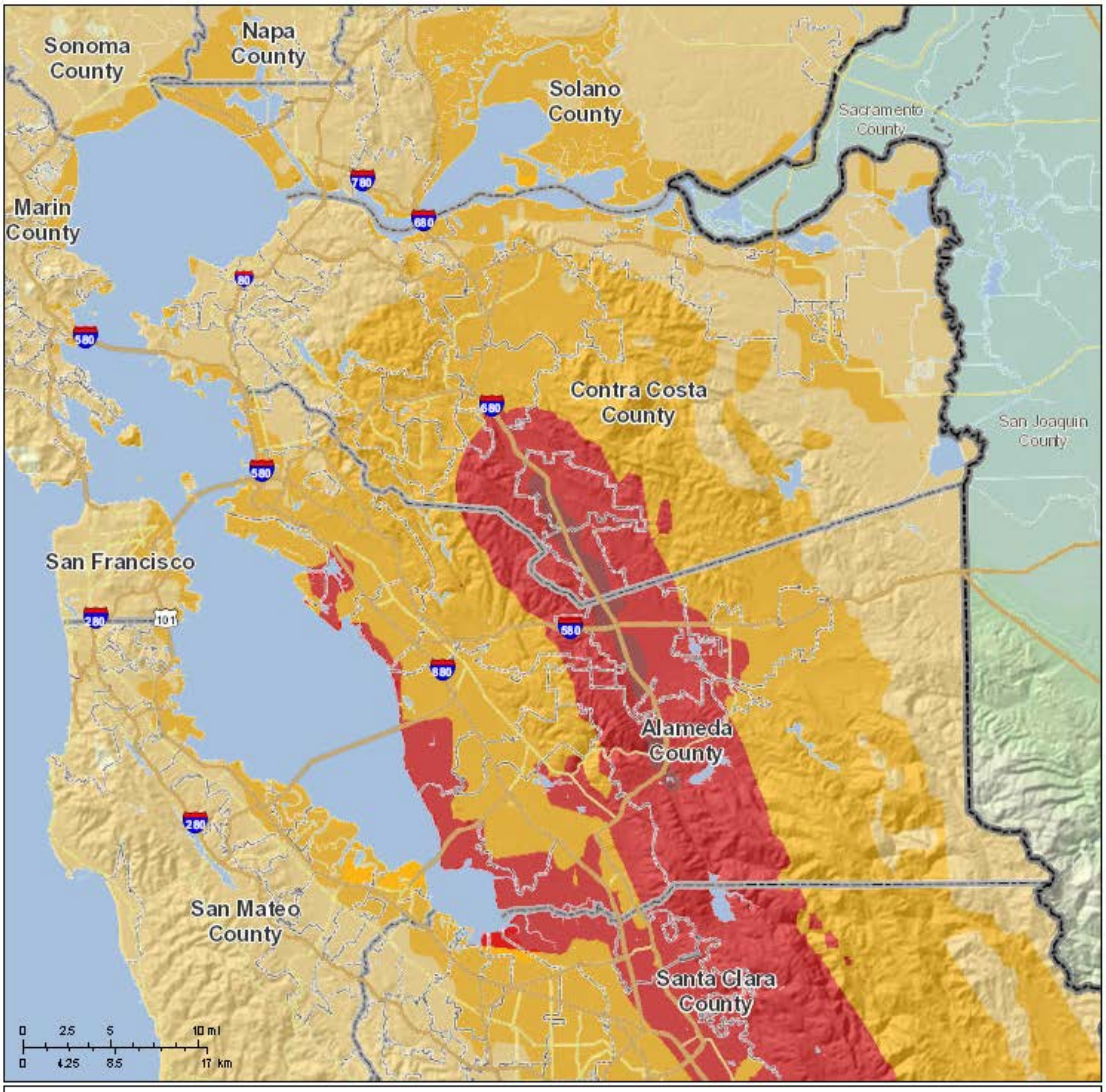


Figure 6.8: Calaveras Fault Scenario Earthquake



Legend

- Light - MMI 5
- Moderate - MMI 6
- Strong - MMI 7
- Very Strong - MMI 8
- Violent - MMI 9
- Very Violent - MMI 10

San Francisco Bay Area Hazards

This map is intended for planning only and is not intended to be site specific. Rather, it depicts the general risk within neighborhoods and the relative risk from community to community.

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RESILIENCE PROGRAM

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Figure 6.9: Concord-Green Valley Fault Scenario Earthquake

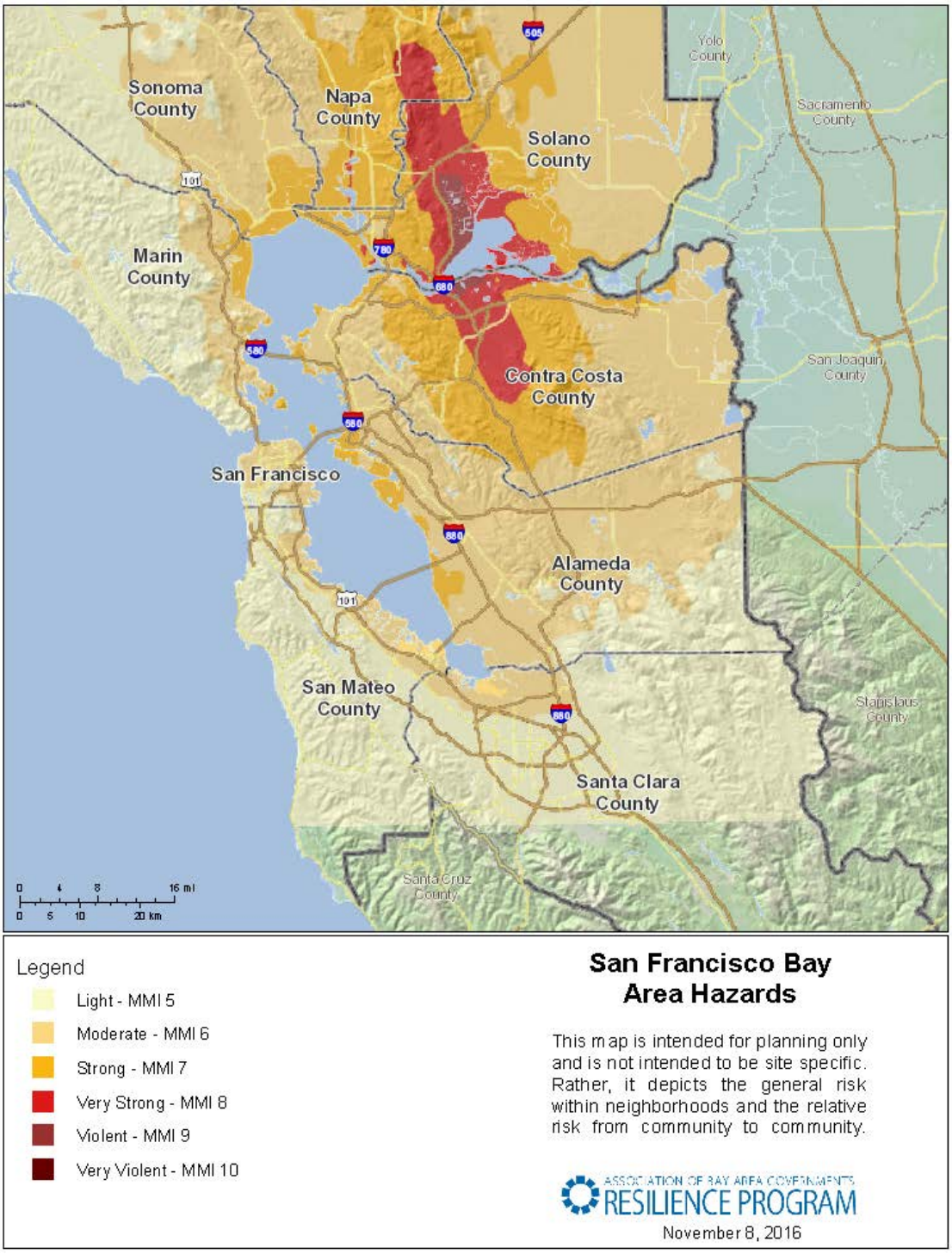
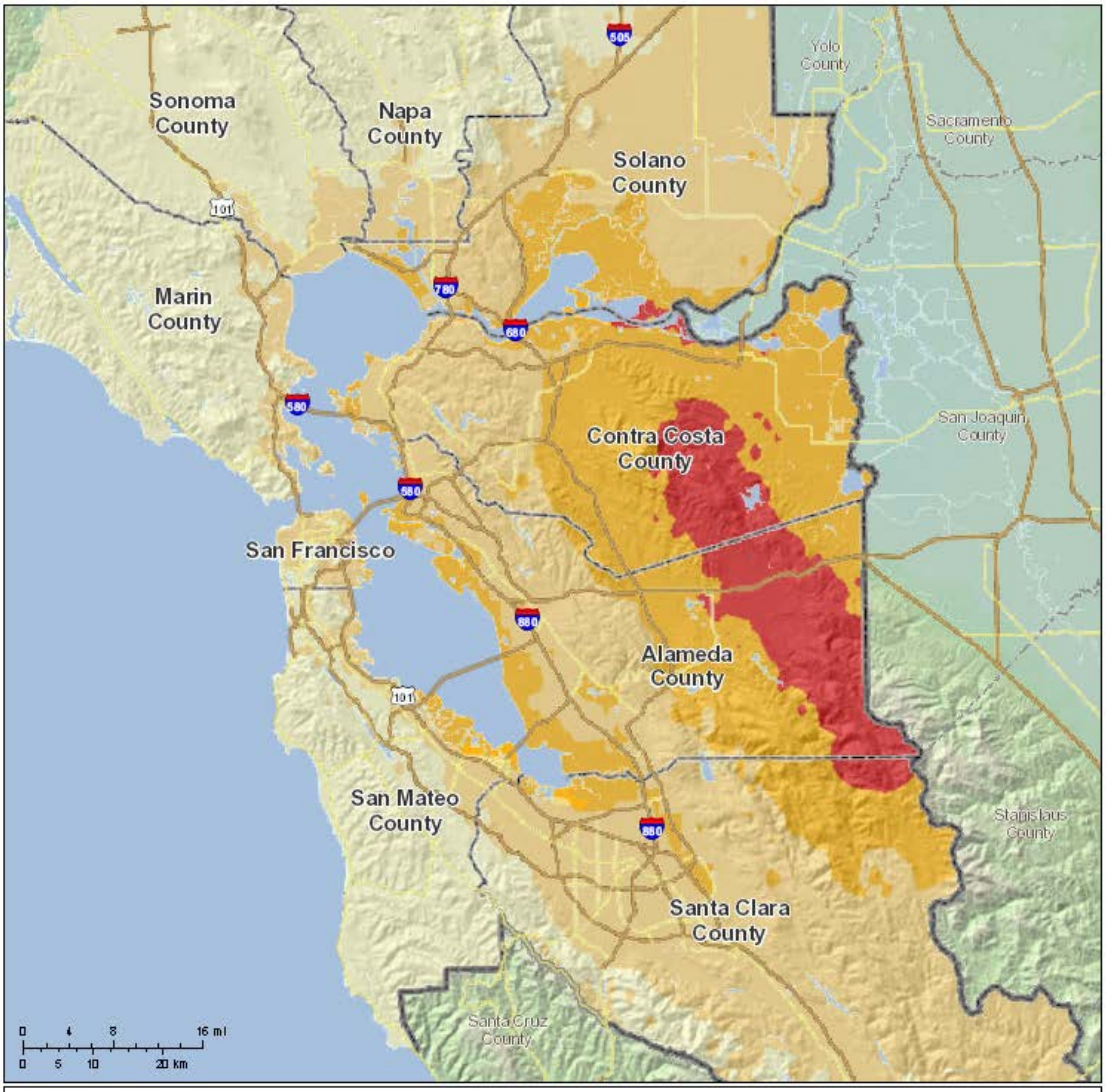


Figure 6.10: Greenville Fault Scenario Earthquake



6.7 Other Aspects of Seismic Hazards

Much of the damage in earthquakes occurs from ground shaking that affects buildings and infrastructure. However, there are several secondary effects of earthquakes that can result in substantially increased levels of damage in some locations. These secondary effects include: surface rupture; liquefaction, settlement, and lateral spreading; landslides; dam, levee, and reservoir failures; tsunamis and seiches, and fires. Any of these consequences can result in very severe damage to buildings, up to and including complete destruction, and also a high likelihood of casualties.

6.7.1 Surface Rupture

Surface rupture occurs when the fault plane along which rupture occurs in an earthquake reaches the surface. Surface rupture can be horizontal and/or vertical displacement between the sides of the rupture plane. For a building subject to surface rupture, the level of damage is typically very high and often results in the destruction of the building. Surface fault rupture is particularly damaging to linear infrastructure features such as roads, pipelines, and levees.

To mitigate the effects of surface fault rupture, the California Geological Survey (CGS) maps active faults that could produce surface rupture, as required by the Alquist-Priolo Earthquake Fault Zoning Act (AP Act) (1972)[1]. Active faults are those that have ruptured in the last 11,000 years (Bryant & Hart, 2007). The AP Act mapped fault zones were shown previously on Figure 6.1.

The intent of the AP Act is to ensure public safety by prohibiting the siting of most structures intended for human occupancy across traces of active faults that constitute a potential hazard to structures from surface fault rupture or creep.

Surface rupture does not occur in all earthquakes. The amount of rupture varies in size and can change over time. Generally, large magnitude earthquakes produce longer ruptures and greater displacement, though the surface expression of the displacement can vary widely. The M6.0 2014 South Napa Earthquake resulted in over 18 inches of displacement in some locations (Brocher, et al., 2015), while the 1989 Loma Prieta earthquake had no surface fault rupture. In the 1906 San Francisco earthquake, surface rupture displacements were greater than 20 feet in some locations (Thatcher, Marshall, & Lisowski, 1997).

Additionally, although the majority of displacement occurs during the actual earthquake event (called “co-seismic slip”), surface displacement can continue to occur in the days, weeks, and even months after the event (called “post-seismic slip”). This was observed in the Napa earthquake and can cause additional damage for up to a year after an earthquake. In a large earthquake on the Hayward fault, the

[1] California Public Resources Code, Division 2, Geology, Mines and Mining, Chapter 7.5, Earthquake Fault Zoning, sections 2621-2630

fault rupture displacement could reach eight feet in some areas (Aagaard, Lienkaemper, & Schwartz, 2012). Most of the displacement would occur during the shaking, and in the first day following the earthquake, but as much as 20 percent of the total afterslip could occur in the year following the earthquake.

Some Park District facilities and parklands are located within AP Act mapped fault zones. Table 6.4 describes the parks with land that cross mapped fault zones. These areas might experience fault rupture as a result of an earthquake on the identified fault, damaging roads, pipelines, levees, dams, and buildings or facilities that cross the fault.

Table 6.4: Park District Lands within Alquist-Priolo Mapped Fault Zones

AP Fault Zone	Park District Land
Concord/Green Valley Fault	Delta/DeAnza Trail
	Diablo Foothills
Greenville Fault	Brushy Peak
	Morgan Territory
Hayward Fault	Claremont Canyon
	Dry Creek Pioneer
	Garin
	Lake Chabot
	Peralta Oaks Headquarters
	Point Pinole
	Quarry Lakes
	Temescal
	Wildcat Canyon
Northern Calaveras Fault	Bishop Ranch Open Space
	Las Trampas
	Pleasanton Ridge
	Sunol Wilderness

Figure 6.11 shows the Alquist-Priolo map delineating the Peralta Oaks area that may be subject to surface rupture in an earthquake on the Hayward Fault. The surface rupture offset could be as much as eight feet, per the USGS estimate referenced above.

The Peralta Oaks headquarters building is within the area where surface rupture is possible. If surface rupture were to occur through the headquarters building, the level of damage would be very high with substantial life safety risk and the building would have to be demolished. The likelihood of surface rupture through the building is probably low, given that the USGS mapped trace of the active fault is approximately 700 feet from the building. However, the possibility of surface rupture through the building cannot be ruled out.

Figure 6.11: Alquist-Priolo Map Showing Peralta Oaks Area Subject to Possible Surface Rupture

6.7.2 Liquefaction, Settlement and Lateral Spreading

Liquefaction is a process where loose, wet sediments lose bearing strength during an earthquake and behave similar to a liquid. Once a soil liquefies, it tends to settle vertically and/or spread laterally. With even slight slopes, liquefied soils tend to move sideways downhill (lateral spreading). Settling or lateral spreading can cause major damage to buildings and to infrastructure such as roads, pipes, cables, and levees.

Liquefaction susceptibility maps show areas with soil types known to have the potential to liquefy with intense shaking. Figure 6.12 illustrates liquefaction susceptibility for the entire Bay Area based on USGS soil type maps. However, site-specific investigations are needed to confirm liquefactions susceptibility on any given site.

Unless areas of liquefaction susceptibility are subject to significant ground shaking, they are not likely to liquefy. Liquefaction hazard maps express where the ground is both susceptible to liquefaction, and where the ground is likely to be shaken long and hard enough in an earthquake.

In northwestern Alameda County, USGS has done more site-specific investigation to determine the approximate percent of the area that is predicted to liquefy in an M 7.1 earthquake on the Hayward Fault. This map is presented on Figure 6-13.

The California Seismic Hazard Mapping Act of 1990[2] requires that CGS identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking in order to minimize the loss of life and property through identification, evaluation, and mitigation of seismic hazards.

When new buildings intended for human occupancy are constructed in these mapped zones, site-specific geotechnical investigations must be conducted to evaluate the seismic hazards and develop mitigation measures. CGS has developed Seismic Hazard Zone Maps for portions of Alameda County as part of its Seismic Hazard Zonation Program, but not yet for Contra Costa County. The liquefaction hazard boundaries are based on the presence of shallow (< 40 feet depth) historic groundwater in uncompacted sands and silts deposited during the last 15,000 years and sufficiently strong levels of earthquake shaking expected during the next 50 years.

The regulatory liquefaction hazard zone map for Alameda County is shown on Figure 6.14. The Park District has a number of shoreline parks and facilities that are likely to be impacted by liquefaction in the event of an earthquake.

[2] Public Resources Code, Chapter 7.8, Section 2690- 2699.6

Figure 6.12: **Liquefaction Susceptibility**

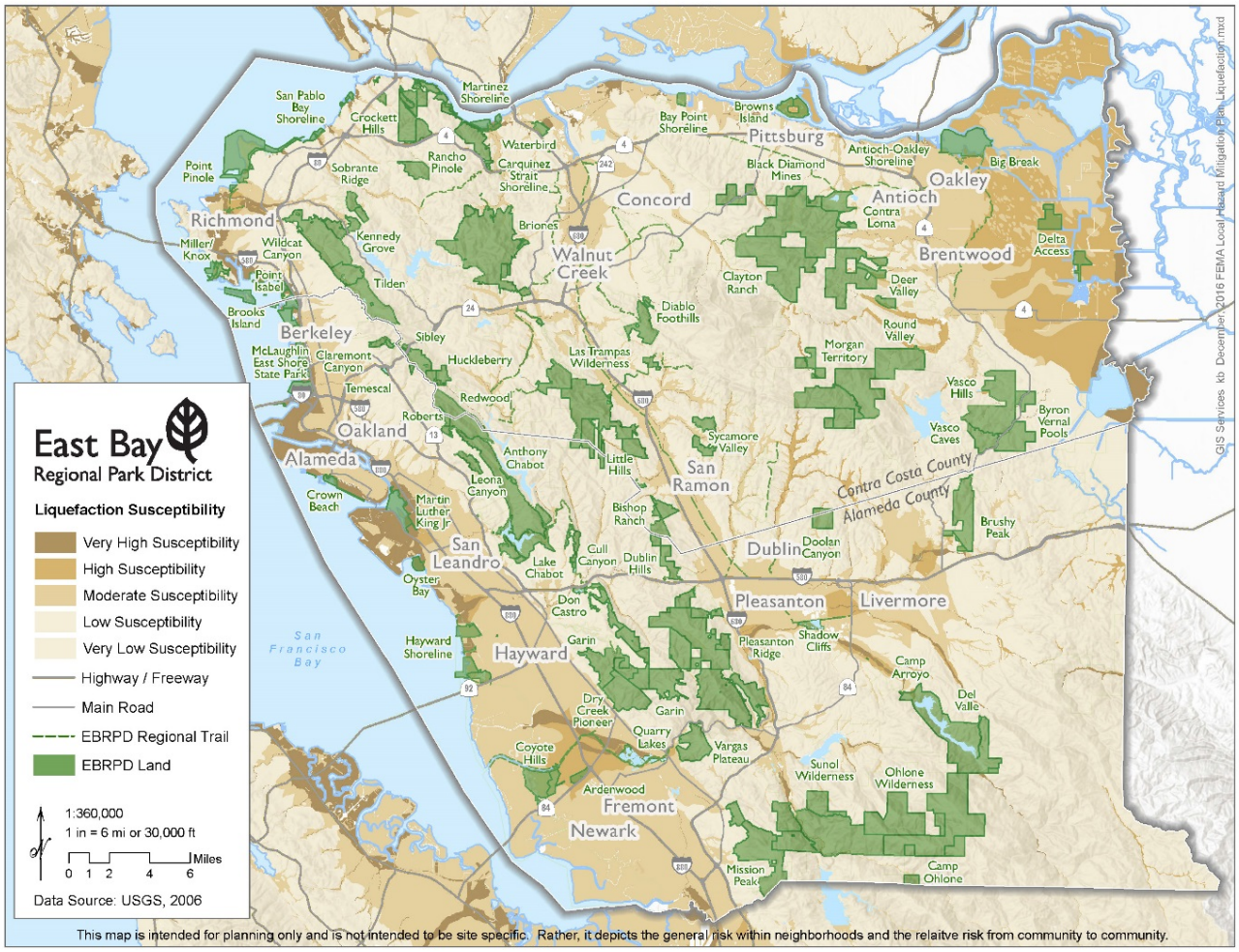


Figure 6:13: Liquefaction Hazard Map for Northwestern Alameda County

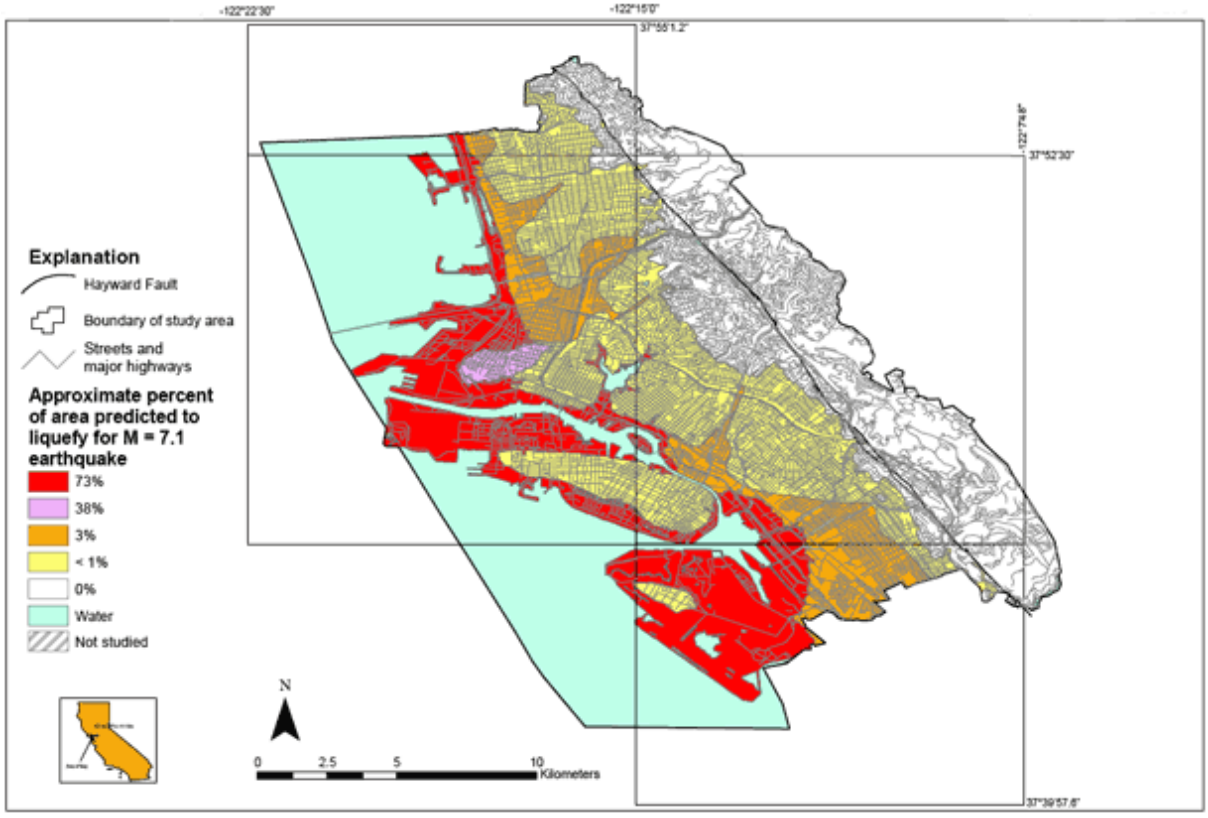
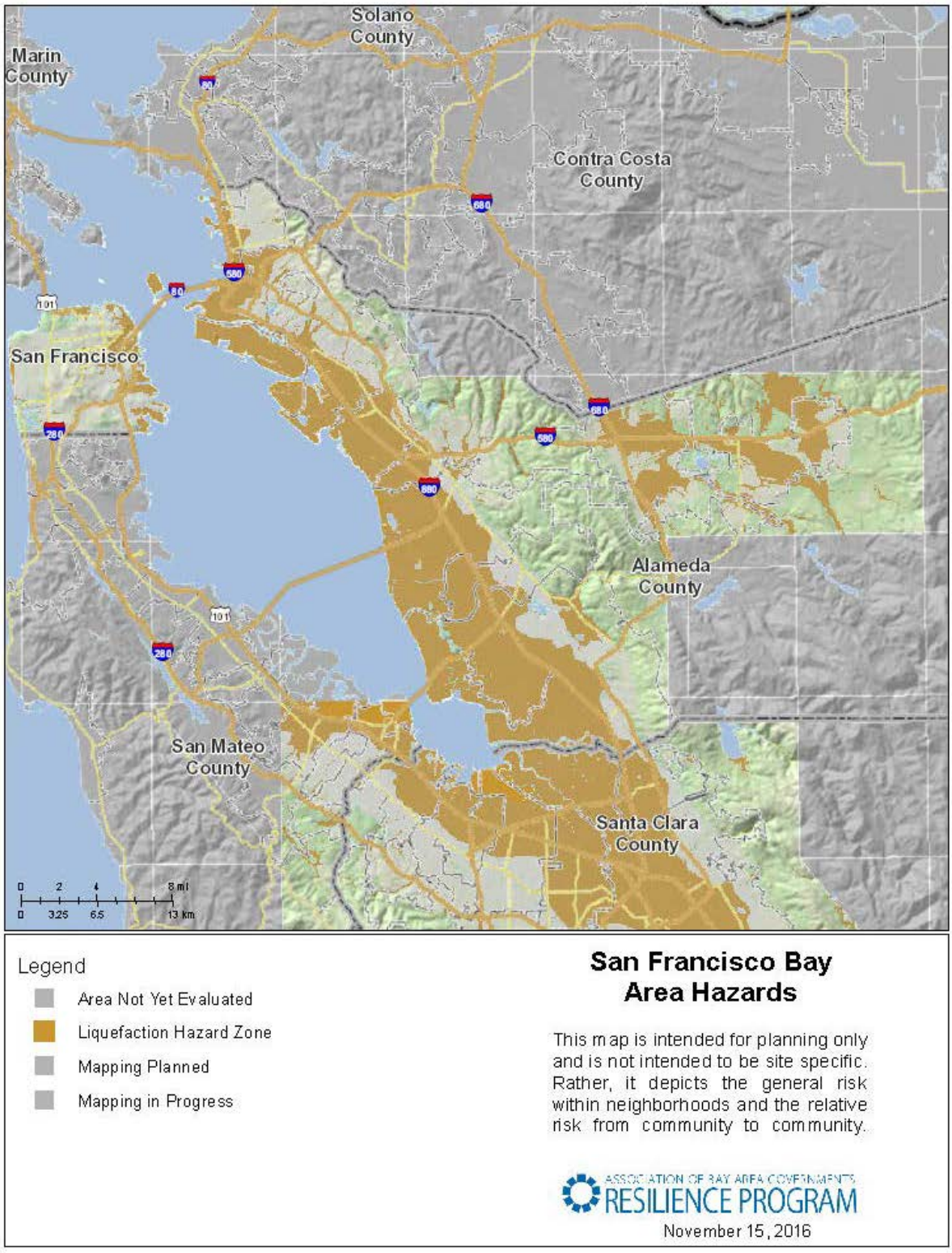


Figure 6.13 on the following page shows regulatory liquefaction zones in the San Francisco Bay area. At present, there are no regulatory liquefaction zones in Contra Costa County.

Figure 6.14: Regulatory Liquefaction Hazard Zone Map



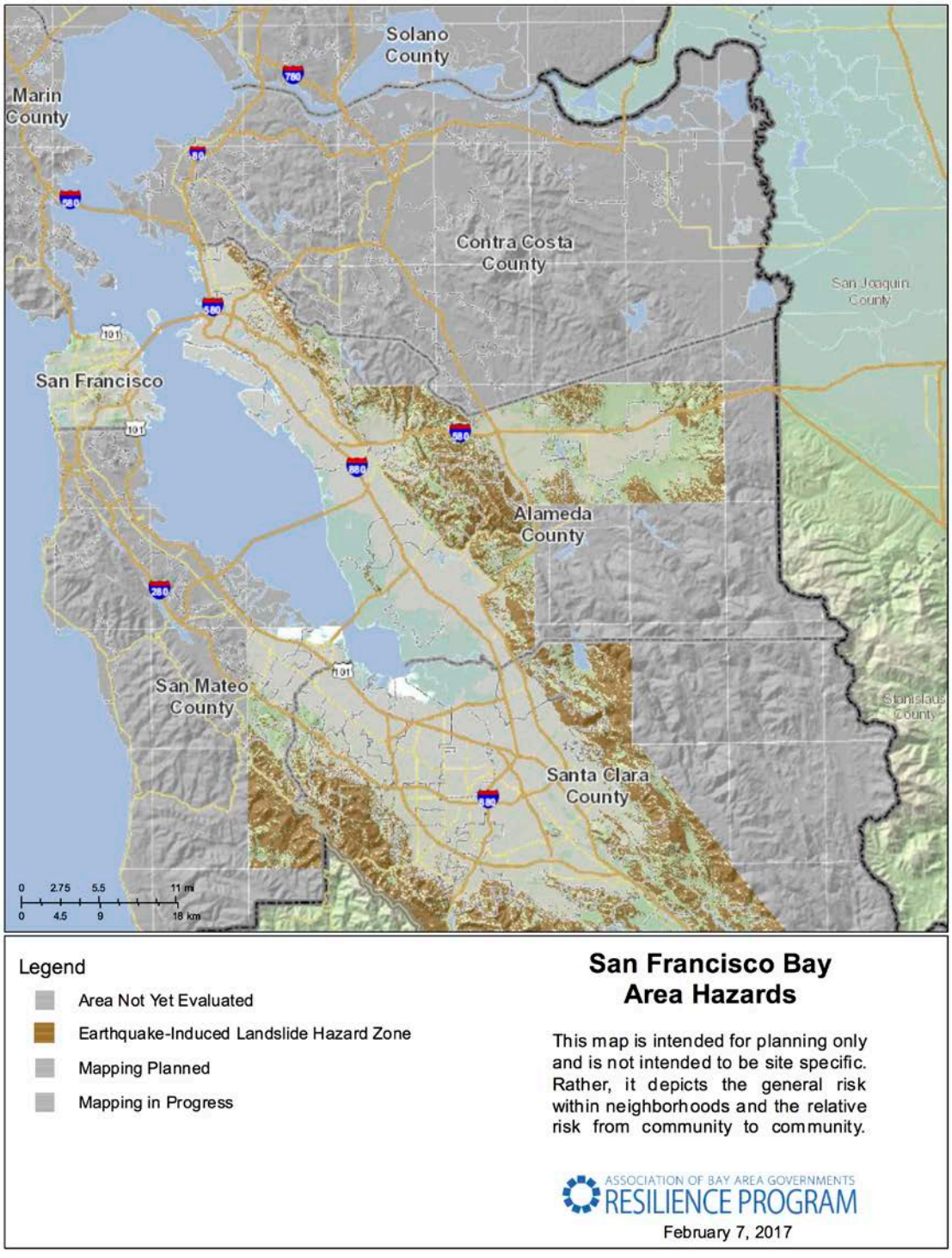
Source: California Geological Survey

6.7.3 Earthquake Induced Landslides

Earthquakes can also induce landslides, especially if an earthquake occurs during the rainy season and soils are saturated with water. The areas prone to earthquake-induced landslides are largely the same as those areas prone to landslides in general. As with all landslides, areas of steep slopes with loose rock or soils and high water tables are most prone to earthquake-induced landslides**.**

The Park District has locations with significant landslide risk. CGS has mapped areas at risk from earthquake-induced landslide in portions of Alameda County as part of its Seismic Hazards Zonation Program, shown on Figure 6-15 on the following page. These areas have not yet been mapped for Contra Costa County. Further information about this landslide risk is included in the landslide chapter of this mitigation plan.

Figure 6.15: Regulatory Landslide Hazard Zone Map



6.7.4 Dam, Levee, and Reservoir Failures

Earthquakes can also cause failure of dams, levees, and reservoirs. Facilities and land downslope from dams or water reservoirs or behind levees might be subject to flooding, if the dams, reservoirs, or levees fail as a result of an earthquake.

The Park District has locations with significant flood risk that include facilities downslope from dams or reservoirs or behind levees. Further information about the Park District's flood risk is included in the flood chapter in this mitigation plan.

6.7.5 Tsunamis and Seiches

Large underwater displacements from major underwater earthquake fault ruptures or landslides can lead to ocean waves called "tsunamis." Since tsunamis have high velocities, the damage from a particular level of inundation is far greater than in a normal flood event. Similarly, water sloshing in lakes during an earthquake, called a "seiche," is also capable of producing damage.

Tsunamis can result from off-shore earthquakes within the Bay Area or from distant events. It is most common for tsunamis to be generated by offshore subduction faults such as those in Washington, Alaska, Japan, and South America. Tsunami waves generated at those far-off sites can travel across the ocean and can reach the California coast with several hours of warning time.

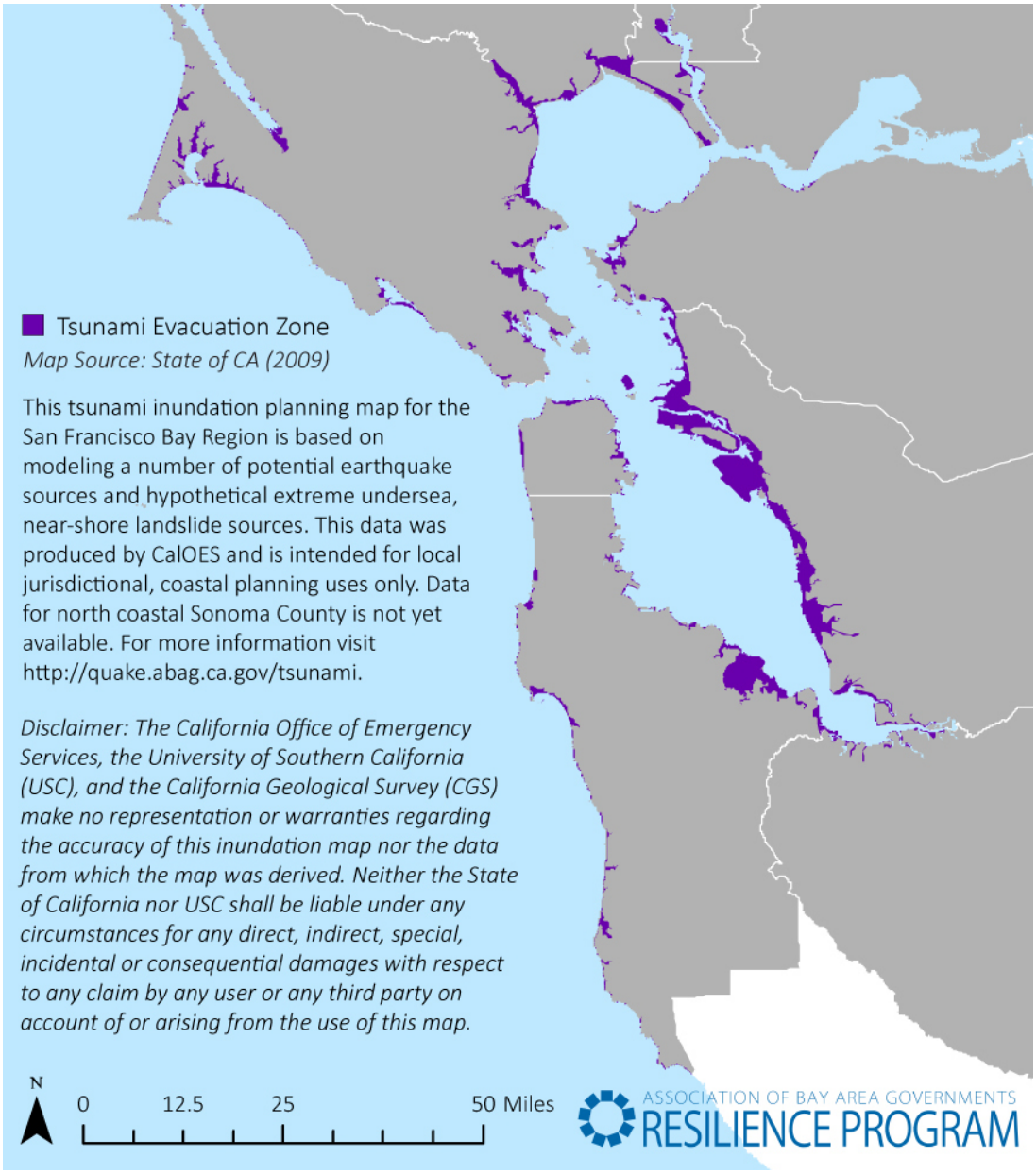
Local tsunamis can also be generated from offshore faults that also include vertical movement. Because of their close proximity, we would have little warning time. However, the Bay Area faults that pass through portions of the Pacific coastline or under portions of the Bay are not likely to produce significant tsunamis, because they move side to side, rather than up and down, which is the displacement needed to create significant tsunamis. They might have slight vertical displacements or could cause small underwater landslides, but overall there is a minimal risk of any significant tsunami occurring in the Bay Area from a local fault. The greatest risk to the Bay Area is from tsunamis generated by earthquakes elsewhere in the Pacific.

Though the Bay Area has experienced tsunamis, it has not experienced significant tsunami damage. In 1859, a tsunami generated by an earthquake in Northern California generated 4.6 meter wave heights near Half Moon Bay. The M6.8 1868 earthquake on the Hayward fault is reported to have created a local tsunami in the San Francisco Bay. In 1960, California experienced high water resulting from a magnitude 9.5 off the coast of Chile. The tsunami generated by the 1964 Alaskan earthquake caused wave heights of up to 1.1 meters along the coasts of San Francisco, Marin, and Sonoma Counties. The 2011 tsunami created by the M9.0 Tohoku earthquake did not cause damage inside the Bay but did cause damage to marinas and ports in both Santa Cruz and Crescent City. California has been fortunate in past distant-source tsunamis (1960, 1964, and 2011) that the events occurred during low tides (Ross, et al., 2013)

The California Office of Emergency Services (Cal OES) has developed tsunami evacuation maps indicating areas that should evacuate if a warning is given. See Figure 6-16 on the following page. The Cal OES tsunami maps are not associated with a particular event but instead represent the worst-case scenario at any given location by combining a suite of extreme, but plausible, inundation scenarios. Additionally, the maps include no information about the probability of a tsunami affecting an area at any given time. These maps are intended to be used for evacuation planning only.

The Park District has facilities and parks within mapped tsunami zones. There are also other facilities outside of mapped zones but at low elevations near the coast that have lower but not-negligible tsunami risk. Further information about the Park District's tsunami risk is included in the flood chapter in this mitigation plan.

Figure 6.16: Tsunami Indundation Emergency Planning Map



As shown above, the tsunami risk for the Park District is largely limited to shoreline areas along San Francisco Bay.

6.7.6 Fire Following Earthquake

Earthquakes are often responsible for igniting fires that can contribute to a considerable share of the overall damage in a disaster. The fires can start from a variety of sources: appliances with natural gas pilot lights might tip, damaged electrical equipment might spark, and gas line connections might break. Recently, in the South Napa Earthquake, a number of mobile homes were destroyed and damaged when the gas connection to a home broke. In the Loma Prieta Earthquake, 36 fires broke out in San Francisco alone but luckily were quickly contained in large part due to the abnormally calm wind that evening, and the fires' proximity to the Bay that allowed a fire boat to pump water to the fire where the water lines had failed. In the 1906 earthquake, over 3.5 square miles of San Francisco burned, representing 80 percent of San Francisco's property value at the time.

Fire following earthquake is especially tricky, because there are often multiple ignitions at once (overwhelming fire crews), typical water supply for fighting fire might be reduced or unavailable, and maneuvering fire crews to the ignition can be difficult if streets are blocked by road damage or debris. Fire following earthquake is an issue that could impact any Bay Area community that experiences an earthquake – both urban and rural. The problem is heightened for urban environments, where many simultaneous ignitions can lead to a firestorm, and single fires can more quickly and easily move structure to structure.

A few characteristics can make specific facilities more vulnerable to fire following earthquake. If a building collapses, there is a high risk for gas or electrical lines to start "seed" fires that then impact undamaged neighboring structures or start wildfires. Areas of liquefaction, fault rupture, and landslide are more vulnerable to fire. There is a greater potential for underground gas mains to break due to ground displacements, and water lines in the area might also be damaged, which could prevent the ability to fight a fire with regular water resources. Areas that are largely built with wood frames or shingle roofs might be less prone to earthquake damage, but are at a heightened risk for the spread of fires. Wildfire hazard for Park District lands is covered in Chapter 10.

6.8 Seismic Risk Assessment for Park District Facilities

6.8.1 Overview

The potential impacts of future earthquakes in the Park District include damage to buildings, contents, infrastructure, casualties, and disruption of services. There might also be other economic impacts including costs for temporary quarters while damaged buildings are repaired and costs for temporary infrastructure components.

The magnitude of potential impacts in future earthquakes can vary enormously from none in earthquakes that are felt but result in neither damages nor casualties to very substantial for larger magnitude earthquakes with epicenters near given facilities.

The earthquake hazard maps previously shown in this chapter indicate that all of the Park District's facilities are located in high or very high seismic hazard areas. All of the Park District's facilities, including buildings, roads, trails, bridges and utility infrastructure have some level of seismic risk – the potential for damage, casualties, and loss of function.

However, the level of seismic risk depends not only on the seismic hazard but also on the seismic vulnerability of each building or infrastructure component. Thus, the seismic vulnerability of the Park District's facilities varies markedly from facility to facility, depending on each facility's structural and nonstructural characteristics and condition.

In general, older facilities are more likely to have higher seismic vulnerabilities, because seismic design requirements for new construction have increased over time. For buildings, seismic vulnerability also varies with the structural system. In general, light wood frame buildings have lower seismic vulnerability than building types such as unreinforced masonry, lightly reinforced masonry, and some concrete buildings including concrete moment frame or tilt-up concrete buildings.

6.8.2 Earthquake Damage in Past Events

The Park District has not experienced any major earthquake damages since its founding for two main reasons:

- The "quiet" period with few significant earthquakes in the Bay Area from 1906 to the 1980s, as discussed previously in Section 6.4.
- None of significant earthquakes in recent decades – 1984 M6.4 Morgan Hill, 1989 M7.1 Loma Prieta and 2015 M6.0 South Napa – have been within or very near the Park District.

The damage in the Loma Prieta earthquake was predominantly damage to parking lots at Crown Beach, Hayward Shores and Redwood parks from liquefaction and sand boils that damaged the asphalt. The absence of major damage in past damage does not mean that the risk of future earthquake damage is low. On the contrary,

because of the long time interval since the last major earthquake on the Hayward Fault and other East Bay faults, the probability of major earthquakes is higher in the next few decades than the long-term probability.

6.8.3 Earthquake Risk Assessment

Headquarters Building

The Park District completed a seismic evaluation of the headquarters building as part of the 2017 update of the Park District's Hazard Mitigation Plan. The likely building performance was compared with performance standards established by the American Society of Civil Engineers in ASCE 41-13 Seismic Evaluation and Retrofit of Existing Buildings, which is the industry standard for seismic evaluations of existing buildings. The evaluation by was performed by G&E Engineering Systems Inc. as reported in G&E Report 32.55.01 Revision A, November 11, 2016.

The G&E report includes the following findings:

- The existing building meets the ASCE 41-13 Life Safety Performance Objective for the ground motion with a 20 percent chance of being exceeded in 50 years, but does not meet the ASCE 41-13 Immediate Occupancy Performance Objective for this level of ground motion. At this level of ground shaking, the building would likely require significant repairs and would perhaps have to be vacated for the repairs to be made.
- The existing building does not meet either the Life Safety or Immediate Occupancy Performance Objectives for the ground motion with a 5 percent chance of being exceeded in 50 years. At this level of ground shaking, the building would likely have major damage, with possible partial collapse and a likelihood of injuries or deaths if the building were occupied at the time of the earthquake. The building might or might not be repairable.

These results mean that the existing building is expected to perform relatively well for earthquakes on faults such as the San Andreas Fault, the Calaveras Fault, and other faults that are a significant distance from the headquarters building.

However, the building is not expected to perform well for a large magnitude M7+ earthquake on the Hayward Fault, which is located only about 700 feet from the building. The building is also within the Alquist-Priolo surface rupture zone as shown previously in Figure 6.11. The possibility of fault rupture increases the risk of major damage and life safety risk. In a major earthquake on the Hayward Fault, it is likely that this building would suffer substantial damage, likely severe enough that the building would probably not be economically feasible to repair.

The Working Group on California Earthquake Probabilities (WGCEP) has developed authoritative estimates of the magnitude, location, and frequency of future earthquakes in California. As shown previously in Figure 6.3, there is an estimated 33 percent chance of a large magnitude earthquake on the Hayward Fault in the next 30 years. This updated probability is higher than the probability used in ASCE 41-13.

The Park District is in the decision-making process about mitigation measures for the headquarters building, including possible retrofit performance objectives or replacing the building with a new, current code building, most likely in a different location.

Other District Buildings

The earthquake risk assessment for other Park District buildings is necessarily more qualitative, because the Park District does not yet have sufficiently detailed building data to make a more quantitative risk assessment using HAZUS or other quantitative methods for evaluating earthquake risk.

The Park District's Catastrophe Risk Assessment (AmWINS Group, Inc., 2015) has an estimated total insured value for buildings and contents of about $125,000,000. The statistical average annual losses are estimated to be about $344,000. Earthquakes with return periods of 50 and 100 years are estimated to result in losses of about $5 million and $10 million, respectively. Given the limited building-specific data, these estimates are best interpreted as rough estimates. These estimates don't include possible damage from earthquake-induced landslides or flooding from dam or reservoir failures.

The expected consequences of major earthquake on the Park District include not only building damages but also casualties (injuries and deaths) and loss of important functions. The buildings at most risk are older buildings, designed to lower seismic performance standards than current or recent code buildings, especially buildings that are non-ductile such as masonry buildings. The important buildings were significant damage is likely include the lightly reinforced masonry buildings in the two corporation yards and historically important buildings including the Tilden, Sunol and Crab Cove Visitor Centers, Temescal Beach House, Tilden Carousel and Brazil Room.

A priority mitigation action item for the Park District is to compile more detailed building inventory data to facilitate a more quantitative earthquake risk assessment.

Park District Infrastructure

In addition to buildings, the Park District's facilities include roads, trails, bridges, dams, and utility infrastructure (water and wastewater). The earthquake risk assessment for the Park District's infrastructure is necessarily qualitative, because the Park District does not yet have sufficiently detailed infrastructure data to make a more quantitative risk assessment using HAZUS or other quantitative methods for evaluating earthquake risk.

The Park District's infrastructure is subject to damage from earthquake ground shaking, from earthquake-induced landslides and from flooding from dam or reservoir failures. For much of the Park District's infrastructure, damage from earthquake induced landslides may be the largest fraction of total earthquake damages.

The Park District infrastructure of most concern includes the Del Valle sewage ponds because failure would contaminate a major drinking water supply, the Del Valle potable water system and several dams including: Lake Anza Dam, Temescal Dam, Jewel Lake Dam and Sunol Dam.

For a major earthquake on the Hayward fault, with very strong ground shaking in areas that contain much of the Park District's infrastructure and widespread earthquake induced damages, damages would be several million dollars or perhaps $10 million dollars or more.

The impacts of earthquake damage to the Park District's infrastructure would include not only repair costs, but also loss of function and life safety risk. Life safety risk would be substantial for park visitors or staff in locations where earthquake-induced landslides occur or for people on bridges that fail.

A priority mitigation action item for the Park District is to compile more detailed infrastructure inventory data to facilitate a more quantitative earthquake risk assessment.

6.9 Earthquake Mitigation Action Items

There are several possible earthquake mitigation Action Items for the Park District's facilities, including:

- Replacement of seismically vulnerable buildings with new buildings that meet or exceed the seismic provisions in the current building code,
- Structural retrofits for buildings,
- Nonstructural retrofits for buildings and contents,
- Retrofit or replacement of important infrastructure with significant risk from earthquake ground shaking and/or from secondary impacts such as liquefaction or landslides.
- Installation of emergency generators for buildings with critical functions, including designated emergency shelters, and
- Enhanced emergency planning, including earthquake exercises and drills.

Of these potential earthquake Action Items, FEMA mitigation grants, which typically provide 75 percent of total project costs, might be available for structural or nonstructural retrofits and for emergency generators.

Earthquake Action Items for the Park District are given in Table 6.5 on the following page.

Table 6.5: EBRPD Earthquake Hazard Mitigation Actions Summary

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Earthquake Mitigation Action Items									
Short-Term #1	Retrofit or replace the Park District's Peralta Oaks headquarters building, as funding becomes available.	2-5 Years	District	Design	X	X		X	X
Short-Term #2	Develop a Park District policy for the desired level of seismic performance for critical and important facilities.	1 Year	District	Design	X	X		X	X
Short-Term #3	Complete seismic evaluations of important buildings including Tilden, Sunol and Crab Cove Visitor Centers, Temescal Beach House, Tilden Carousel, and Brazil Room.	1-3 Years	District	Design	X	X			X
Short Term #4	Complete evaluations of critical infrastructure include the Del Valle sewage ponds and the District owned dams.	1-3 Years	District	Design	X	X	X	X	X
Short-Term #5	Evaluate nonstructural seismic vulnerabilities in Park District facilities and mitigate components that pose significant life safety or loss of function risks.	1-5 Years	District or Grants	Design	X	X			X
Short-Term #6	Complete and update the Park District's inventory of facilities, including data necessary to evaluate seismic risk.	Ongoing	District	Finance	X	X			X
Long-Term #1	Replace the Public Safety Office, Service Yard Office and Fire Station #1 with new current-code buildings, as funding becomes available.	Ongoing	District or Grants	Design	X	X	X	X	X
Long-Term #2	Retrofit or replace critical and important facilities with significant seismic deficiencies, as identified by the evaluations in Short Term #2, as funding becomes available.	Ongoing	District or Grants	Design	X	X			X
Long-Term #3	Enhance emergency planning for earthquakes including duck, cover and hold drills and evacuation drills.	Ongoing	District or Grants	Risk & Fire	X			X	X
Long-Term #4	Locate new facilities outside of high earthquake hazard areas including sites subject to liquefaction, surface rupture, earthquake-induced landslides, or in close proximity to faults, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

6.10 References

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7.0 Wildland-Urban Interface Fires

7.1 Introduction

The native vegetation of the East Bay Hills evolved with the presence of occasional wildfires. These wildfires generally promoted the health and regeneration of a mosaic of native grasslands, oak woodlands, and forests (East Bay Regional Park District, 2010). Low intensity and frequent wildfires are generally considered beneficial, leading to an expansion of native grasslands and an increase in the bio-diversity and productivity of chaparral and north coastal scrub ecosystems.

After the arrival of the Europeans, the native vegetation has been substantially and dramatically altered over the last 100 years by human activities that have included livestock grazing, logging, quarrying, road and trail construction, introduction of non-native species (most notably non-native grasses, eucalyptus and pine), and the suppression of wildfires.

In the early 1900s, plantations of eucalyptus and pine were planted for hardwood production and to forest the primarily grass-covered hills in preparation for coming real estate development (East Bay Regional Park District, 2010). As these trees have grown and aged since their initial planting, many of the older pines have begun to fail as they reach the end of their lifespan or are attacked by insect pests or disease (for example, bark beetles and pine pitch canker). The increasing numbers of trees affected by these ailments create an elevated fuel load in the parks. Similarly, eucalyptus trees planted for hardwood production have become dense and flammable woodlands. As the park vegetation ages and less land is grazed or burned by prescribed fire, Park District staff has noted that it is increasingly difficult to cost-effectively manage the vegetation to reduce wildfire hazards.

In 2010, the Park District developed a Wildfire Hazard Reduction and Resource Management Plan that focused on the wildland-urban interface (WUI), the boundary between open space parklands and adjacent residential neighborhoods, between Castro Valley and Richmond. The goal of the plan is to minimize the risk of Diablo wind-driven catastrophic wildfire along the wildland-urban interface while ensuring the protection and enhancement of ecological values and resources within the Park District's jurisdiction. The focus of this chapter is also on WUI fires, as this poses the greatest threat to Park District facilities and parklands located within two highly urban counties of the Bay Area.

7.2 Historical Wildland-Urban Interface Fires

Fire records for the East Bay Hills are incomplete, but historic newspaper articles and old fire planning studies document an active and dangerous fire history for the area going back centuries (East Bay Regional Park District, 2010). Under normal conditions, most fires that start in the East Bay Hills are efficiently controlled by firefighters with no loss of life or structures. During most of the year, temperatures in

the East Bay are moderate, and vegetation is relatively moist and fire-safe. Summers bring overnight and morning fog along the hills until around noon, with moist midday winds blowing westerly in from the coast.

However, on occasion, a phenomenon known as “Diablo winds” turns these conditions around. These hot, dry winds blow from the east, often in the early morning when major fires are least expected. They can fan the flames of small sparks into wildfires that have been observed to move down from a ridge top in 30 minutes, expand to one square mile in an hour, and consume hundreds of residences in one day. The few days each year when all of the high fire danger conditions—low humidity, high temperatures, and hot, dry Diablo winds blowing in from the east—are extreme are labeled Red Flag days, and usually occur in the fall months.

During the 75-year period between 1923 and 1998, 11 Diablo wind-driven fires in the Berkeley/Oakland hills burned a total of 9,840 acres, destroyed more than 4,000 homes, took 26 lives, and resulted in over $2 billion in financial losses. The most significant fire in this period was the October 20, 1991 Tunnel Fire in the Oakland-Berkeley hills, which ranks as one of the worst wildland-urban firestorm disasters to ever strike the United States. The fire resulted in 25 deaths, 150 injuries, and the displacement of over 10,000 persons. With destruction and damage to over 3,400 residential units, losses were in excess of $1.5 Billion in 1991 dollars (approximately $2.7 Billion in 2016 dollars[1]).

For this fire, the Park District received 29 grants from the Federal Emergency Management Agency (FEMA) for fire costs, including emergency protective measures and repairs/restoration of parklands and facilities, with total project costs of nearly $2.5 million. Including costs not eligible for FEMA grants, the total costs to the Park District were likely more than $3.0 million. Four Park District parks were impacted by this fire: Temescal Regional Recreation Area, Sibley Volcanic Regional Preserve, Claremont Canyon Regional Preserve, and Huckleberry Botanical Regional Preserve. Most of the damage was in the Temescal Regional Recreation Area.

Because the Park District owns and operates hundreds of thousands of acres of open space, including eucalyptus forests in this area, the 1991 Oakland Hills Fire Storm continues to greatly influence Park District planning, mitigation, fire response, and operational activities.

Table 7.1: significant wildland-urban Interface fires in the Park District’s history.

Figure 7.1: major historical wildfire perimeters for wildfires occurring between 1950 and 2014 within the Park District service area.

[1] http://www.bls.gov/data/inflation_calculator.htm

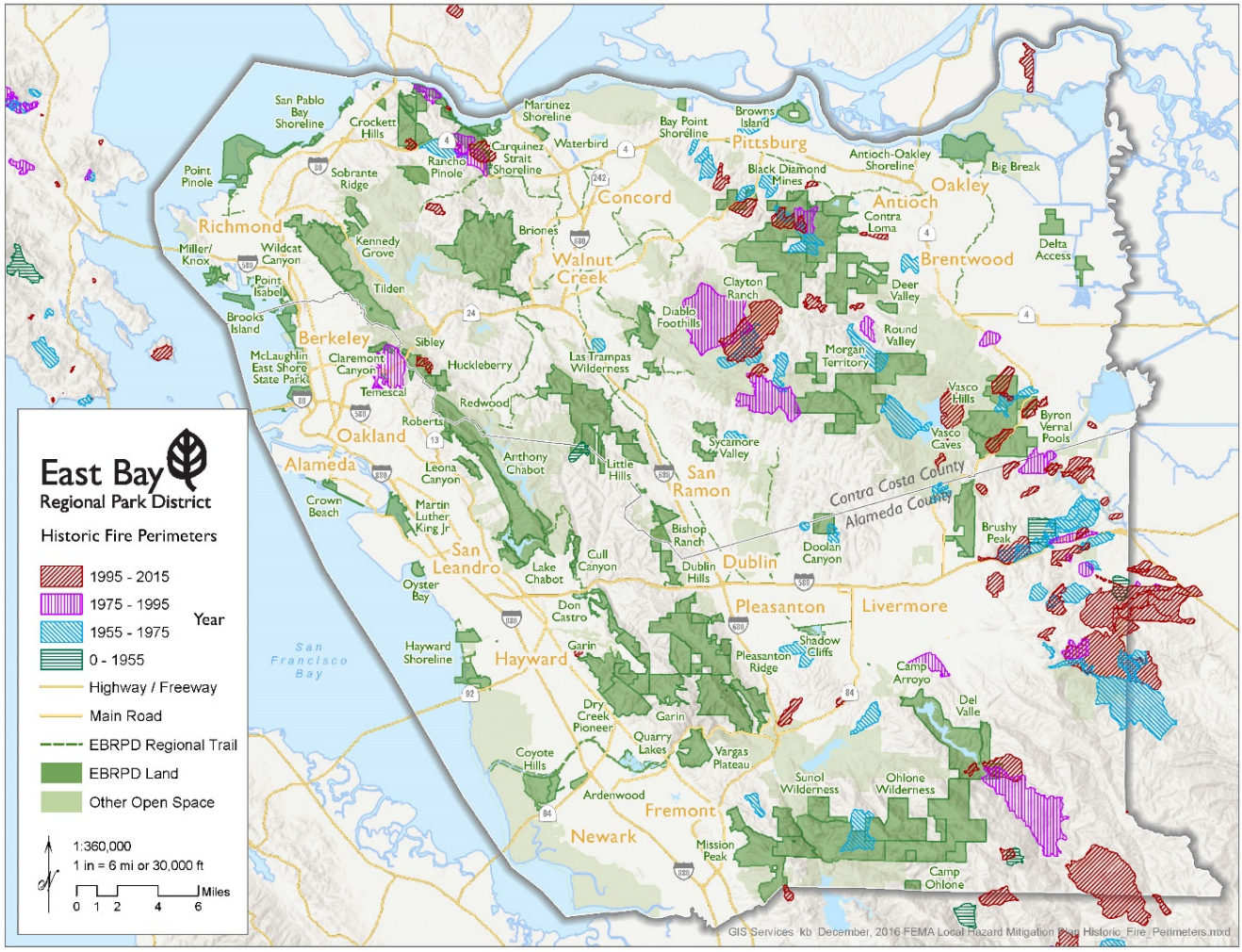
Table 7.1 of Major Wildland-Urban Interface Fires within the Park District

Historical fires within Park District jurisdiction before its creation					
September 1923	North of UC Berkeley Campus	Berkeley	584 homes, 130 acres	Smoker	Diablo wind
June 1929	Lake Temescal	Oakland	300 acres grassland	Unknown	West wind
November 1931	Leona	Oakland	5 homes, 1800 acres	Unknown	Diablo wind
November 1933	Redwood/Joaquin Miller	Oakland	1 life, 5 homes, 1000 acres	Smoker	Diablo wind
Historical fires within Park District jurisdiction since its creation					
September 1937	Broadway Terrace	Oakland	4 homes, 700 acres	Backyard fire	West wind
September 1940	Broadway Terrace	Oakland	30 acres	Unknown	West wind
September 1946	Buckingham/Norfolk	Oakland/ Berkeley	1,000 acres	Arson and rekindle	Diablo wind
November 1955	Montclair	Oakland	10 acres	Unknown	West wind
October 1960	Leona	Oakland	2 homes, 1,200 acres	Unknown	Diablo wind
November 1961	Tilden, Briones, Roberts, and Chabot	Berkeley, Martinez Oakland, Castro Valley	4 fires, 400 acres	Arson	South-west wind
October 1968	Oak Knoll	Oakland	204 acres	Unknown	West wind
September 1970	Fish Canyon Fire	Oakland	37 homes destroyed, 21 homes damaged, 204 acres	Arson	Diablo wind
December 1980	Wildcat Canyon Fire	Berkeley	5 homes, 2 acres	Power line	Diablo wind
October 1990	Leona	Oakland	200 acres	Vehicle accident	West wind
October 1991	Tunnel Fire	Oakland/ Berkeley	25 lives, 3,354 homes, 456 apartments, 1,600 acres	Rekindle	Diablo wind

Source: (Diablo Fire Safe Council, 2015) (City of Berkeley, 2014)

Wildland and/or wildland/urban interface fires are extremely likely to occur every year. The Park District typically has multiple fires in a given year. The likelihood that fires will occur in a given year is almost 100%. Most of the fires are extinguished quickly and burn less than an acre or only a few acres. Larger fires burning tens of acres, hundreds of acres or more occur much less frequently.

Figure 7.1 Fire Perimeters



Source: CalFire, 2014

As shown above, most of the major historical wildland fires have been in the eastern part of the Park District. However, because most of the high density development in high fire risk areas is in the East Bay Hills, the fire risk to people and property is highest in the East Bay Hills.

7.3 Probability of Future Wildland/Urban Interface Fires

The threat of catastrophic wildfires under Diablo wind conditions presents significant risks to public health and safety, homes, and property along the wildland-urban interface (East Bay Regional Park District, 2010). The hot and dry periods of late summer and fall in the Bay Area, the steep topography of the East Bay Hills, seasonal wind patterns, flammable vegetation, dense development patterns adjacent to parklands, and limited firefighting access all contribute to creating a substantial regional fire threat. The continued increase in development along the wildland-urban interface and sustained development of communities in and adjacent to open space areas also put an increasing number of people at risk from wildfires.

Beginning in the early 2000s, residential losses in California from wildfire dramatically changed and further demonstrated the increasing risks from wildfires. For the 80-year period between 1923 and 2003, major fires resulted in the loss of 13,600 homes, 73 percent (11,055 homes) of which were destroyed between 1990 and 2003 alone (East Bay Regional Park District, 2010).

The ongoing serious drought has exacerbated and continues to exacerbate the risk of major wildland/urban interface fires in or near the Park District's lands.

Key factors concerning why the 1991 Oakland-Berkeley Firestorm burned so many acres and homes before being extinguished still exist today (East Bay Regional Park District, 2010):

- Major increases in flammable vegetation over the past 70 years have significantly increased wildfire risks. Steep hillsides have been converted from grazed grasslands to brush with hillside and ridge top homes surrounded by flammable vegetation, which is often under or adjacent to groves of unmaintained pine or eucalyptus.
- Unmaintained eucalyptus and pine groves on both private and public lands, especially on ridgetops, represent a serious crown fire and spotting threat to adjacent residential land uses.
- Unmaintained native brush and invasive, exotic species often cover, without interruption, several canyon areas and slopes above and below many East Bay Hills residential neighborhoods.
- Diablo wind fires under the worst conditions of high wind speed, low humidity, and high temperature move so quickly that positioning fire crews and obtaining air support for rapid containment and control might not be possible given current fuel levels.
- It is impossible for fire agencies to quickly extinguish all Diablo wind fires. Several areas in the East Bay Hills can produce flame fronts that cannot be controlled using water from hydrants, fire engines, helicopter buckets, or retardant drops from airplanes until late in the afternoon when the winds have slowed.

7.4 Wildland and Wildland-Urban Fire Hazard Mapping and Hazard Assessment

The level of fire hazard for wildland-urban interface fires depends on:

- Vegetative fuel load,
- Topography,
- Climate and weather conditions,
- Ignition sources and frequency of fire ignitions, and

- Fire suppression resources (fire agency response time and resources of crews and apparatus, access, and water supplies).

High vegetative fuel loads, especially brush and trees, increase the level of wildland-urban fire hazard. Steep topography increases the level of fire risk by exacerbating fire spread and impeding fire suppression efforts by making access more difficult. The level of hazard in areas prone to wildland-urban interface fires is also substantially increased when weather conditions including high temperatures, low humidity, and high winds greatly accelerate the spread of wildland fires and make containment difficult or impossible.

Climate change is resulting in higher temperatures and longer dry periods over a longer fire seasons, as well as changes in vegetation. These continuing climate changes have led and will continue to lead to an increase in the frequency of wildfires, exacerbate their intensity and rate of spread. Given these factors, future losses from wildland fires are likely to be greater than those in the past.

The California Department of Forestry and Fire Protection (CalFire) maps areas of significant fire hazards (fire hazard severity zones) based on fuels, terrain, weather (temperature, humidity, and wind). These maps represent the likelihood of an area burning over a 30- to 50-year time period.

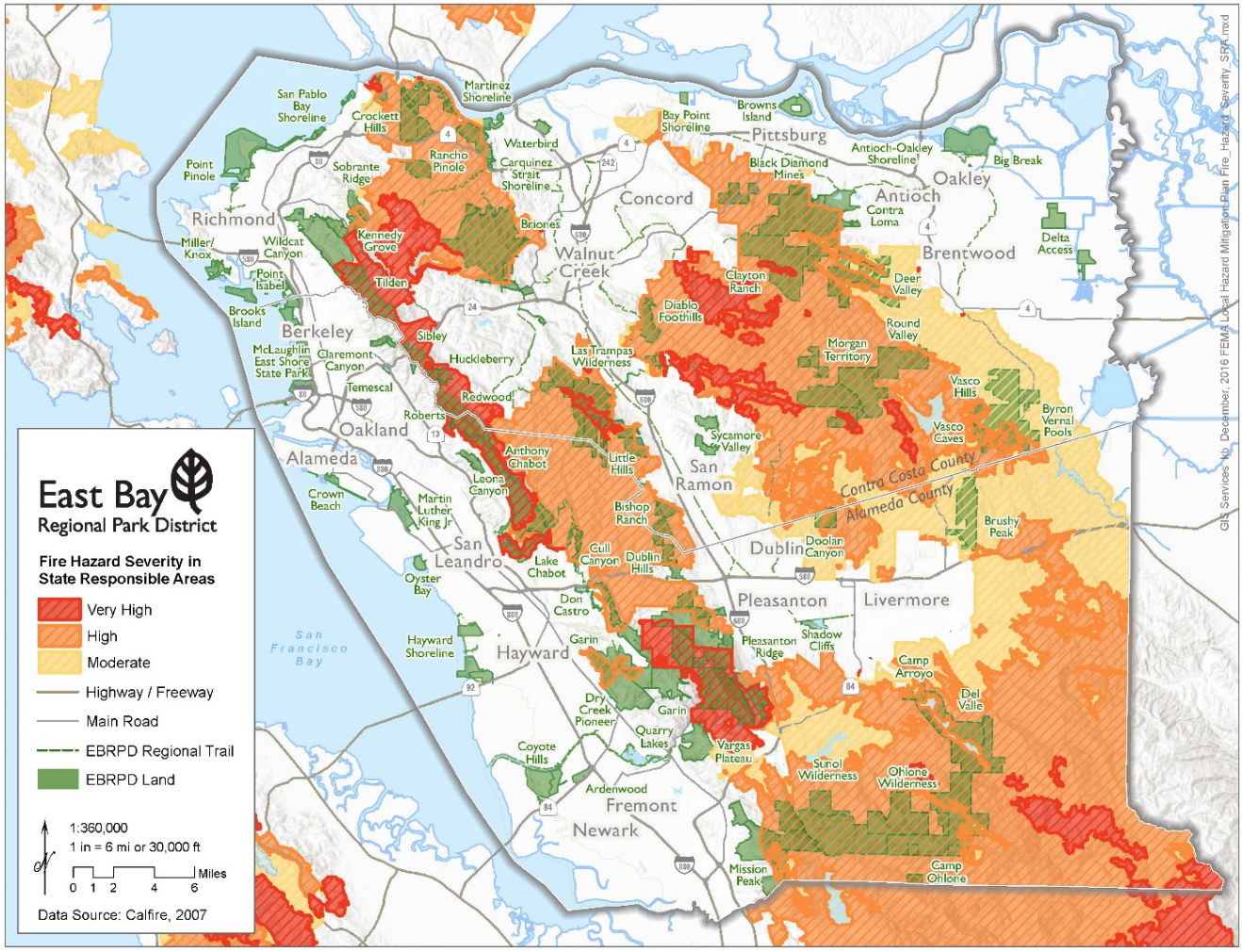
Figures 7.2 and 7.3 depict the areas within Alameda and Contra Costa Counties that are Federal, State and Local responsibility areas for fire protection.

Under designation by the State of California, Park District lands within the wildland-urban interface are predominately State Responsibility Areas (SRAs) for fire protection. CalFire has the legal responsibility to provide fire protection on all SRA lands. Fire hazard severity within SRAs is shown on Figure 7.2.

Some areas, such as Point Pinole Regional Shoreline, Wildcat Canyon Regional Park, Claremont Canyon Regional Preserve, Leona Canyon Regional Open Space Preserve and land immediately northwest of Lake Chabot Regional Park, are designated as Local Responsibility Areas (LRAs). Local fire jurisdictions, such as the Richmond, Berkeley, or Oakland Fire Departments, have the legal responsibility to provide fire protection on LRA lands.

In coordination with these firefighting agencies, the Park District Fire Department provides a strong secondary wildland fire response in support of CalFire on SRAs and to the local fire departments on LRAs. In actuality, the Park District fire suppression resources are often the first “on scene” to parkland fires, and many times are the only resources used (East Bay Regional Park District, 2010).

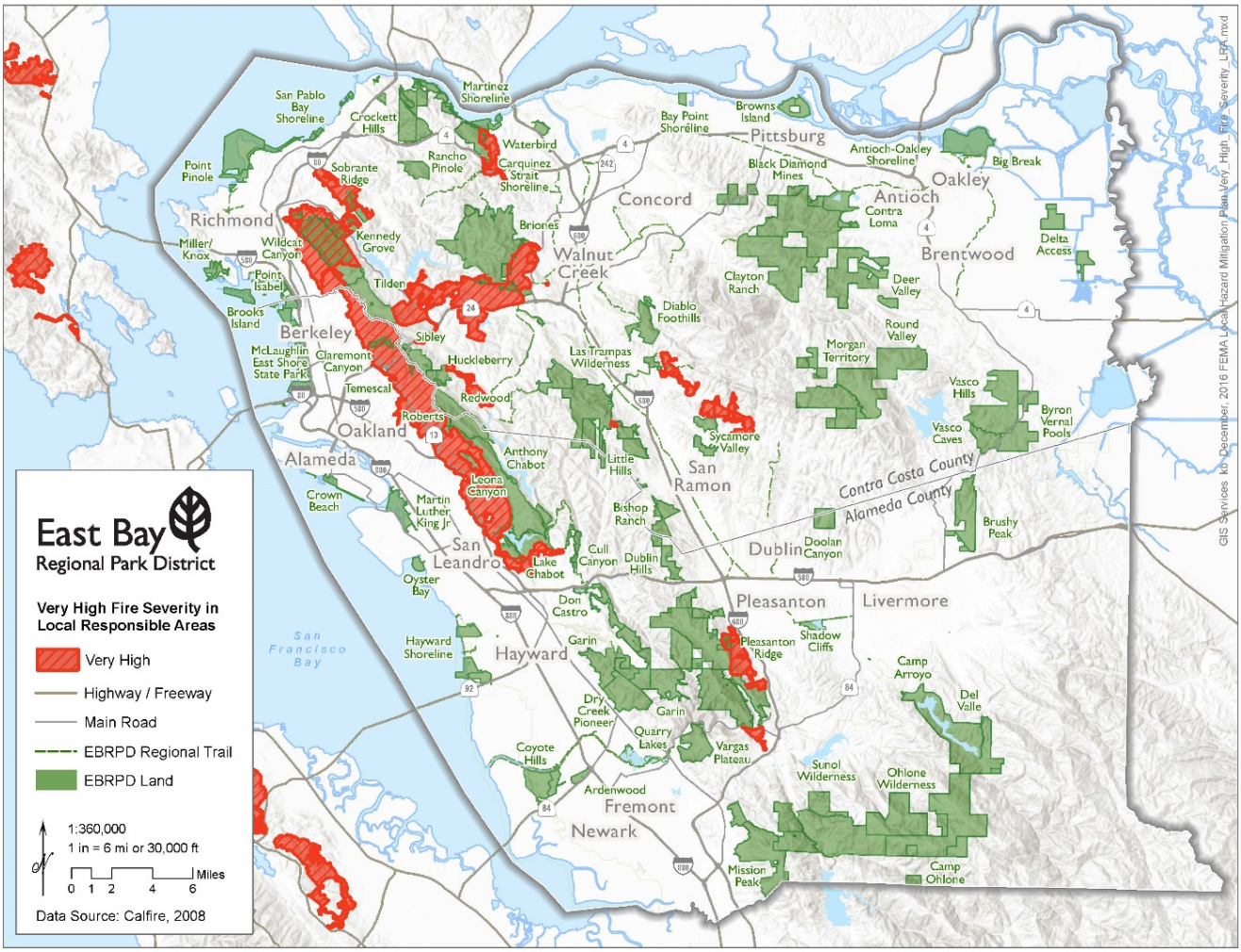
Figure 7.2: Fire Hazard Severity in State Responsibility Areas



Source: CalFire, 2014

Figure 7.3 maps very high fire severity in LRAs. CalFire does not map lower levels of fire hazard severity in local responsibility areas.

Figure 7.3: Very High Fire Severity in Local Responsibility Areas



Source: CalFire, 2008

The Park District has 27 parks that are entirely or partially designated as High or Very High fire severity areas within local or state fire responsibility areas:

- Anthony Chabot Regional Park
- Black Diamond Mines Regional Preserve
- Briones Regional Park
- Camp Arroyo
- Camp Ahone
- Carquinez Strait Regional Shoreline
- Castle Rock Regional Recreation Area

- Claremont Canyon Regional Preserve
- Crockett Hills Regional Park
- Del Valle Regional Park
- Diablo Foothills Regional Park
- Garin/dry Creek Pioneer Regional Parks
- Huckleberry Botanic Regional Preserve
- Kennedy Grove Regional Recreation Area
- Lake Chabot Regional Park
- Las Trampas Regional Wilderness
- Mission Peak Regional Preserve
- Morgan Territory Regional Preserve
- Pleasanton Ridge Regional Park
- Redwood Regional Park
- Roberts Regional Recreation Area
- Sibley Volcanic Regional Preserve
- Sunol Regional Wilderness
- Temescal Regional Recreation Area
- Tilden Regional Park
- Vasco Caves Regional Park
- Wildcat Canyon Regional Park

7.5 Park District/s 2010 Fuels Management Plan

In 2010, The Park District undertook a resource inventory and wildfire hazard assessment to identify wildfire hazards located within the wildland-urban interface and in the vicinity of strategic fire routes and Park District facilities at risk (East Bay Regional Park District, 2010). The assessment was done using a fire behavior prediction model. Fires were modeled under Diablo wind conditions with extremely hot, dry weather to assess worst-case hazards. This wildfire study encompassed 13 parks along the East Bay Hills where the wildland/urban interface fire risk is especially high.

The Park District “facilities at risk” are facilities located on Park District parklands that are considered highly valuable, including structures and other physical improvements; natural and cultural resources; community infrastructure; and economic, environmental, and social values for which the wildland fire protection system is created and funded to protect. Some of these facilities are considered to

be “irreplaceable”, for example the Tilden Merry-Go-Round, the Temescal Bath House, and the Chabot Equestrian Center. Table III-1 in the Wildfire Hazard Reduction and Resource Management Plan displays those facilities at risk identified by Park District staff, their respective park locations, and the treatment area in which they are located, if applicable.

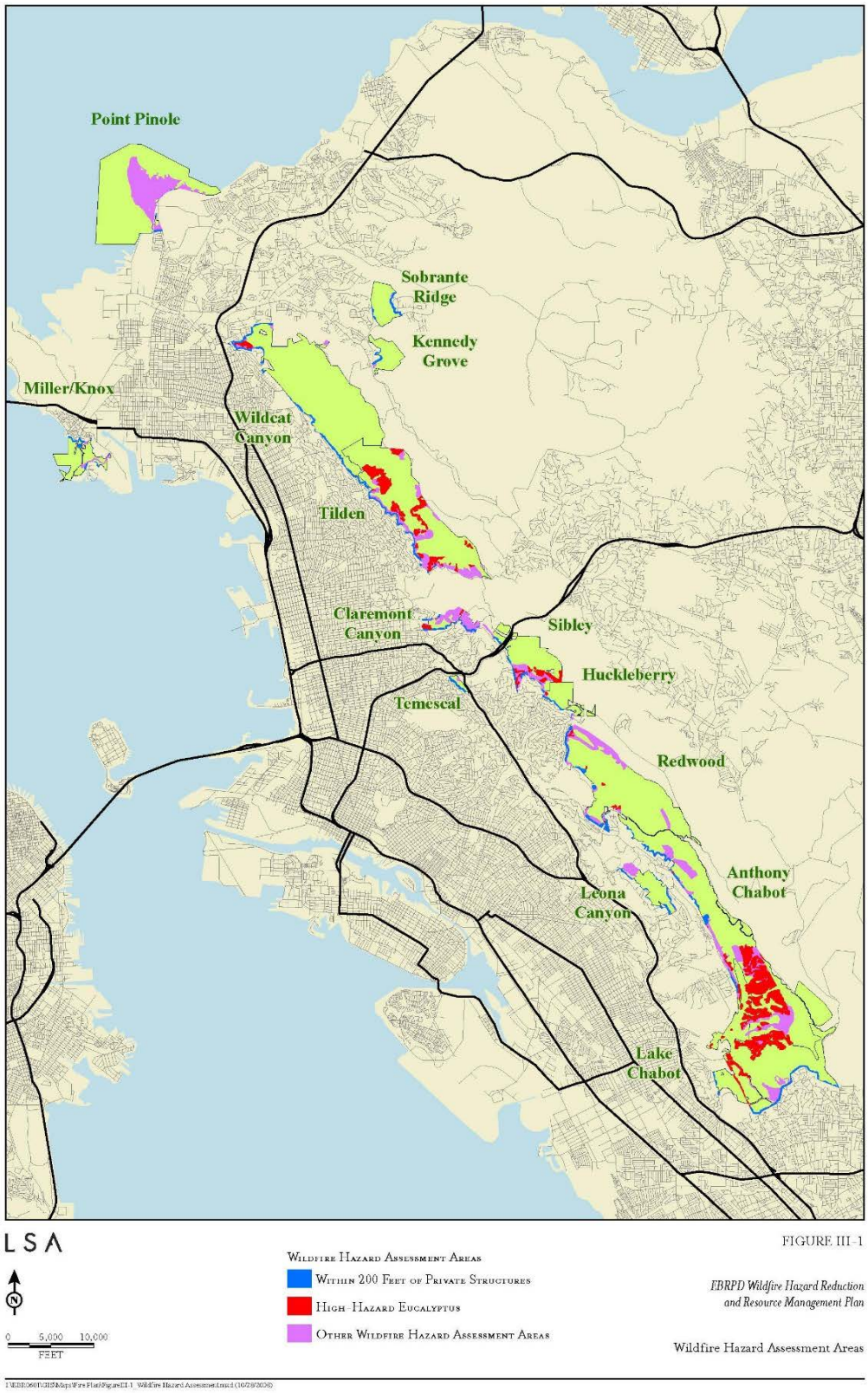
Park District staff also identified and mapped strategic fire routes to facilitate and support wildfire response and emergency access as well as evacuation during an emergency incident. Strategic fire routes primarily include those roadways and trails on Park District lands, including unpaved roads and trails within the parks as well as some paved roads that connect and pass through parks.

The following areas are identified on the wildfire hazard assessment map:

- Parklands located within 200 feet of homes and other structures
- Locations of stands that represent significant threats from torching and crown fires that can cause ember flight
- Areas of vegetation with the potential to produce greater than 8-foot flame lengths
- Lands within 200 feet of Park District facilities at risk.

As part of the wildfire hazard assessment, the Park District and its consultant team also conducted a thorough delineation and decision process to identify and characterize recommended treatment areas as either an “Initial Treatment Area” or a “Maintenance Area”. These areas are further discussed and mapped in the Wildfire Hazard Reduction and Resource Management Plan. Figure 7.4 shows the study areas included in this plan.

Figure 7.4: Wildfire Hazard Reduction and Resource Management Plan: Study Areas



Source: (East Bay Regional Park District, 2010)

7.6 Wildland-Urban Interface Fire Risk Assessment

7.6.1 Overview

The previous sections of this chapter have documented the areas within the Park District's service area and the Park District lands that are within high or very high fire severity areas.

The Park District's wildland/urban interface fire risk is two-fold:

- Risk to the Park District's lands, buildings, and infrastructure, and
- Risk to adjacent lands, especially adjacent lands with high density development.

The level of risk from wildland-urban interface fires for the Park District's buildings, infrastructure, and lands depends on:

- Level of fire hazard as outlined above,
- Environmental importance of the Park District's lands,
- Value and importance of buildings and infrastructure,
- Vulnerability of inventory at risk, including whether fire-safe construction practices and defensible space measures have been implemented, and
- Population at risk and the efficacy of evacuations.

Life safety risk in wildland-urban interface fires arises in large part from delays in evacuations, once a fire has started. For park facilities with significant risk from wildland-urban interface fires, a well-defined, practical and practiced evacuation plan is essential to minimize potential life safety risk.

Under "normal" conditions–without unusually high temperatures, unusually low humidity and high winds–the vast majority of wildland or wildland/urban interface fires are extinguished quickly. The burned acreage is typically small from a fraction of an acre to a few tens of acres. Damage to structures is most often nil. If structures are damaged, the damage is typically limited to one structure for a small number of structures. Life safety risk is minimal, if any. For these "typical" wildland or wildland/urban interface fires the total environmental impacts and property damage are minor.

However, much larger fires with much greater impacts have occurred in the past and will occur again in the future, especially under Diablo wind conditions. The 1991 Tunnel Fire in the Oakland-Berkeley hills burned about 1,500 acres (about 2.5 square miles) of mostly residential areas, with the destruction of about 3,400 buildings, with damages of about $2.7 billion in 2016 dollars) and 25 deaths.

This catastrophic fire was the most severe fire experienced to date within the Park District's service area of Alameda and Contra Costa Counties. Nevertheless, even

larger, more destructive fires are possible.

There are factors which suggest that the fire risk might be higher in future decades than in the past several decades, including:

- The ongoing drought,
- Climate change, which will likely increase the number of days with unusually high temperatures (relative to historical temperatures),
- The regrowth of vegetation from past levels.

The photos below from the Wildfire Hazard Reduction and Resource Management Plan show Wildcat Ridge in 1971 and 2004.

Figure 7.5 Wildcat Ridge Vegetation: 1971 and 2004

Various factors have influenced a vegetative change in the East Bay Hills leading to increased plant densities and fuel volumes in many areas, such as along Wildcat Ridge.

There are also factors that have reduced wildland and wildland/urban interface fire risk, including:

- Fuel reduction and defensible space measures implemented by the Park District, Alameda and Contra Costa counties, cities, and other agencies throughout the two counties.
- Greater awareness, understanding, and modeling of wildland fires that have improved planning for and responses to fire ignitions.
- Gradually improved fire suppression resources and techniques.

The extent to which factors that increase or reduce wildland and wildland/urban interface fire is very difficult to estimate. However, ongoing climate change and limited resources for fire mitigation activities might tip the balance towards increasing fire risk over the next several decades.

7.6.2 Fire Risk for the Park District

Wildland fires can affect any of the park lands. As noted previously, the acreage burned in a fire can range from a fraction of an acre to hundreds or thousands of acres. The severity of consequences depends not only on the size of a given fire but also what vegetation if burned. For example, grassy areas burned might regenerate in a year or two, while forest areas severely burned might take many years to regenerate. The severity of consequences for a given fire also depends on the extent to which environmentally sensitive areas are burned. The Park District's current Wildfire Hazard Reduction and Resource Management Plan includes consideration of such factors.

Fire risk for the Park District also includes risk to its facilities, including buildings, bridges (especially wood bridges), and infrastructure. Even for very large fires with more acres burned than the 1991 Tunnel Fire, any given fire will impact only a limited number of parks. That is, a District-wide fire is outside the bounds of possibility.

As previously discussed, the repair/restoration costs for the 1991 Tunnel Fire were $3 million. In 2016 dollars, this amount would correspond to nearly $6 million. Based on the fire history, the majority of fires within the Park District would have repair/restoration costs well below $1 million. Large or very large fires would have repair/restoration costs of several million dollars. Only truly extreme fires could have repair restoration costs of $10 million or more.

The Park District considers the Headquarters Building, the two Corporate Yard facilities, the seven Visitor Centers/Education Facilities, and three historic buildings

(Temescal Beach House, Tilden Carousel and Brazil Room) to be critical buildings based on operational, emergency response or historic criteria.

Of the thirteen District-identified critical facilities, twelve are located in the East Bay Hills, and these sites have a high or very high risk level for wildland/urban interface fires. . The exception is the Big Break Visitor Center that is located in far eastern Contra Costa County, a location with lower wildland fire hazard.

7.7 Mitigation Action Items for Wildland-Urban Interface Fires

7.7.1 Mitigation Goals

The four key wildfire reduction and resource management goals identified in the Wildfire Hazard Reduction and Resource Management Plan are:

- Reduce fire risks on District-owned lands in the East Bay's wildland-urban interface to an acceptable level
- Maintain and enhance ecological values for plant and wildlife habitat consistent with fire reduction goals
- Preserve aesthetic landscape values for park users and neighboring communities
- Provide a vegetation management plan that is cost-effective and both financially and environmentally sustainable for the Park District on an on-going basis.

The most common mitigation measures to address these goals include:

- Defensible space activities,
- Hazardous fuel reduction activities, and
- Ignition resistant construction activities.

7.7.2 Existing Ongoing Mitigation Activities

The Park District is a major participant in wildfire hazard reduction programs, especially in the Oakland-Berkeley hills (East Bay Regional Parks Department, 2013). To provide its firefighting and fuels management services, the Park District has a crew of full-time firefighters and fully-trained employee volunteer firefighters who serve on-call in addition to their other jobs. The Park District also employs Civicorp youth crews and County Correctional Department work crews to perform fuels management work.

To help slow the spread of wildfire, the Park District long ago established a fuel break through the East Bay hills between Castro Valley and Richmond. This area is composed of thinned vegetation between parklands and homes, intended to both slow the advance of fire and give firefighters a place to make a stand.

To maintain the fuel break, the Park District uses methods including brush clearing by hand, tree removal by heavy equipment, and prescribed fire under careful control. Conservation grazing has also proved to be an effective technique. Livestock such as sheep, goats, or cattle are seasonally introduced onto Park District property and managed to control plant growth. Cattle conservation grazing, which takes place in about 60 percent of the regional parklands, has a collateral benefit of reducing fire loads.

The Park District's fuels management activities have been ongoing since its inception in 1934, funded largely from the Park District's operating budget and various fire hazard mitigation grants under the Federal Emergency Management Agency (FEMA) and other agencies. In November 2004, voters in western Contra Costa and Alameda Counties approved Measure CC, a parcel tax that provided $9 million in funding for create a Wildfire Hazard Reduction Plan and continue fuels management activities in the East Bay Hills.

In 2010, the District Board of Directors approved a Wildfire Hazard Reduction and Resource Management Plan (Fuels Plan). The Fuels Plan is specifically directed at the wildland-urban interface between Castro Valley and Richmond.

With a combination of Park District and external funds (such as FEMA grants) some of the high priority fuel reduction projects outlined in the Fuels Plan are either completed or included in the 2016 Capital Improvement Plan. However, there are still approximately 1,550 acres identified in the Fuels Plan that remain untreated. Completing the fuel reduction measures for the remaining 1,550 acres is a high priority for the Park District and will be completed as funding becomes available.

As part of the 2016/2017 mitigation planning process, the Park District is in-process of identifying high priority sites for future fuel reduction projects in high or very high fire severity locations in close proximity to high density development, based on:

- Building inventory data and
- Fire behavior prediction based on the USGS Landfire data that portrays vegetative fuels both inside and outside the Park District's boundaries, including flame lengths, rate of fire spread, crown fire potential, and maximum ember (spotting) distribution distance.

7.7.3 Updated Mitigation Action Items

The Park District's mitigation action items for wildland-urban interface fires are shown in the table on the following page. All of these action items are compatible with and support the goals in the Fuels Plan.

Table 7.2: Wildland-Urban Interface Fire Mitigation Action Items

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Wildland/Urban Interface Fire Mitigation Action Items									
Short-Term #1	Complete the remaining fuel reduction projects identified in the Fuels Plan, and expand to other areas as funding becomes available.	Ongoing	District	Fire	X	X	X	X	X
Short-Term #2	Continue to refine the Park District's fuels reduction strategies to maximize the reduction in fire risk, while minimizing possible impacts on the natural environment.	1 Year	District	Fire	X	X	X	X	X
Short-Term #3	Review and refine emergency response and evacuation planning for locations with high risk for wildland and/or wildland/urban interface fires.	1 Year	District	Fire	X	X	X	X	X
Short-Term #4	Continue outreach and education programs through the Hills Emergency Forum, the Fire Wise Program, Local Fire Safe Councils and other organizations.	Ongoing	District	Fire	X	X	X	X	X
Long-Term #1	Pursue additional grants for fuels management and other fire risk reduction projects from FEMA and other agencies including Calfire, US Forest Service and California Fire Safe Council.	Ongoing	District	Grants	X	X	X	X	X
Long-Term #2	Evaluate and implement mitigation measures to reduce fire risk, including enhancing defensible space around buildings, fuel reduction measures near important facilities and upgrading building elements with materials designed to be fire-resistant, as funding becomes available.	Ongoing	District or Grants	Fire	X	X	X	X	X
Long-Term #3	Continue and expand the Park District's hazardous tree abatement programs as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #4	Locate new facilities outside of areas with significant wildland/urban interface fire risk, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

7.8 References

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8.0 Droughts

8.1 Introduction

Drought is generally defined as a period of dryness when precipitation is significantly less than typical for a given location, although there is no absolute standard definition. Drought periods may last for a single season, a single year or for several years or more. The National Drought Mitigation Center defines a “short” drought as less than 6 months and a “long” term drought as more than 6 months. Short term droughts primarily affect agriculture and grass lands. Long term droughts affect not only agriculture and grass lands, but also the hydrology and the ecology of an affected area.

Several types of droughts are commonly distinguished:

- Meteorological drought: the degree of dryness, expressed as a reduction in precipitation from an average or normal amount based on monthly, seasonal or annual time scales.
- Hydrological drought: the effects of precipitation shortfalls on stream flows and reservoir, lake and groundwater levels.
- Agricultural drought: soil moisture deficiencies relative to the water demand of plant life, usually crops.
- Socioeconomic drought: when demand for water exceeds supply as a result of weather-related supply shortfall.

The consequences of long term droughts may be severe, including widespread crop failures, lower water tables that may cause wells to run dry and deaths of mature trees and other substantial ecological impacts. In some cases, long term droughts may result in extensive wind-driven erosion, as happened during the dust-bowl years in the central United States in the 1930s, with long-term reductions in agricultural productivity.

In California, short term droughts are somewhat mitigated by extensive water storage. However, longer term droughts typically necessitate re-allocation of water supplies, with reductions in water for agriculture, mandatory reductions in water use for some users and mandatory conservation measures. The economic impacts of such restrictions can be severe for some sectors of the economy.

Droughts are a natural phenomenon arising from the normal fluctuations in weather and climate from year to year. Over the past century, California has had nine periods of drought. However, there is a consensus that global climate change is expected to increase both the frequency and the severity of future droughts.

Table 8.1 on the following page summarizes the major droughts in California over the past century.

Table 8.1: Historical Droughts in California[1,2]

Year(s)	Areas Affected	Disaster Proclamations
1917-1921	Statewide except central Sierra Nevada and north coast	No
1922-1926	Statewide except central Sierra Nevada	No
1928-1937	Statewide	No
1943-1951	Statewide	No
1959-1962	Statewide	No
1976-1977	Statewide, except for southwestern deserts	Presidential declaration; Statewide disaster proclamation
1987-1992	Statewide	No
2007-2009	Statewide, particularly the central coast	Statewide disaster proclamations (2008 and 2009)
2012-2015	Statewide	Statewide disaster proclamation (2014)

[1]Paulson et al 1991; [2]Cal OES, 2015

The 2012-2015 drought period continued through most of 2016. Heavy precipitation in late 2016 and early 2017 may be the end of this drought period.

Historical drought records have been extended for more than 1,000 years into the past, using tree growth ring records and other scientific methods. The 2012-2016 drought appears to be the most severe drought over the past 500 years.

Figures 8.1 and 8.2 on the following pages show the level of drought severity in Alameda County and Contra Costa County in mid-2016 and in January 2017.

In mid-2016, the entirety of both counties had “extreme” or “exceptional” drought levels per the United States Drought Monitor. Most of the areas had “extreme” drought, with the most eastern portions of both counties having “exceptional” drought.

In January 2017, the drought severity level was significantly reduced. Most locations in Alameda County and Contra Costa County have “normal” or “abnormally dry” conditions, with only small areas in the far eastern part of the counties having “moderate” drought conditions.

The frequency of droughts affecting the Park District varies with the severity of the droughts. Typically, short periods of reduced precipitation occur frequently – every few years. More severe droughts happen approximately every decade. Very severe droughts occur every few decades. However, the frequency and severity of future droughts is likely to increase because of global climate change. The likelihood of a period of drought occurring in a given year is about 10% to 40%.

Figure 8.1: Drought Severity in Mid-2016

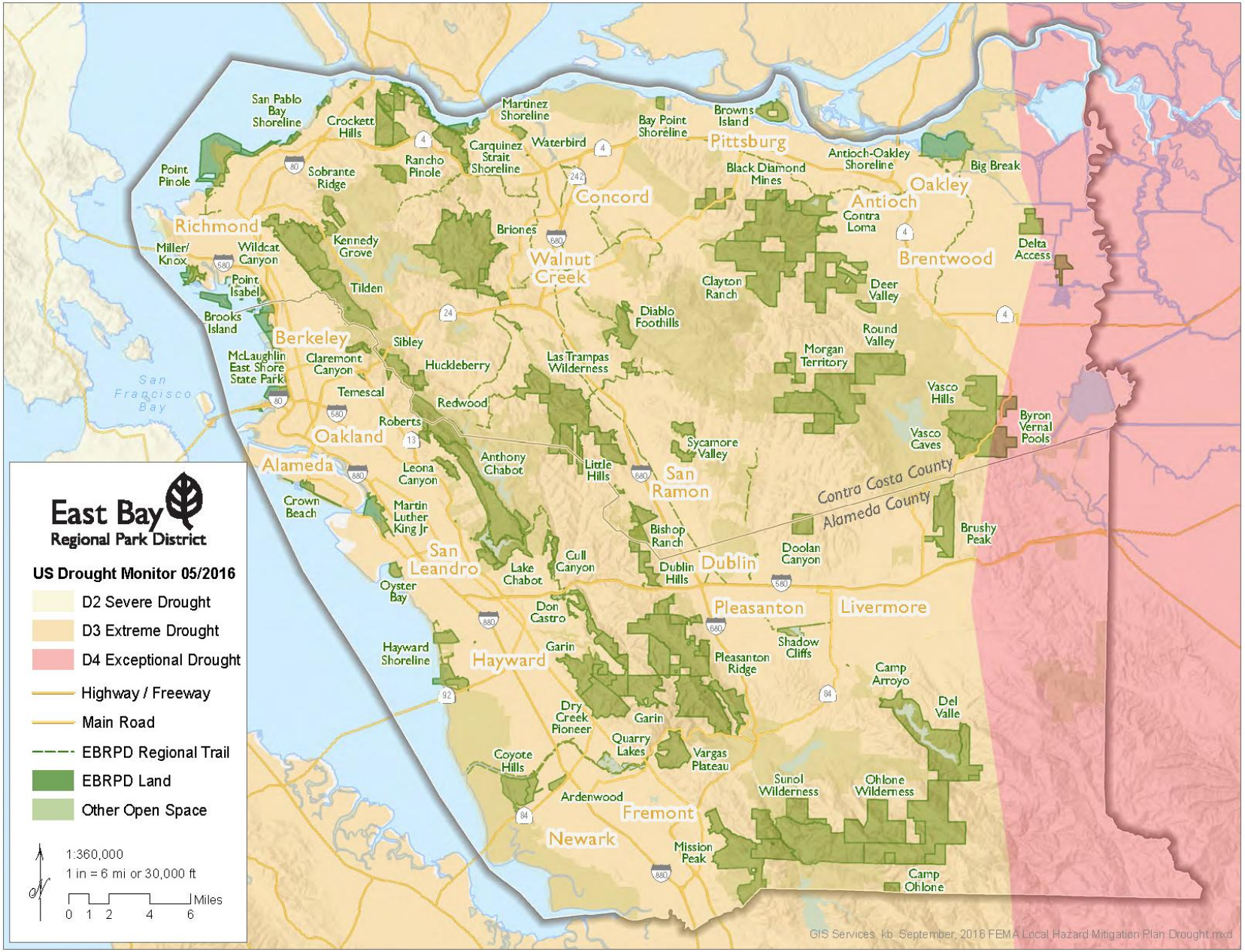
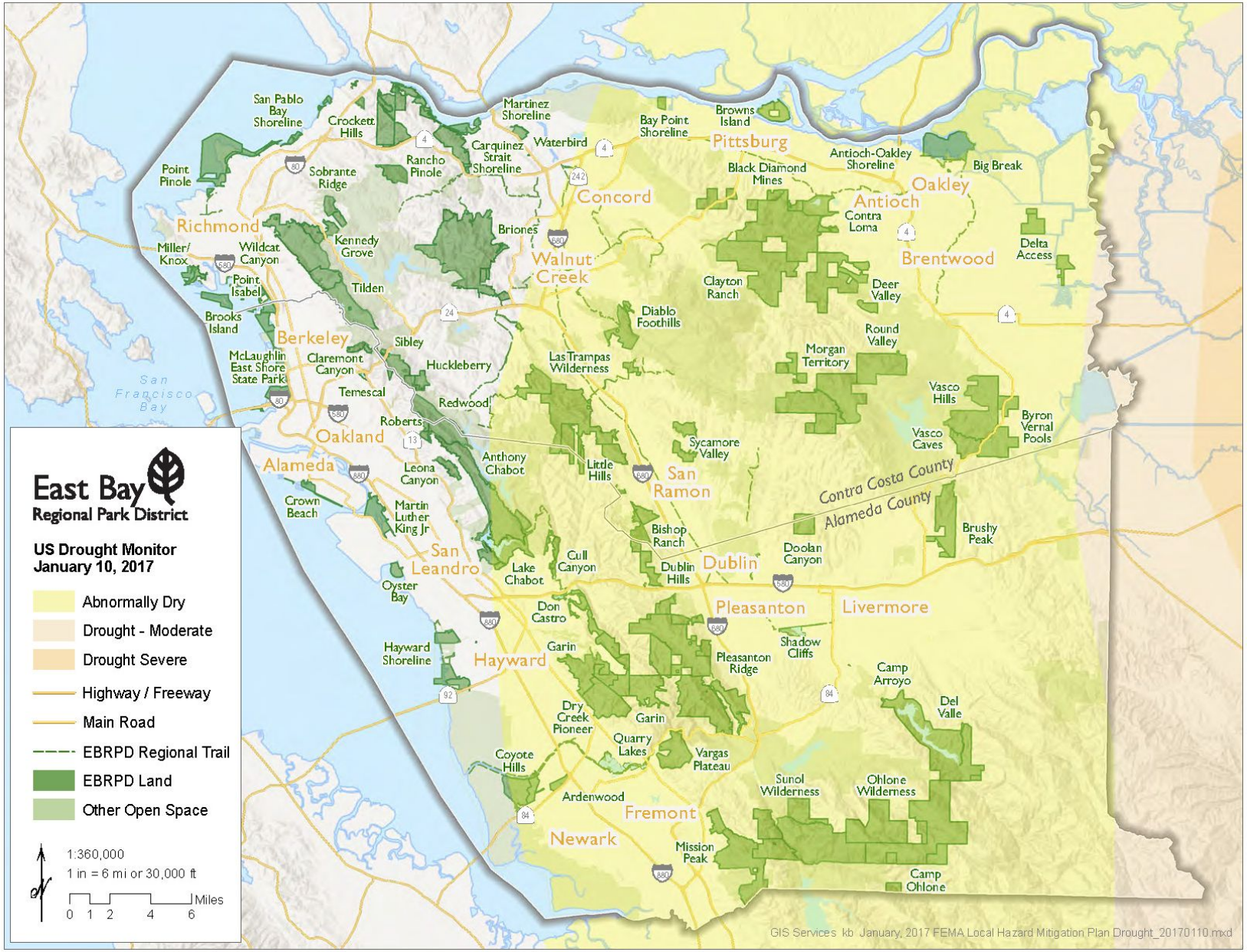


Figure 8.2: Drought Severity in January 2017



8.2 Drought Impacts on the East Bay Regional Park District

The impacts of severe droughts on the Park District include:

- Stress and damage to drought-sensitive ecosystems,
- Increased risk of wildland and wildland/urban interface fires,
- Increased tree deaths and tree falls, with increased costs for management of hazardous trees,
- Reductions in water available for irrigation, and
- Water use restrictions imposed by potable water suppliers.

For the Park District, the most severe impacts of droughts are likely to be stress and damage to drought-sensitive ecosystems and increased risk of wildland and wildland/urban interface fires.

The dollar costs to the Park District from drought include increased costs for removal of dead trees, which could range from a few thousand dollars to $100,000 or more. The greatest potential for dollar costs is from more severe wildland/urban interface fires that may affect not only the Park District but adjacent high density development. These costs could range from a few thousand dollars for very small fires, to several million dollars for larger fires. In extreme events, such as the 1991 Oakland Hills Fire, the damages could be several billion dollars.

8.3 Water Conservation and Drought Mitigation

Continuation and expansion of the Park District's ongoing water conservation measures is a high priority. The Park District's water conservation measures include:

- Installation timed irrigation systems with soil moisture sensors to avoid overwatering and to meet the target of 20% reduction in water use,
- Installation of low-flow showers, toilets and sinks in campgrounds, and
- Reduced use of cattle grazing for vegetation control, with reductions in water use to support cattle.

There are also larger scale strategies for meeting water needs during drought periods that apply predominantly to water utilities, including:

- Water transfers between utilities, which does not reduce overall water use, but does provide more efficient use of existing water supplies.
- Conjunctive management, the coordinated, planned use and management of both surface water and groundwater supplies.
- Recycled wastewater use for irrigation.
- Urban runoff management, including groundwater recharge.
- Desalination of brackish and sea water.

In some locations, the Park District may be able to implement some of these types of measures to at least a limited extent.

The Park District's Mitigation Action Items for drought are summarized in Table 8.2 on the following page.

Table 8:2 Mitigation Action Items for Drought

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Drought Mitigation Action Items									
Short-Term #1	Continue and enhance the Park District's water conservation measures, including xeriscaping.	Ongoing	District	Operations		X	X	X	X
Short-Term #1	Evaluate possible increases in water storage, including cisterns to provide emergency water for fire suppression and implement if feasible, as funding becomes available.	Ongoing	District	Operations	X	X	X	X	X

9.0 Floods

9.1 Introduction

Nineteen of the Park District's 65 parks are located along low lying areas on the Bay and Delta shoreline. These parks are most at risk from flooding resulting from storm events, tsunamis, levee failures and sea level rise. These parks are also subject to riverine flooding and local stormwater drainage flooding. As sea level continues to rise, some parts of some of the shoreline parks may become permanently unusable. The Park District's 46 inland parks may experience riverine flooding and/or stormwater water drainage flooding.

Portions of the East Bay Regional Park District are subject to flooding from several different flood sources including:

- Riverine flooding from rivers and streams,
- Coastal flooding from the combination of storm surges and high tides,
- Tsunamis,
- Local stormwater drainage flooding, and
- Flooding from failures of dams, reservoirs or levees.

Riverine flooding from rivers and streams, also known as overbank flooding, occurs most commonly from winter storms with heavy rainfall from November to February. Although less common, overbank flooding can also occur at other times of the year. The severity of overbank flooding depends primarily on flood depth. However, other factors such as flood duration, flow velocity, debris loads, and contamination with hazardous materials also may significantly impact the severity of any given flood event. The lower portions of coastal rivers and streams are more likely to flood during high tides with backwater conditions that lead to overbank flooding.

Coastal flooding for the Park District is generally associated with Pacific Ocean storms from November through February, especially when the peaks of storm-driven surges coincide with high tide and strong winds. The severity of coastal flooding depends not only on flood depths but also on wave effects and debris impacts. Wave pounding exerts substantial forces on structures and extended ponding by frequent waves may destroy structures not designed to withstand wave forces. Wave action may also destroy structures by erosion scour that undermine foundations. Debris impacts may greatly increase damages for a given flood depth.

Tsunamis generated by earthquakes anywhere in the Pacific Ocean can result in coastal flooding in San Francisco Bay. An offshore earthquake in the Cascadia subduction zone, stretching from Cape Mendocino, California to Vancouver Island, British Colombia could generate a significant tsunami for the Bay Area. Offshore earthquakes occurring elsewhere in the Pacific Rim could reach California with several hours warning for evacuation (CGS, 2005).

The anticipated tsunami events are likely to raise water levels in coastal areas by a few inches to a few feet and may result in localized, but significant damage. There are no known tsunami sources capable of generating large tsunamis within the San Francisco Bay Area.

Storm water drainage flooding occurs when inflows of storm water exceed the conveyance capacity of a local storm water drainage system. With this type of flooding, the drainage system overflows, resulting in water ponding in low lying areas. Storm water drainage flooding is generally localized, with flood depths that may range from a few inches to several feet. The Park District has many locations where flows in small, unnamed drainage channels may exceed the capacity of culverts resulting in scour and damage to culverts and trails. Severe events may result in damages to trails, roads and bridges.

Failures of dams, levees or reservoirs for potable water systems may result in flooding. Failures of major dams operated and regulated by state or federal agencies are possible, but unlikely because these dams are generally well-designed, well-monitored and well-maintained. Failures of smaller dams maintained by local governments, special districts or private owners are more common. Many of the dams and reservoirs within or upstream from the Park District's facilities are owned and operated by the East Bay Municipal Utility District (EBMUD) and other entities.

Levee failures occur not only from overtopping but also before overtopping and may occur at any time, not only during high water events but also under normal non-flood conditions. There are numerous causes for such failures, including scour, foundation failures, under-seepage, through-seepage, animal burrows, and others. Levees can also fail as a result of earthquakes.

Much of the land in the Sacramento-San Joaquin Delta Region is below sea level and is protected by approximately 1,115 miles of levees in the Delta and 230 miles of levees in the Suisun Marsh. Many of these levees were constructed at heights of three to five feet high and were maintained by local landowners over the past 100 plus years to protect farm land from flooding.

Today, most of these levees retain water 365 days a year. An earthquake that produces strong shaking in Delta Region Marsh could result in flooding of several or more islands. The probability of levee failure is increasing over time due to sea level rise, increased flooding potential from global climate range resulting in early winter snow melts, and the likelihood of an earthquake.

Failures of reservoirs for potable water systems occur, especially from earthquakes. These reservoirs typically have much smaller storage volumes than dams, so flooding from failures is generally localized, but may be severe where flows are confined in narrow channels which contain structures or infrastructure. Similar localized flooding may occur from failures of large diameter water pipes.

9.2 Flood Hazard and Risk Assessments

9.2.1 FEMA-Mapped Floodplains

FEMA Flood Insurance Rate Maps (FIRMs) delineate the regulatory (100-year) floodplain areas in California. Per FEMA regulations, there are limitations on new development within the 100-year floodplain.

FEMA mapped floodplains are shown in Figure 9.1 on the following page

The 100-year flood is defined probabilistically. A 100-year flood does not occur exactly every 100 years. Rather, the 100-year flood is the flood with a 1% chance of being exceeded in any given year. A 1% annual chance of flooding corresponds to about a 26% chance of flooding in a 30-year time period. A given location may have two or more 100-year (or greater) flood events within a few years or have none in several decades or longer. Figure 9.1 shows the parks that are located within FEMA 100 and 500-year flood zones. The Park District's Headquarters Building and Emergency Operations Center are not located within a mapped FEMA Flood Zone.

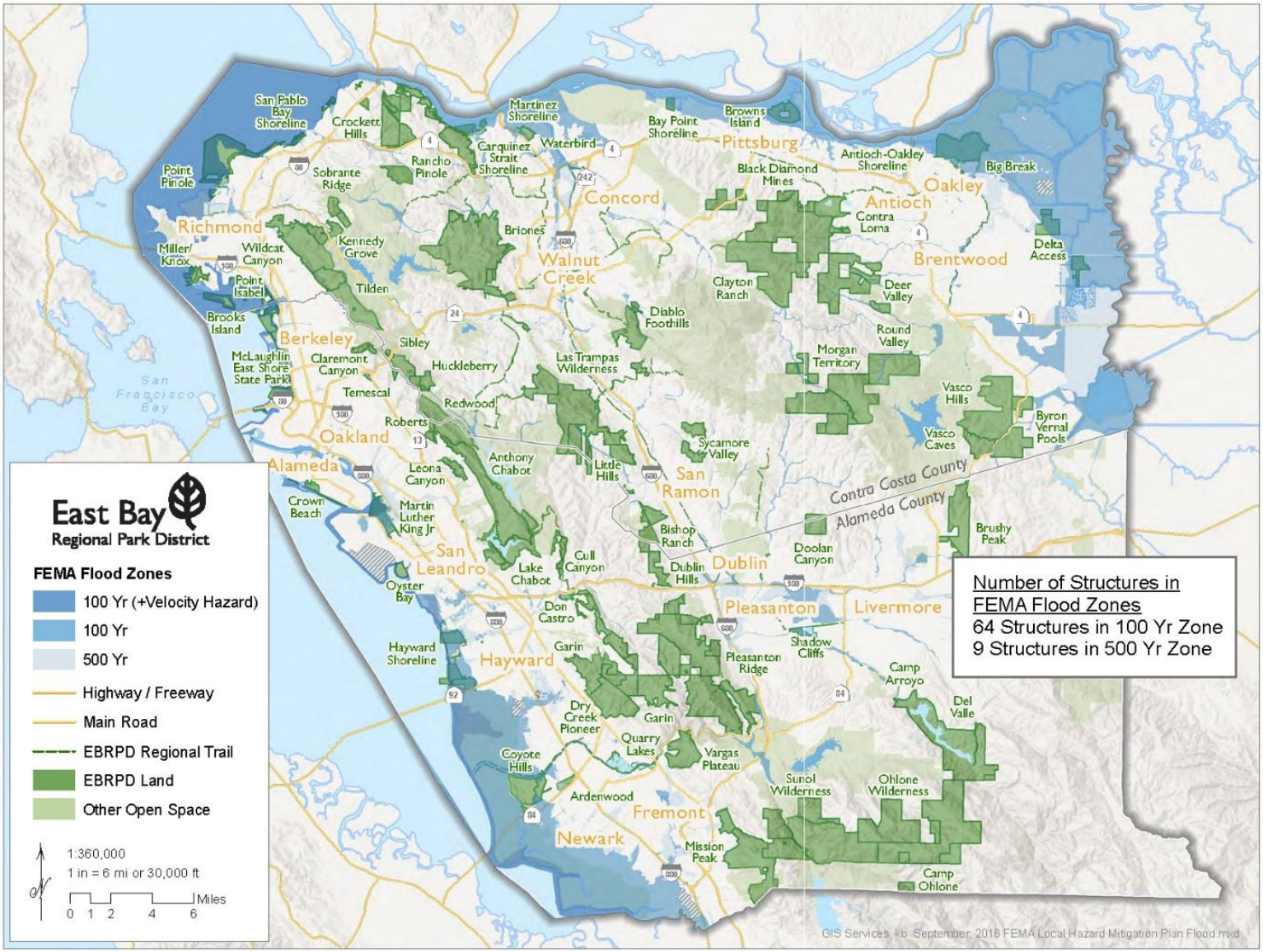
FEMA's floodplain mapping provides a good starting point for flood hazard risk assessments. Facilities and park lands within FEMA mapped floodplains have at least some level of flood risk. However, determining the level of risk quantitatively requires additional flood hazard data, including the elevation of facilities and habitat relative to the elevation of a range of flood events. It is also important to recognize that some facilities not within FEMA-mapped floodplains also have high levels of flood risk.

FEMA floodplain maps represent the best available data at the time the maps were prepared. The frequency and severity of coastal flooding is expected to gradually increase as sea level gradually rises. For riverine flooding, flood risk in a given location often increases with time because increasing development within the watershed increases runoff, and because development and fill within floodplains or sedimentation in a river channel may increase flood elevations. Flood risk at a given location may also decrease over time if flood control structures such as levees or upstream dams for flood control are constructed or improved. The FEMA flood maps were last updated in Alameda County and in Contra Costa County in 2015.

Recent and future FEMA floodplain maps are available in digital GIS-format and are known as DFIRMs. For any given location, the most recent FEMA maps should be used for flood risk assessments. The most updated DFIRMS can be accessed at https://msc.fema.gov/portal/search.

The parks that have at least portions of their areas in FEMA-mapped 100-year or 500-year floodplains are listed in Table 9.1. Nearly all of the parks have at least some areas in mapped floodplain.

Figure 9.1: EBRPD Parks Within FEMA Flood Zones



Source: FEMA, 2015

Table 9.1: Parks with Areas within FEMA-Mapped 100-Year or 500-Year Floodplains

FEMA 100 Year Floodplain Park List	
Alameda Creek Trail	Huckleberry Botanic
Alameda Point Shoreline Trail	Kennedy Grove
Antioch/Oakley Shoreline	Lafayette-Moraga Trail
Bay Point Shoreline	Las Trampas
Big Break Regional Trail	Martin Luther King Jr. Shore
Big Break Shoreline	Martinez Shoreline
Black Diamond Mines	McLaughlin Eastshore St Park
Briones	Miller/Knox
Briones-Las Trampas Trail	Morgan Territory
Briones-Martinez Trail	Niles Canyon Trail
Brooks Island	North Richmond Shoreline
Browns Island	Oyster Bay
Byron Vernal Pools	Point Isabel
CA State Riding & Hiking Trail	Point Pinole
Carquinez Strait Shoreline	Quarry Lakes
Contra Costa Trails	Round Valley
Contra Loma	San Pablo Bay
Coyote Hills	SF Bay Trail
Crown Beach	Shadow Cliffs
Deer Valley	Tassajara Creek Trail
Del Valle	Temescal
Delta Access	Tilden (Nature Area)
Delta/DeAnza Trail	Vasco Caves
Diablo Foothills	Vasco Hills
Don Castro	Waterbird
Dry Creek Pioneer	Wildcat Canyon
East Bay Gateway	Wildcat Creek Trail

FEMA 500 Year Floodplain Park List	
Ardenwood	McLaughlin Eastshore St Park
Briones-Las Trampas Trail	Oyster Bay
Briones-Mt Diablo Trail	Pleasanton Ridge
Brushy Peak	Point Pinole
Delta Access	San Pablo Bay
Lafayette-Moraga Trail	SF Bay Trail
Martin Luther King Jr. Shore	Vargas Plateau
Martinez Shoreline	Wildcat Creek Trail

FEMA floodplain maps identify several types of flood zones, with varying levels of flood hazard. The FEMA flood zone designations have evolved over time, with older maps using different nomenclature than recent maps.

Table 9.2: FEMA Flood Zones

HIGH RISK AREAS

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over 30 years. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE, A1 – A30	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over 30 years. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over 30 years. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam).
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

HIGH RISK COASTAL AREAS

ZONE	DESCRIPTION
V	Coastal areas with a 1% of greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over 30 years. No base flood elevations are shown with these zones.
VE, V1 – V30	Coastal areas with a 1% of greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over 30 years. Base flood elevations derived from detailed analysis are shown at selected intervals within these zones.

MODERATE TO LOW RISK AREAS

ZONE	DESCRIPTION
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.

UNDETERMINED RISK AREAS

ZONE	DESCRIPTION
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

FEMA Flood Insurance Rate Maps are always accompanied by Flood Insurance Studies. Flood Insurance Studies contain summaries of historical floods, details of the flood mapping and quantitative flood hazard data, which is essential for quantitative flood risk assessments. FEMA Flood Insurance Studies and Flood Insurance Rate Maps include a large number of terms of art and acronyms. A good summary of the terms used in flood hazard mapping is available from FEMA (FEMA, 2006).

The level of flood hazard (frequency and severity of flooding) for a given park or building is not determined simply by whether the park or building is or is not within the mapped 100-year floodplain. Rather, the level of flood hazard depends to a great extent on the elevation of the park or building elevation relative to the elevation of floods of various return periods, such as 10-years or 50-years or 100-years.

9.2.2 Flooding Outside FEMA Mapped Floodplains

Flood hazard areas for the Park District are not limited to areas within FEMA-mapped floodplains. There are many flood-prone locations within the Park District that are not FEMA-mapped because there is not enough development to warrant FEMA mapping. Locations within the Park District that areas outside of FEMA-mapped floodplains may have significant flood risk if any of the following conditions apply:

- There is a history of floods from any source affecting or near a park or facility.
- Local storm water drainage flooding is common on or near a park or facility.
- A Park or facility is near a river or stream or drainage channel not mapped by FEMA.
- A Park or facility is behind a levee or downstream of a dam or reservoir.

For flood-prone locations without quantitative flood hazard data, a different approach is required to evaluate flood hazards and flood risk than for locations where neither a FEMA Flood Insurance Study nor an equivalent local flood study provide the stream discharge and flood elevation data necessary for quantitative calculations.

There most direct way to identify flood-prone locations is simply to identify locations with at least one damaging flood event and especially to identify locations with multiple past damaging flood events.

For flood prone locations with high value or high importance buildings or infrastructure, more quantitative evaluations may be warranted, including:

- Complete a local hydrologic and hydraulic study completed to obtain the types of quantitative flood hazard data contained in a FEMA Flood Insurance Study. Such local studies may also be worthwhile when the FEMA Flood Insurance Study is old and there are reasons, such as increased development in the watershed, to suspect that flood hazards may have significantly increased.

- For locations subject to stormwater drainage flooding, engineers knowledgeable about the stormwater system may be able to provide quantitative data on the conveyance capacity of the system to supplement historical flood data. Stormwater systems are often designed to handle only 2-year or 5-year flood events, and are infrequently designed to handle rainfall events greater than 10-year or 15-year events.

- For locations behind levees or downstream from dams or reservoirs, further evaluations requires consultation with subject matter experts to determine the likelihood of future failures resulting in flooding.

One important caveat is that the absence of a history of past flood events may indicate that flood risk is low, but this is not necessarily the case. Flood risk is inherently probabilistic. A park location that hasn't had a flood in 10, or 20 or 30 years may have just been "lucky" and flood damage might occur with floods of similar return periods. Or, the flood risk might have increased over time because of increasing development upstream in the watershed (which increases runoff) or because of channel changes. Or, a park might not have frequent flooding, but the level of damages for a 50-year or 100-year event might be very severe. Furthermore, gradual sea level risk is likely to extend future flooding to locations near the coast that have not yet experienced a significant flood.

9.3 Historical Floods Affecting the Park District

Historically, flooding associated with severe winter storms has been among the most common disasters in the Bay Area. The Park District has frequently suffered significant damage in past severe winter storms from floods as well as from high winds, landslides, debris flows and erosion. The most common damage from winter storms have been to infrastructure, including:

- Washouts of culverts and trails,
- Landslides or debris slides affecting roads, trails and bridges,
- Erosion of channels and adjacent areas, and
- Tree falls.

The Park District generally has several winter storm events every year, with damages in these events ranging from minor cleanup to millions of dollars. Three severe events were in 1986, 1998 and 2005-2006:

- Winter of 1996 heavy flood damage at Del Valle Lake. Detailed damage estimates are not available for this event.
- February 2, 1998 – El Nino – FEMA DR 1203. The Park District suffered nearly $1.2 million in damages to 34 sites due to this disaster due to flooding, landslides, debris flows and erosion.
- December 17, 2005 to January 12, 2006 – Winter Storms – FEMA DR 1628. The Park District suffered over $6 million in damages to 52 sites due to flooding, landslides, debris flows and erosion

Since the adoption of the Park District's 2010 Hazard Mitigation Plan, there have been one more significant flood event:

- March 2016 – severe winter storms with flooding, landslides, debris flows, and erosion. Major landslides in Wildcat Canyon, Richmond and Claremont Canyon.

The preliminary estimates for flood damage in March 2016 is $2,193,000 based on damage reports submitted by the Park District to Cal OES and FEMA. These damage included approximately $1.5 million at Del Valle Regional Park and smaller damages at numerous locations in both Alameda and Contra Costa counties.

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9.4 Sea Level Rise

9.4.1 Overview

Coastal flood events are expected to become more frequent and more severe in the future because of global warming and sea level rise. Sea level rise will also increase the likelihood of major flood events in the Bay Area because higher water levels in tidal creeks and flood control channels will reduce the capacity to discharge rainfall runoff. While some creeks already flood when rainstorms coincide with high tides, rising sea levels will cause flooding during smaller, more frequent rainfall events.

The National Research Council (NRC) *Sea-Level Rise for the Coasts of California, Oregon, and Washington* study (2012) has provided regionally-specific sea level rise projections for the west coast.

Table 9.3: Regional Sea Level Rise Projections Relative to Year 2000 for the California Coast South of Cape Mendocino

Year	NRC Projected Sea Level Rise (inches) with Standard Deviation of Uncertainty (A1B Scenario)[1]
2030	5.6 (±1.9)
2050	11.0 (±3.6)
2100	36.1 (±10)

Source: (National Research Council, 2012)

Sea level rise will increase the frequency and severity of coastal flooding. Human interventions to reduce the rate of global warming may partially reduce the severity of future impacts, but cannot eliminate the impacts. The expected impacts of rising sea levels include:

- More frequent floods: Rising sea levels will lead to more frequent flooding of existing flood-prone areas, including more frequent overtopping and overbank flooding of riverine systems that already flood when rainfall coincides with high tides due to the increased backwater effect. In addition, gravity drained and pumped systems that discharge stormwater into flood control channels can have reduced performance, causing backups and flooding of streets.

- More extensive, longer-duration flooding: As sea levels rise, storm events will flood larger areas for longer periods of time and that there will be new

[1] The A1 scenario family assumes high economic growth, low population growth that peaks mid-century, and the rapid introduction of more efficient technologies (A1B is balanced and A1FI is fossil fuel intensive). The B1 scenario family assumes the same low population growth as the A1 scenarios, but a shift toward a lower-emission service and information economy and cleaner technologies.

overtopping and overbank flooding of riverine systems that that do not currently cause flooding.

- Shoreline erosion and overtopping: Sea level rise may cause shoreline protection, such as levees, berms and revetments, to be damaged or fail to due to increased tidal and wave energy. There is also the potential that shoreline protection will be overtopped during storm events when there are extreme tide levels and wind-driven waves, flooding inland areas, including homes and community services that are currently protected.

- Elevated groundwater and increased salinity intrusion: As sea levels rise, groundwater and salinity levels are also predicted to rise. This may cause damage to below grade living spaces, finished basements, and electrical/mechanical equipment that is below or at-grade. In addition, increasing groundwater levels may increase liquefaction susceptibility, and require the use of pumping of stormwater for flood management, which will increase both operations and maintenance costs.

- Permanent inundation: Sea level rise can cause areas that are not currently exposed to regular high tide inundation to be flooded, resulting in the need to either protect or move people and infrastructure, and the loss of trails, beaches, vistas, and other shoreline recreation areas. In addition, increased tidal scour due to increased tidal prism in riverine systems can trigger changes in channel geometry and sediment transport processes.

9.4.2 Sea Level Rise Effects on the Park District

The Adapting to Rising Tides Program (ART) of the Bay Conservation Development Commission undertook an analysis to understand the sea level rise vulnerability and risk to shoreline parks within the Park District. In many locations, the Park District flood protection systems protect not only its own park and recreation areas, but also inland development, such as that managed by Union Pacific Railroad, cities, and private land owners (Adapting to Rising Tides, 2015a).

ART Program staff and Park District supervisors completed surveys and site visits to determine the sensitivity of park resources for nine parks along the shoreline to both temporary and permanent flooding. The sea level rise maps used to evaluate park exposure do not account for the nearshore dynamic processes, such as beach and shore erosion that are likely to occur within natural areas. Therefore, the estimates of the percentage of shoreline parks expected to be flooded are conservative estimates of the potential impact to these areas. The actual impacts may be even more severe.

The following table shows the percentages of parks and trails inundated for three future sea level rises of 12, 48 and 96 inches (1, 4 and 6 feet).

Table 9.4: Percentage of Parks and Trails Inundated for Three Future Sea Levels

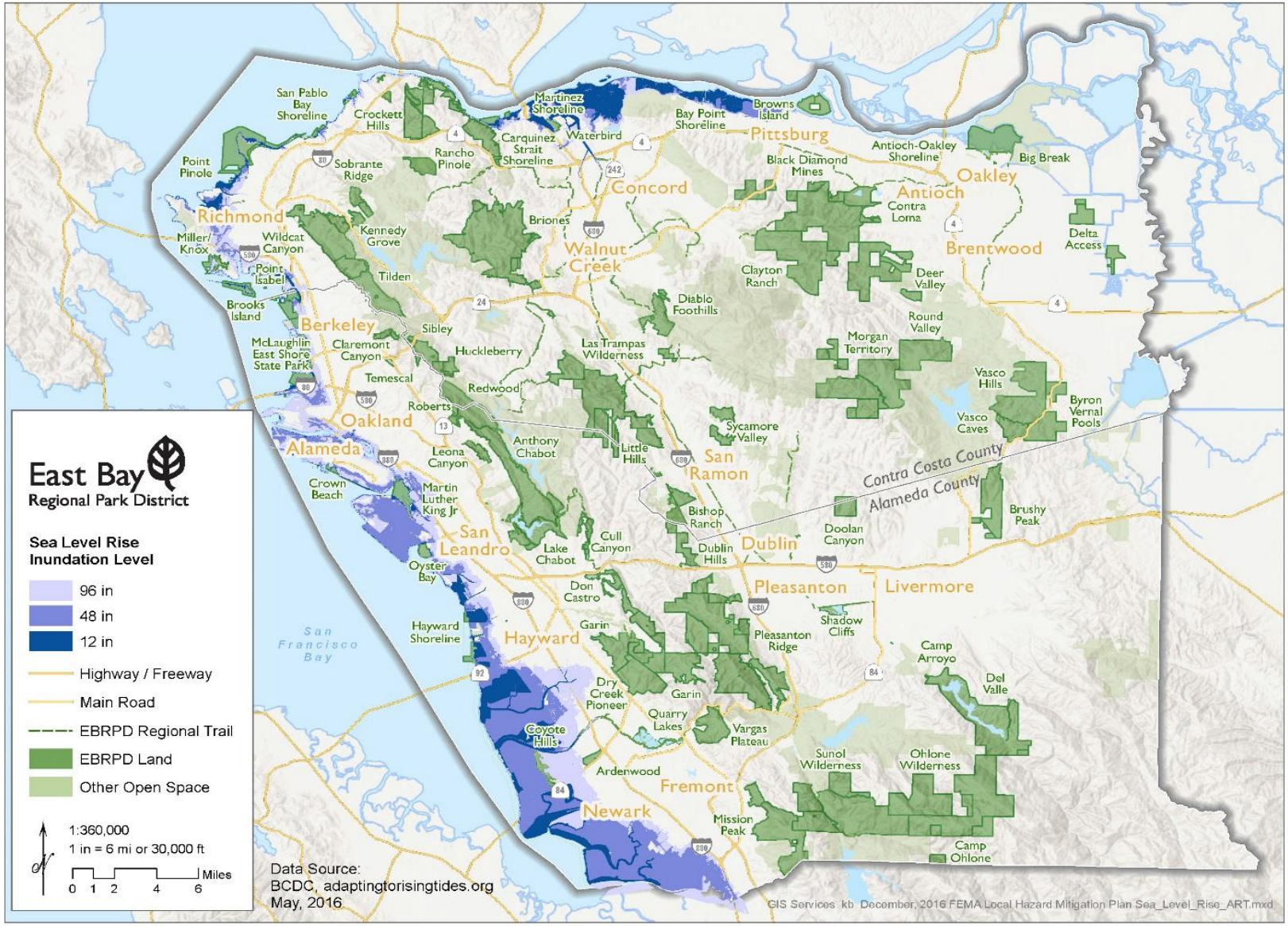
Park Name	12 inches	48 inches	96 inches
Alameda Creek Trail	0%	3%	92%
Alameda Point Shoreline Trail	0%	15%	100%
Bay Point Shoreline	51%	78%	87%
Brooks Island	6%	9%	11%
Carquinez Strait Shoreline	0%	0%	0%
Coyote Hills	0%	0%	71%
Coyote Hills-Ardenwood Trail	0%	0%	98%
Crown Beach	0%	24%	52%
Delta/DeAnza Trail	0%	0%	9%
East Bay Gateway	0%	56%	70%
Hayward Shoreline	0%	76%	79%
Martin Luther King Jr. Shore	0%	19%	28%
Martinez Shoreline	20%	30%	44%
McLaughlin Eastshore St Park	2%	8%	14%
Miller/Knox	1%	1%	16%
North Richmond Shoreline	59%	70%	70%
Oyster Bay	0%	3%	6%
Point Isabel	14%	20%	63%
Point Pinole	5%	10%	13%
San Pablo Bay	5%	11%	15%
SF Bay Trail	0%	0%	100%
Waterbird	31%	35%	39%
Wildcat Creek Trail	2%	31%	44%

Source: (Adapting to Rising Tides, 2015a,b)

Figure 9.2 on page 9-13 shows areas inundated with various levels of sea level rise. This map was developed by the Adapting to Rising Tides Program (2015b). This map does not consider natural processes such as erosion or marsh migration that will be affected by future sea level rise. Detailed vulnerability assessments for each park are described in the ART report (Adapting to Rising Tides, 2015a).

All of the parks evaluated are exposed to at least some level of inundation from sea level rise. Low-lying parks consisting mostly of wetlands, such as the North Richmond Shoreline, Bay Point Shoreline, Martinez Shoreline, Point Isabel and Waterbird will be significantly impacted much sooner with only one foot of sea level rise and will be nearly inundated with 6 feet of sea level rise. Higher elevation parks, such as Miller Knox Regional Shoreline and Oyster Bay Regional Shoreline, will only experience limited inundation even with eight feet of sea level rise. The NRC prediction of a three feet sea level rise by 2100 is the most likely sea level rise scenario for the San Francisco Bay. This level of risk would mean that daily tides in 2100 would be comparable to today's 100-year coastal storm event.

Figure 9.2: EBRPD Parks with Projected Sea Level Rise Scenarios



Projected rise in sea level rise will impact the Park District's 40 miles of Bay Shoreline through increased sand and bank erosion, as well as the loss of land, directly affecting the Bay Trail, piers, levees, boat launches, developed wetland areas and other shoreline facilities. Although much of the Park District's shoreline ownership is off-shore wetlands, the protected open space serves an essential function as a buffering mechanism for adjacent communities against storm damage and tidal flooding. The Park District is already facing major expenses for beach and replacement at Crown Beach and levee repair to protect marsh habitat along the Hayward Shoreline.

9.5 National Flood Insurance Program (NFIP) Insured Structures

The Park District does not participate in the National Flood Insurance Program and has no NFIP insured structures. The Park District also does not participate in the Community Rating System.

9.6 Damage Estimates for Future Floods

The Park District has two distinct types of flooding:

- Flooding in non-coastal areas of the Park District is from overbank flooding from streams and lakes as well as stormwater drainage flooding.
- Flooding in coastal areas of the Park District is predominantly from high water events in San Francisco Bay or San Pablo Bay from high tides, storm surges, and tsunamis.

For the non-coastal areas of the Park District, flood damages are likely to be generally comparable to that experienced over the past several decades, which included three major events with flood damages from approximately $1 million to several million dollars and numerous smaller events with damages from a few thousand dollars to several hundred thousand dollars. There are two caveats on this generalization. First, future repair costs for flood events similar to historical flood evens will be higher because of inflation in costs over the decades. Second, flood events significantly larger than those experienced to date are possible. Rainfall events with long return periods, such as 50-, 100- or 500-years could occur in any given year. For more severe rainfall events than have been experienced to date, flood damages to the Park District could be $5 million to $10 million or more.

For the coastal areas of the Park District, sea level rise will substantially increase the severity and frequency of flood damages, including permanent flooding from daily tides in the lowest elevation areas of coastal parks. Quantitative estimates of the expected damage to Park District facilities are not available.

The commentary above for flooding in non-coastal and coastal parks applies in the absence of implementation of flood mitigation measures. The Park District's goal is

to reduce future flood damages to the extent practical, contingent on the availability of funding.

9.7 Mitigation for Flood Hazards

The key goals of the Park District's flood mitigation program include:

- Reduce current and future flooding risk on Park District-owned and managed land to an acceptable level,
- Maintain and enhance natural habitat and wildlife along the shoreline and in flood prone areas, and
- Preserve aesthetic landscape values for park users and neighboring communities.

Over the years, the Park District's role has expanded to include a greater range of management objectives on the parklands it owns and operates, including natural area restoration, community engagement, and new partnerships with neighboring landowners. Climate change will further stress the Park District's management of shoreline and flood-prone parks and facilities and increase the risk of flood hazards.

The Park District has already undertaken a number of projects to improve its vulnerability to current and future flooding and is committed to continuing to work with its partner and neighboring agencies to plan for and address the increasing flood risk along the Bay shoreline and inland flood areas. Since the adoption of the 2010 Local Hazard Mitigation Plan, the Park District has undertaken the following flood mitigation projects.

- **Crown Memorial Beach Restoration.** In response to erosion and increased flood risk, the Park District undertook sand replacement at Crown Memorial Beach in Alameda in 2013. The nearly 2-mile long, man-made beach faced significant sand loss over the years as projected due to ordinary erosion and through damage from severe storm events. The project included bringing in more than 82,000 cubic yards of sand and grading it to conform to the 1988 as-built beach footprint. The project also includes the shoreward extension of the existing groin structure located near the foot of Park Street that separates the beach from the Elsie Roemer Bird Sanctuary. The extension of the groin will help keep additional sand out of the bird sanctuary, which will benefit the wildlife habitat. This phase of the project is ongoing in 2016. Funding for the project came from FEMA, the California Department of Boating and Waterways, California Department of Fish and Game, City of Alameda, and Measure WW Bond.

- **Hayward Marsh Restoration and Enhancement Project.** The Hayward Marsh was constructed under dry site conditions in 1980 and has not been dredged or improved since its construction. Thirty years of operation has

resulted in a significant amount of sedimentation in the interior marsh channels and reduces the ability of the marsh to treat wastewater and provide bird and fish habitat. Islands in the marsh currently support populations of CA least tern and western snowy plover. This project will help significantly enhance the marsh to provide additional habitat for these species and insure that their existing habitat is protected. The marsh is also currently experiencing levee failures and is in severe need of levee maintenance. This project will completely restore the interior levees of the marsh to ensure that the habitat of the marsh is maintained. The interior levee repairs will maintain the treatment aspects of the marsh so the marsh can continue to treat wastewater and reduce the potential for sanitary sewer overflows. Additionally, this project will help repair outboard levees along the San Francisco Bay and provide additional flood protection benefits to combat sea level rise for the residents of city of Hayward. This project is being funded from Measure WW Bond funds.

- **Bay Point Regional Shoreline Wetland Restoration project.** The project is located on Suisun Bay in the unincorporated community of Bay Point in eastern Contra Costa County. The project will preserve and restore 48-acre piece of Suisun Bay marshland and to provide public access to the bay shoreline. Actions being undertaken for marsh restoration include draining seasonal non-tidal ponds; dredging, excavating, and grading; and creating new channels to allow tidal waters to enter the existing ponds. The project will provide better circulation and exchange between Suisun Bay and the existing tidal marsh areas, improve water quality for fishery habitat, improve site drainage and water quality, increase stormwater storage and passive treatment capacity, and stabilize the eroding shoreline.

The Park District's Master Plan includes the following flood mitigation elements:

- Reserve funding for repair and maintenance of shoreline facilities from storm damage resulting from sea level rise, including the protection of tidal marsh habitat,
- Plan new facilities to ensure maximum sustainability in anticipation of rising tidal levels,
- Continue to work with other concerned agencies and programs, such as the San Francisco Bay Conservation and Development Commission (BCDC), National Oceanic and Atmospheric Administration (NOAA), the Adapting to Rising Tides (ART) Program, U.S. Army Corps of Engineers (ACOE), and the Alameda and Contra Costa Flood Control Districts, to plan and manage for sea level rise.

The Park District's Mitigation Action Items for floods are shown in Table 9.5 on the following page.

Table 9.5: Flood Mitigation Action Items

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Flood Mitigation Action Items									
Short-Term #1	Evaluate the adequacy of existing levees for floods, including storm surge, tsunamis and sea level rise and develop prioritized mitigation actions.	1-3 Years	District	Planning	X	X	X	X	X
Short-Term #2	Compile and maintain an inventory of sites with a history of overbank flooding or localized stormwater drainage flooding and develop prioritized mitigation actions.	1-3 Years	District	GIS	X	X	X	X	X
Short-Term #3	Enhance emergency planning, including flood response actions including flood fighting via temporary barriers, for sites with significant flood risk.	1-2 Years	District	Operations	X	X	X	X	X
Long-Term #1	Implement flood risk reduction measures for shoreline facilities or sites with high flood risk, including levees at Hayward Shoreline, shoreline protection along the Bay and recreational facilities at Lake Del Valle, as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #2	Implement flood risk reduction measures for facilities or sites with high flood risk from overbank or stormwater drainage flooding, as funding becomes available.	Ongoing	District or Grants	Operations	X	X	X	X	X
Long-Term #3	Locate new facilities outside of areas with significant flood risk, whenever possible.	Ongoing	District or Grants	Design	X	X	X	X	X

9.8 References

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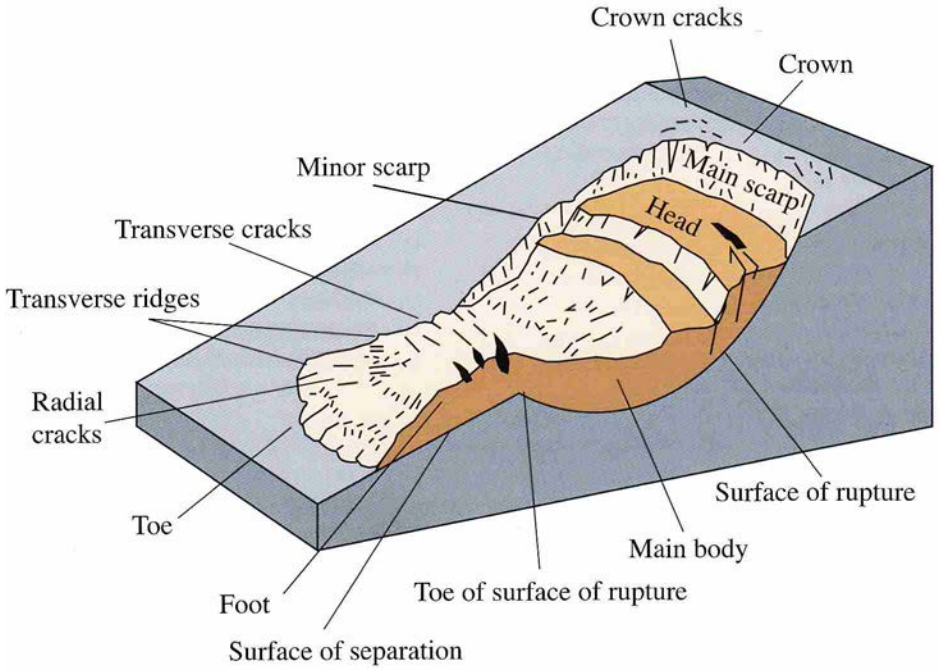
10.0 Landslides

10.1 Introduction

The term “landslide” refers to a variety of slope instabilities that result in the downward and outward movement of slope-forming materials, including rocks, soils and vegetation. The slope-forming materials may move by falling, toppling, sliding, spreading, or flowing.

The descriptive nomenclature for landslides is summarized in the following figure.

Figure 10.1: Landslide Nomenclature



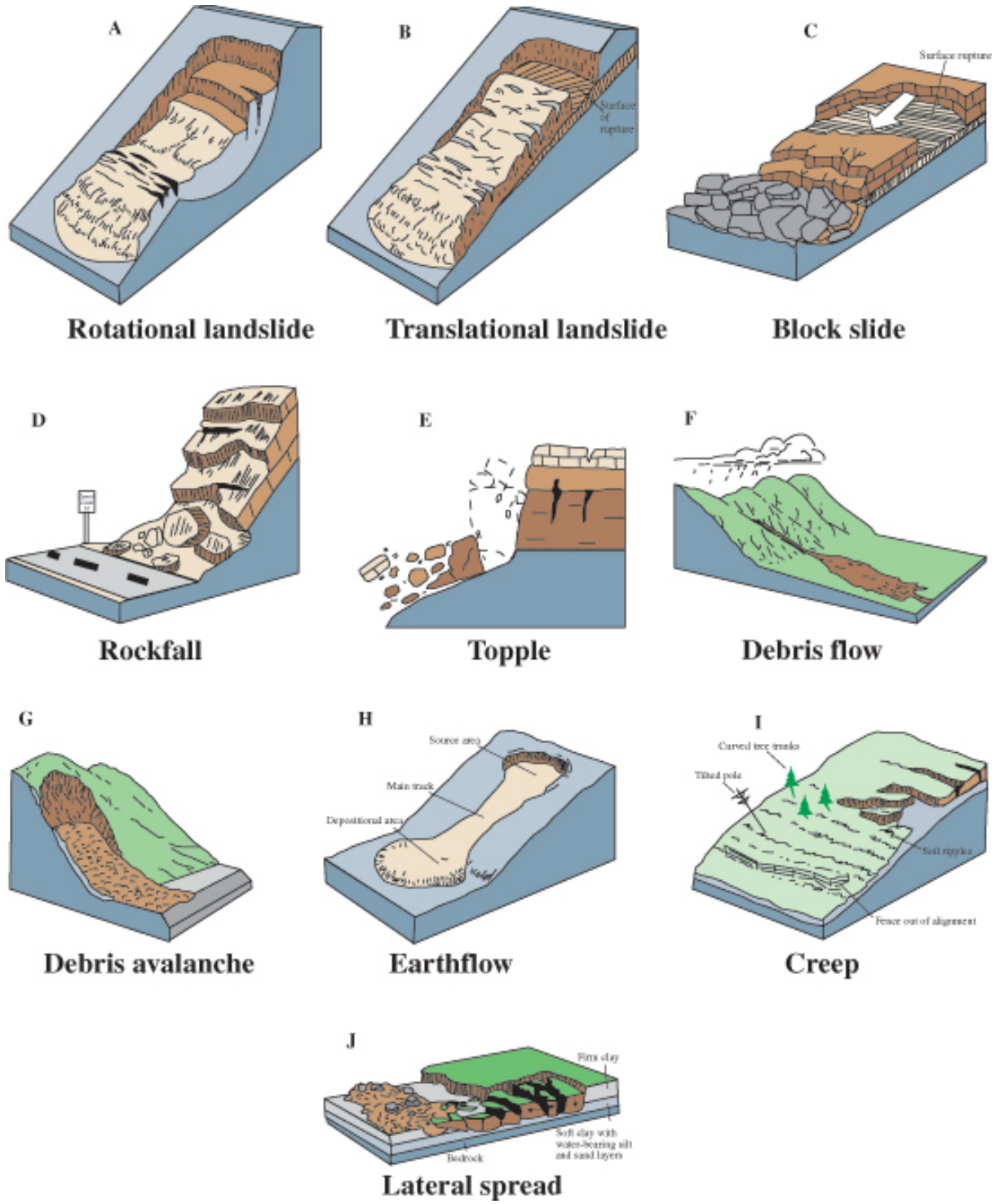
Source: (U.S. Geological Survey, 2004)

10.2 Types of Landslides

The various types of landslides are differentiated based on the types of materials involved and the mode of movement. The most common types of landslides are shown in Figure 10.2 on the following page.

The most common type of landslide in the East Bay hills are debris flows and mudslides in which a combination of loose soil, rock, organic matter, air, and water mobilize as a slurry that flows downslope. Mudflows are differentiated from debris flows by more than half of the material containing sand-, silt-, and clay-size particles. Debris flows and mudslides are commonly initiated during heavy rainfall events that mobilize loose soil or rock on steep slopes. Debris flows can move very rapidly, at rates ranging from meters per hour to meters per second and travel relatively long distances, making them a significant threat to life and property.

Figure 10.2: Major Types of Landslides



Source: (U.S. Geological Survey, 2004)

Debris flows and mudslides are closely related to flooding, as both processes are related to precipitation, runoff, and the saturation of ground by water. In addition, landslides and mudflows usually occur on small, steep stream channels and are often mistaken for floods. However, landslides and mudslides may be much more destructive than floods because of their higher densities, high debris loads, and high velocities. Figure 10.3 shows a small debris flow. Intense 1998 El Níño rains activated this debris flow type of landslide in eastern Fremont in southern Alameda County.

Figure 10.3: Debris Flow Example

Source**:** (Roberts, Roberts, & Brennan, 1999)

The East Bay hills are also susceptible to deep seated landslides, translational or rotational earth slides and rock slides, especially following long periods of cumulative rainfall. Deep seated landslides can occur long after the rain has stopped. Deep seated landslides tend to be on the order of a few meters to tens of meters deep. This type of landslide tends to fail the hillside a little at a time and to move more slowly than debris flows, but some of these landslides can move quickly.

Any type of landslide may result in damages or complete destruction of buildings in their path, as well as deaths and injuries. Landslides frequently cause road blockages by depositing debris on road surfaces or road damage if the road surface itself slides downhill. Utility lines and pipes are also prone to breakage in slide areas.

10.3 Landslide Susceptibility

There are three main factors that determine the susceptibility (potential) for landslides:

1) Slope,
2) Soil/rock characteristics, and
3) Water content.

Steeper slopes are more prone to all types of landslides. Loose, weak rock or soil is more prone to landslides than are competent rocks or dense, firm soils. Water saturated soils or rocks with a high-water table are much more prone to landslides because the water pore pressure decreases the shear strength of the soil or rock and thus increases the probability of sliding.

Landslides are most likely to occur in or near places where they have occurred in the past. Areas that are susceptible to landslides also include:

- On or at the base of steep slopes,
- At the base or top of a fill slope,
- At the base or top of a steep cut slope,
- In or at the base of swale or drainage hollow.

Also, areas were fires or drought have denuded slopes of vegetation are very prone to debris flows and mudslides.

Most landslides occur during rainy months when soils are saturated with water. As noted previously, the water content of soils or rock is a major factor in determining the likelihood of sliding for any given landslide-prone location. Cumulative rainfall over the winter months can also make hillsides more susceptible to landslides. However, landslides may occur at any time of year, in dry months as well as in rainy ones.

Landslides are also commonly triggered by earthquakes. Areas prone to seismically triggered landslides are generally the same as those prone to ordinary (non-seismic) landslides. As with ordinary landslides, seismically triggered landslides are more likely from earthquakes that occur when soils are saturated with water.

10.4 Historical Landslides

Flooding and landslides associated with severe storms have historically been the most common disasters in the Bay Area. Extensive landslides have occurred 24 times since 1950, approximately once every three years, since 1950 (California Governor's Office of Emergency Services, 2013).

Since 1997, the Park District has sustained major damage from two declared disasters, both related to severe storms. In these disasters, the Park District suffered damage due to flooding, landslides, debris flows and erosion. In each of these storms, heavy rainfall was correlated with locations with high concentrations of landslides.

February 2, 1998 – El Niño – DR 1203

EBRPD suffered nearly $1.2 million in damages to 34 sites due to this disaster. Landslides were widespread throughout the entire Bay Area. However, the concentration of landslides was particularly high in the East Bay hills. The USGS documented approximately 300 landslides in the Bay Area and Santa Cruz County, with approximately $150 million in damage (Godt, 1999).

Figures 10.4 and 10.5 on the following pages show locations of damaging landslides in Alameda County and Contra Costa County, respectively.

December 17, 2005 to January 12, 2006 – Winter Storms – DR 1628

The Park District EBRPD suffered over $6 million in damages to 52 sites due to this disaster from flooding, landslides, debris flows and erosion.

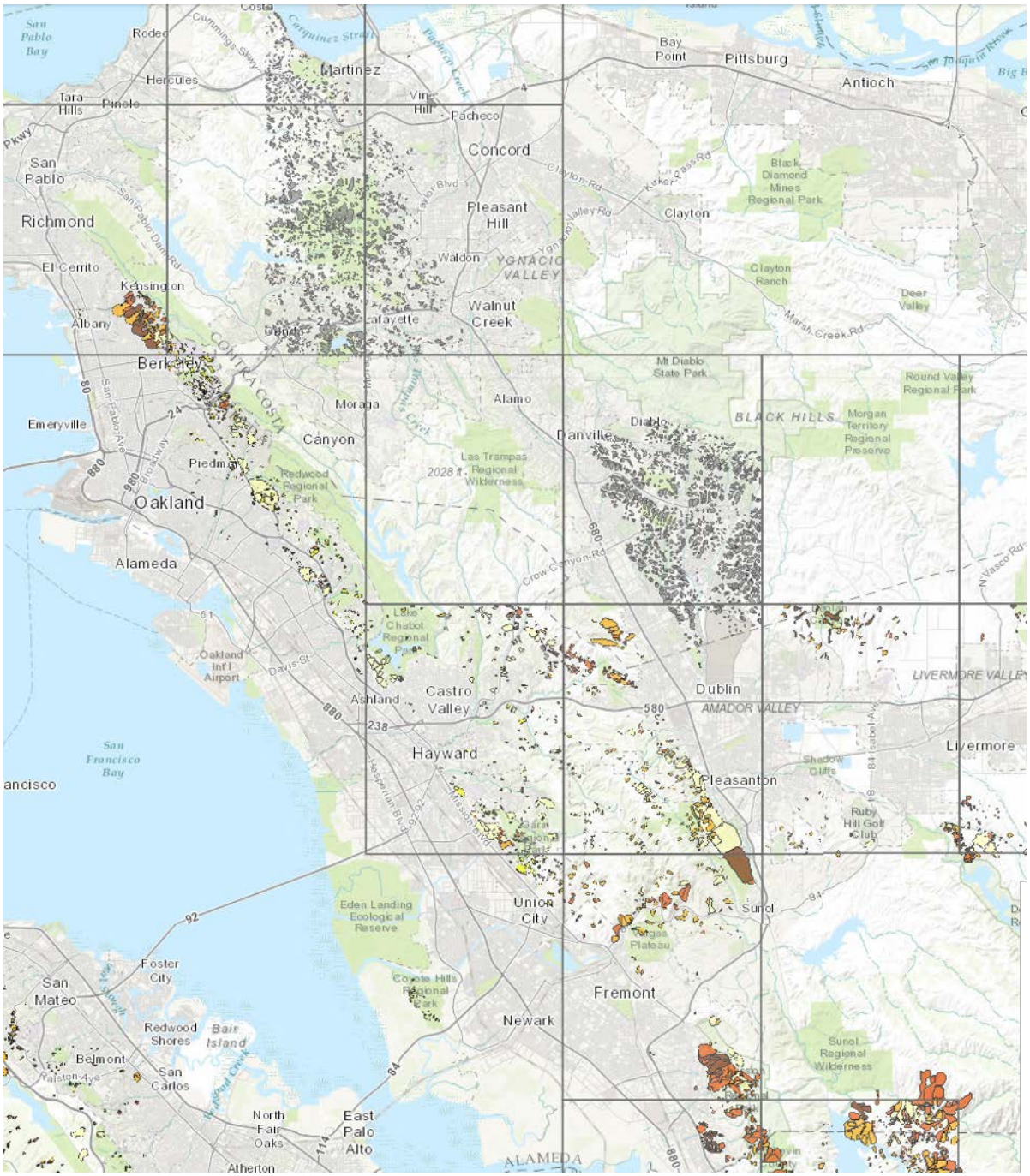
More recently, severe storms in the winter of 2011 resulted in landslides at Lake Chabot and severe storms in March of 2016 resulted in extensive landslides in Wildcat Canyon, Richmond and Claremont Canyon. The repairs costs in 2011 at Lake Chabot were $165,000.

The preliminary estimates for landslide repairs in the March 2016 heavy rainfall events are $1,548,000, based on damage estimates that the Park District has submitted to Cal OES and FEMA. The largest damage, $1,000,000, occurred in Claremont Canyon on Gelston Road.

10.5 Landslide Hazard Mapping and Risk Assessment

Figure 10.4 shows the locations of previous landslides. The geographic distribution of previous landslides provides a general idea of where future landslides are most likely. However, assessment of the landslide risk at a particular location requires evaluation by a state licensed geotechnical engineer or engineering geologist.

Figure 10.4: Previous Landslides



Source: (California Geological Survey, 2016)

Figure 10. 4 shows the concentration of previous landslides in the East Bay hills. As noted previously, both winter storm and earthquake triggered landslides tend to occur in or near places that have experienced previous landslides. However, landslides may also occur in other locations.

Figure 10.5 shows the California Geological Survey map of susceptibility for deep seated landslides. The map does not include information on landslide triggering events, such as rainstorms or earthquake shaking, nor does it address susceptibility to shallow landslides such as debris flows. Mapped active landslides are assigned to the highest susceptibility class.

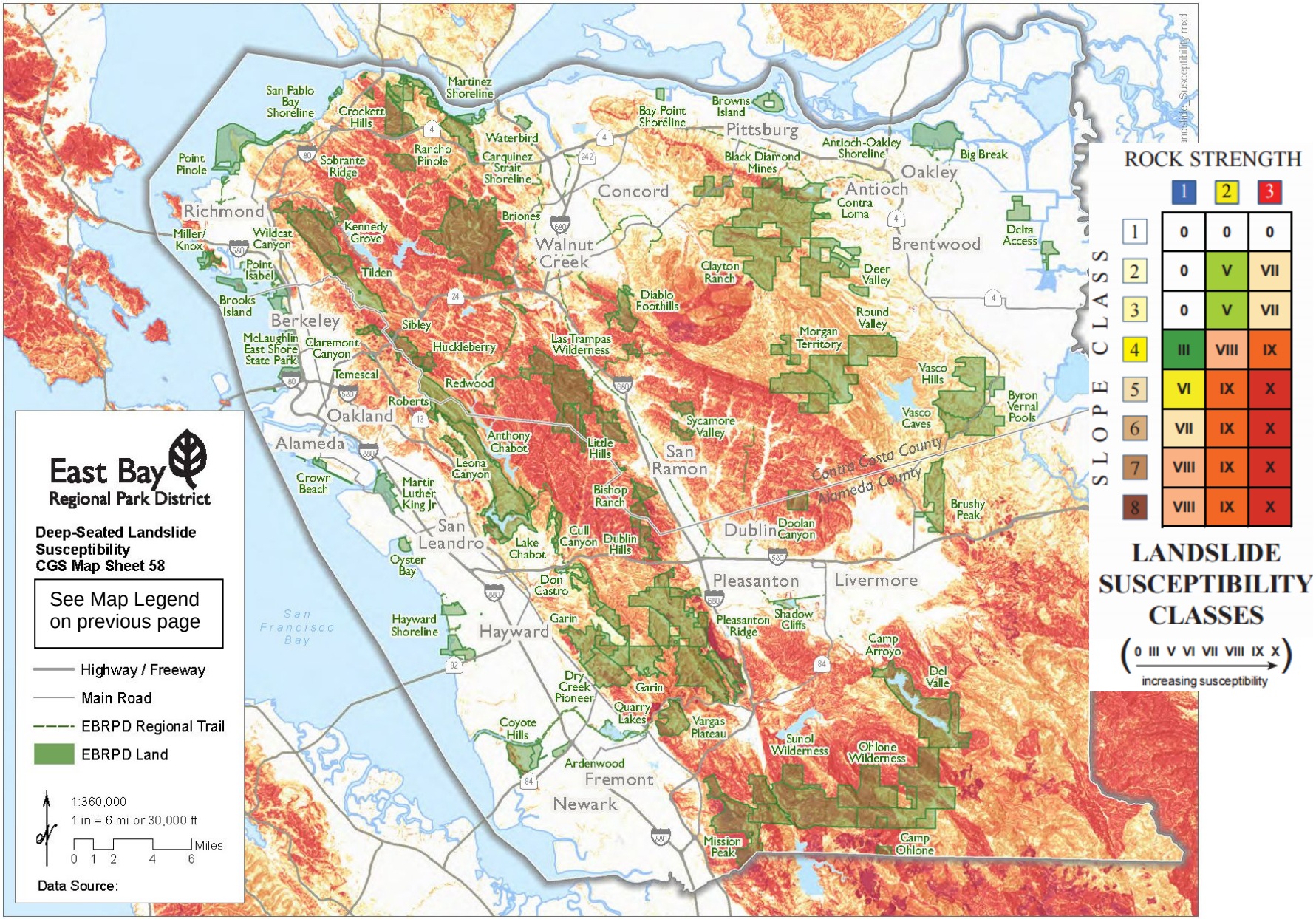
The areas shown in dark orange and red have the highest susceptibility for deep seated landslides. Rock strength and slope are combined in Figure 10.7 to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks, and moderate to very steep slopes in weak rocks. Mapped active landslides are assigned to susceptibility class X. *Source:* (Wills, Perez, & Gutierrez, 2011).

Landslides are possible in most of the Park District's parks. The parks with a history of relatively frequent landslides include:

- Wildcat Canyon,
- Lake Chabot,
- Mission Peak,
- Bishop Ranch,
- Las Trampas,
- Briones,
- Alhambra Valley,
- Shadow Cliffs, and
- Lafayette-Moraga Trail.

Landslides within the Park District are highly likely to occur. Landslides occur virtually every year, typically during winter storms with prolonged heavy rainfall. The likelihood of a landslide occurring in a given year is nearly 100%.

Figure 10.5 Susceptibility for Deep Seated Landslides



The potential impacts of future landslides on the Park District's lands and facilities include damage to trails, roads, bridges, buildings and other Park District facilities. Most landslides within the Park District's parks are small landslides and many occur in undeveloped areas of the park, with no buildings or infrastructure affected.

The most common impact is damage to trails from small landslides. Previous landslides have not damaged major buildings or facilities but damage to major buildings or facilities is possible in future landslides. In addition to damage and loss of function of park facilities, injuries or deaths are possible. The likelihood of injuries and deaths is generally low, because landslides tend to occur during heavy rains when the number of people in parks is much lower than during better weather. However, landslides often occur without warning and the possibility of future injuries or deaths cannot be excluded.

Quantitative evaluation of landslide risk at any given location requires a detailed, site-specific evaluation of slope stability by an engineering geologist or geotechnical engineer. Such detailed studies would be warranting only when a location with major facilities has a history of landslides or has steep slopes with evidence of downslope creep.

Qualitatively, the level of damage from future landslides in the Park District varies enormously. Small landslides in undeveloped areas are part of the natural evolution of the landscape and may not require any repairs. Small landslides affecting trails and roads typically require only removal of debris from the trail or road. Larger landslides affecting trails, roads, bridges, other infrastructure and building require debris removal and repair – or relocation – of the damaged facilities.

The total repair costs for landslide events can range from none for small landslides undeveloped areas of the park, to low costs for minor debris removal, to very high costs major repairs. In dollar terms, repair costs can range from a few thousand dollars to several million dollars. In extremely severe winter storms with return periods of 50 years, 100 years or more damages could run into the tens of millions of dollars. Similarly, a major earthquake on one of the many faults within the Park District's boundaries that occurs during raining months could results in millions of dollars in repair costs. The worst case earthquake for landslide damage would be a major earthquake on the Hayward Fault during the raining months because of the very strong ground shaking in the East Bay hills, including many areas with very high landslide hazards.

10.6 Mitigation for Landslides

There are four primary mitigation measures for landslides:

- Avoid construction of buildings or infrastructure in high landslide hazard areas, whenever possible.
- Relocate existing buildings or infrastructure in high landslide hazards area,
- Close high landslide hazard areas to the public during periods of heavy rains,

- Stabilize slopes that pose risks to existing buildings or infrastructure.

Slope stabilization measures vary depending on the type of landslide, surficial landslides such as debris flows or mudflows vs. deep seated landslides and on the size of the potential landslide. Common slope stabilization measures include:

- Retaining walls with tie-backs into the slope,
- Increase drainage within the slope by inserting water collection pipes,
- Grading or other drainage improvements to direct surface water away from the slope,
- Constructing berms or other barriers to divert landslides away from at risk buildings or infrastructure,
- Re-planting vegetation in areas denuded of vegetation from fires or shallow landslides,
- Covering landslide areas with an impermeable membrane, and
- Grading or otherwise removing soil and/or rock from the top of the slope.

The appropriate slope stabilization measure(s) for a given location vary depending on the expected type and severity of landslide event. Landslide mitigation measures are best developed by an engineering geologist or geotechnical engineer.

For locations subject to major, deep-seated landslides, relocating existing buildings or infrastructure out of the high landslide hazard may be the only viable mitigation option.

The Park District's goals for landslide mitigation are to 1) minimize future landslide damage to the Park District's lands and facilities, and 2) minimize life safety risks from future landslides.

The Park District's mitigation Action Items are summarized in Table 10.1 on the following page.

Table 10.1: Landslide Mitigation Action Items

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Landslide Mitigation Action Items									
Short-Term #1	Develop a Park District policy for closure of sites with high landslide risk during periods of heavy rainfall.	1 Year	District	Risk	X			X	X
Short-Term #2	Consult with an engineering geologist or geotechnical engineer regarding landslide risk for sites with important facilities with a history of landslides and/or apparent high risk.	1-3 Years	District or Grants	Design	X	X	X	X	X
Short-Term #3	Compile and maintain an inventory of sites with a history of landslides and develop prioritized mitigation actions.	Ongoing	District	Finance	X	X	X	X	
Long-Term #1	Implement landslide mitigation measures at high landslide hazard sites with important facilities including Wildcat Canyon, Lake Chabot and the other parks listed in this chapter, as funding becomes available.	Ongoing	District or Grants	Design	X	X	X	X	X
Long-Term #2	Locate new facilities outside of areas with significant landslide risk, whenever possible.	Ongoing	District	Design	X	X	X	X	X

10. 7 References

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11.0 OTHER NATURAL HAZARDS

Previous chapters have addressed the natural hazards which pose the greatest risks for the East Bay Regional Park District's lands, facilities and people: earthquakes, wildland/urban interface fires, droughts, floods and landslides. In addition to these hazards there are other natural hazards which pose less, but potentially significant risks to the Park District. This chapter addresses these other natural hazards.

11.1 High Winds

High wind events in the Park District typically occur during severe winter storms. The most common impacts are tree falls, including entire trees or tree branches. Tree falls in developed areas may result in damage to buildings, vehicles and overhead electric power lines and communication towers as well as injuries or deaths to people. In the Park District, most tree falls don't result in damage to the Park District's or facilities or people, although some wind events may result in temporary loss of electric power or disruption of communications. Repair costs for tree fall events are mostly limited to debris removal costs, with minor repairs to facilities in some events.

Localized high wind events can also occur from thunderstorms or tornadoes. The effects of these wind events are similar to those for winter storms, with most of the damage limited to tree falls.

Since 1950, 423 tornadoes have been reported in California with five of these in Contra Costa County and three in Alameda County There have been no reported deaths from tornadoes in California and only a total of 90 injuries over the 67 year period of record through 2015. The vast majority of these California tornadoes are F0 or F1 on the Fujita Scale (EF0 or EF1 on the Enhanced Fujita Scale). (www.tornadohistoryproject.com).

Of the eight tornadoes in Alameda and Contra Costa Counties, one was F1 and the other seven were F0. These small tornadoes typically cause only minor, very localized damages.

11.2 Snow and Ice Storms

The risk of snow or ice storms in Alameda County and Contra Costa County is essentially nil, with the exception of occasional light snow or ice on Mount Diablo and other high elevation locations. The impacts of snow or ice storms on the Park District are likely to be minimal, if any.

11.3 Extreme Temperatures

The climate in Alameda County and Contra Costa County varies dramatically depending on location, especially with distance from the coast. Inland locations have far more very cold days and very hot days than locations near the coast.

For example, the extreme recorded low and high temperatures in Oakland are 24 ^{o}F and 104 ^{o}F, respectively. Oakland has an average of 2.7 days per year with temperatures at or below 32 ^{o}F and 3.8 days per year with temperatures at or above 90 ^{o}F (www.wrcc.dri.edu).

On the other hand, the extreme recorded low and high temperatures in Livermore are 18 ^{o}F and 115 ^{o}F, respectively. Livermore has an average or 31 days per year with temperatures at or below 32 ^{o}F and 58 days per year with temperatures at or above ^{o}F (www.wrcc.dri.edu).

The impacts of extremely high temperatures include increased risk of wildland/urban interface fires and health issues and deaths in vulnerable populations. The impacts of unusually cold temperatures include health issues and deaths in vulnerable populations and possible freezing damage to irrigation systems. Under unusually hot or cold temperatures, some of the District's facilities might be needed for temporary shelter.

11.4 Volcanic Hazards

The USGS has identified 17 active or potentially active volcanic sites in California, including Mt. Shasta, Lassen Volcanic Center, Mammoth and others. The closest potentially active volcanic site to the Park District is the Clear Lake Volcanic Field in Lake County.

Volcanic hazards for the Park District are limited to the possibility of volcanic ash falls. Volcanic ash falls are remotely possible from volcanic events at the volcanic sites in California or from volcanic events in Oregon or Washington. However, given the prevailing westerly winds in the East Bay, most of these possible volcanic events would results in nil or just traces of volcanic ash in the Park District.

Most ash fall events impacting Park District are likely to be very minor with much less than one inch of ash. However, even minor amounts of ash fall can result in some impacts. The possible impacts of ash falls include health effects and several other disruptive effects such as:

a) Respiratory problems for at-risk populations such as young children, people with respiratory problems and the elderly,

b) Clogging of filters and possible damage to vehicle engines, furnaces, heat pumps, air conditioners, commercial and public building combined

HVAC systems (heating, ventilation and air conditioning) and other engines and mechanical equipment,

c) Clean-up and ash removal from roofs, gutters, sidewalks, roads vehicles, HVAC systems and ductwork, engines and mechanical equipment,

d) Impacts on public water supplies drawn from surface waters, including degradation of water quality (high turbidity) and increased maintenance requirements at water treatment plants, and

e) Possible electric power outages from ash-induced short circuits in distribution lines, transmission lines and substations.

There have been no volcanic events affecting the Park District in the recorded history of California. The probability of future events is not nil, but is extremely low. The return period for volcanic events affecting the Park District is likely several thousand years or longer. The likelihood of a volcanic event (ash fall) occurring in a given year is less than 0.1%.

11.5 Mitigation Action Items

The Park Districts' mitigation Action Items for the above other hazards are shown in Table 11.1.

Table 11.1: Mitigation Action Items for Other Natural Hazards

Hazard	Action Item	Timeline	Source of Funds	Responsible Department	Plan Goals Addressed				
					Life Safety	Protect Facilities	Protect Environment	Enhance Emergency Planning	Enhance Awareness and Education
Other Natural Hazards Mitigation Action Items									
Short-Term #1	Review and update the Park District's emergency operations plan to include high wind events, snow or ice storms, and extreme temperatures.	1-2 Years	District	Risk	X	X		X	X
Short-Term #2	Continue and enhance the Park District's hazardous tree mitigation programs, as funding becomes available.	Ongoing	District/ Grants	Fire	X	X	X	X	X
Short-Term #3	Evaluate infrastructure and buildings possibly vulnerable to high winds, including communications towers.	1-3 Years	District	Design	X	X		X	X
Long-Term #1	Implement tie downs or other measures to mitigate infrastructure and buildings vulnerable to high winds, as funding becomes available.	Ongoing	District/ Grants	Risk	X	X		X	X

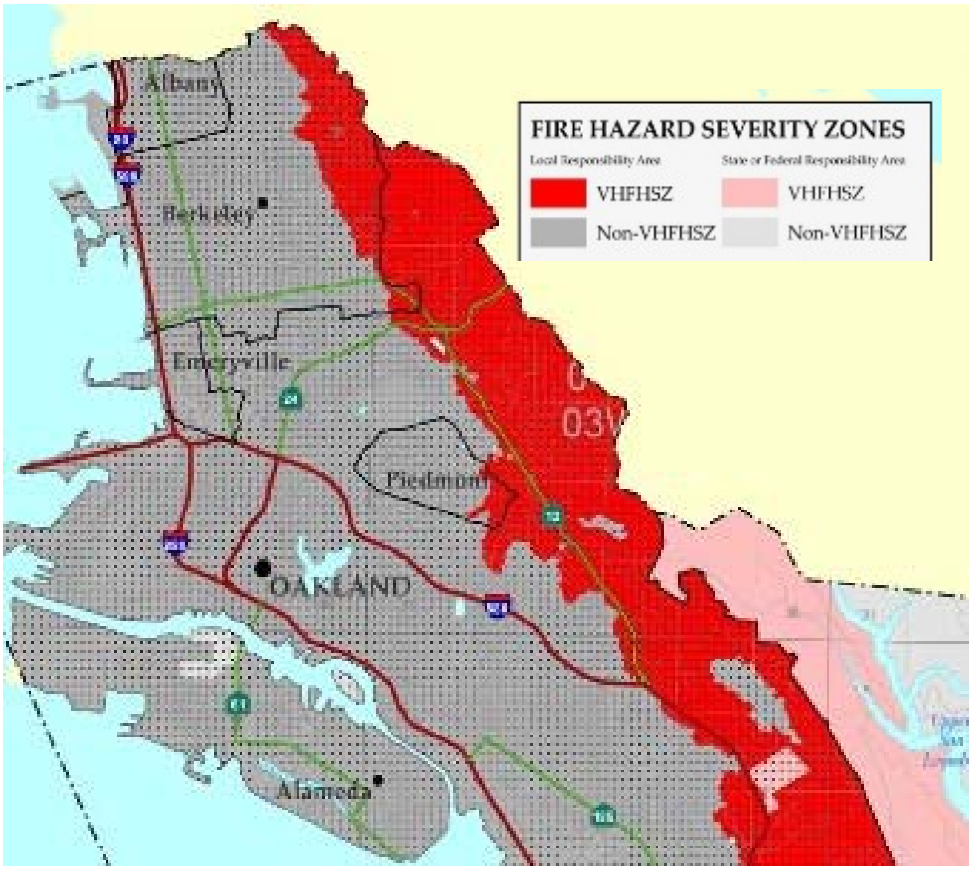
Exhibit B

East Bay Regional Park District

Tilden-Claremont

Hazardous Fuels Reduction Project

BENEFIT-COST DOCUMENTATION REPORT



Revised

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May 2, 2021

Cover map: California Department of Forestry and Fire Prevention (Cal Fire) (2008): fhsxl_map.1.jpg. The red and pink areas shown on the map are Very High Fire Severity Zones for Local Responsibility and State or Federal Responsibility Areas, respectively.

1. Introduction

The Oakland-Berkeley Hills in the East Bay and other nearby areas have a decades long history of major wildland-interface fires, including the 1991 Oakland Hills fire that destroyed over 3,000 homes and killed 25 people.

As shown in the cover map Cal Fire's mapping of the Oakland-Berkeley Hills is "very high" fire hazard severity – the highest risk category. This residential area is immediately adjacent to and comingled with very high fuel load, wildland areas and is thus at extreme risk for wildland/urban interface fires. That factors that result in the very high risk level also include the following:

- Climate with a very long dry season with little or no rainfall and periods of high winds,
- Hilly topography which results in rapid spread of fires uphill and impedes fire suppression efforts, and
- Limited water supply in the low building density hilly areas which further impedes fire suppression efforts.

The project areas include 5,469 residential buildings that are included in the BCA calculations. This building inventory as 12,887,291 square feet of total living space have a replacement value of over $3 billion - $3,327,797,205. This replacement value excludes an additional 975 buildings for which there is insufficient data to estimate the replacement value.

Benefit Cost Analysis Summary

The benefit-cost analysis was completed with the FEMA Version 6.0 Benefit-Cost Software, using the Wildland Fire module.

The calculated benefit-cost ratio (BCR) is 16.35 which means the project is highly cost-effective. This BCR is very conservative:

A. Only buildings within ½ mile of project areas were included, although FEMA allows buildings up to 2 miles to be counted,
B. FEMA benefits for Infrastructure, Timber Value, and Fire Suppression were not included,
C. FEMA benefits for Volunteers were not included, and
D. FEMA Ecosystem Services were also not included.

Detailed documentation of the value of homes and other buildings at risk and the other inputs into the BCA are provided in the body of this report.

2. FEMA WUI Burn Return Periods

FEMA's burn return periods for benefit-cost analysis are designated by zip code. The 20 project areas for hazardous fuel reduction are in four zip codes as shown below.

Table 1
Zip Codes for Project Areas

Project	Zip Code		Project	Zip Code
CC001	94704		TI008b	94708
CC002	94704		TI009	94708
CC003	94704		TI010	94708
CC004	94704		TI011	94708
CC005	94705		TI012	94563
CC008	94704		TI014	94563
CC009	94705		TI015	94563
CC010	94704		TI018	94563
CC011	94704		TI019	94563
TI006	94708		TI020	94708
TI008a	94708		TI021	94708

The four different zip codes are: 94704, 94705, 94708 and 94563, as shown in the following overlays of zip codes with each of the project areas.

Figure 1
Zip Code Maps

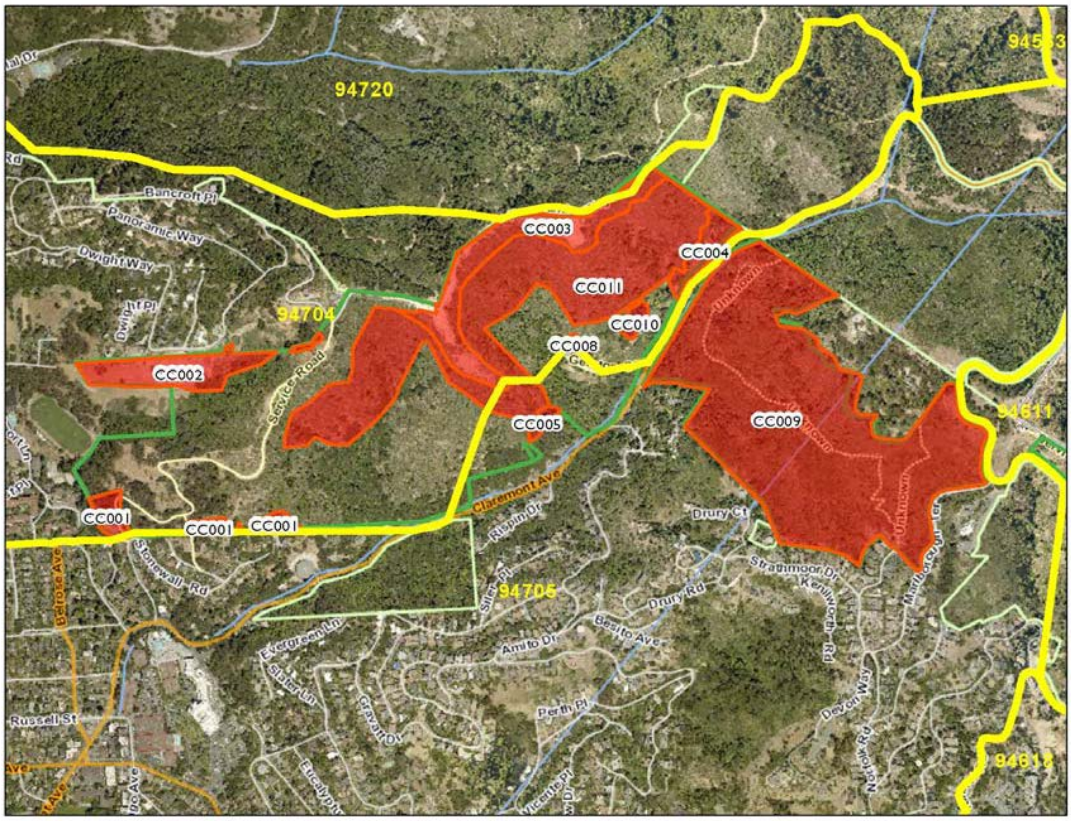
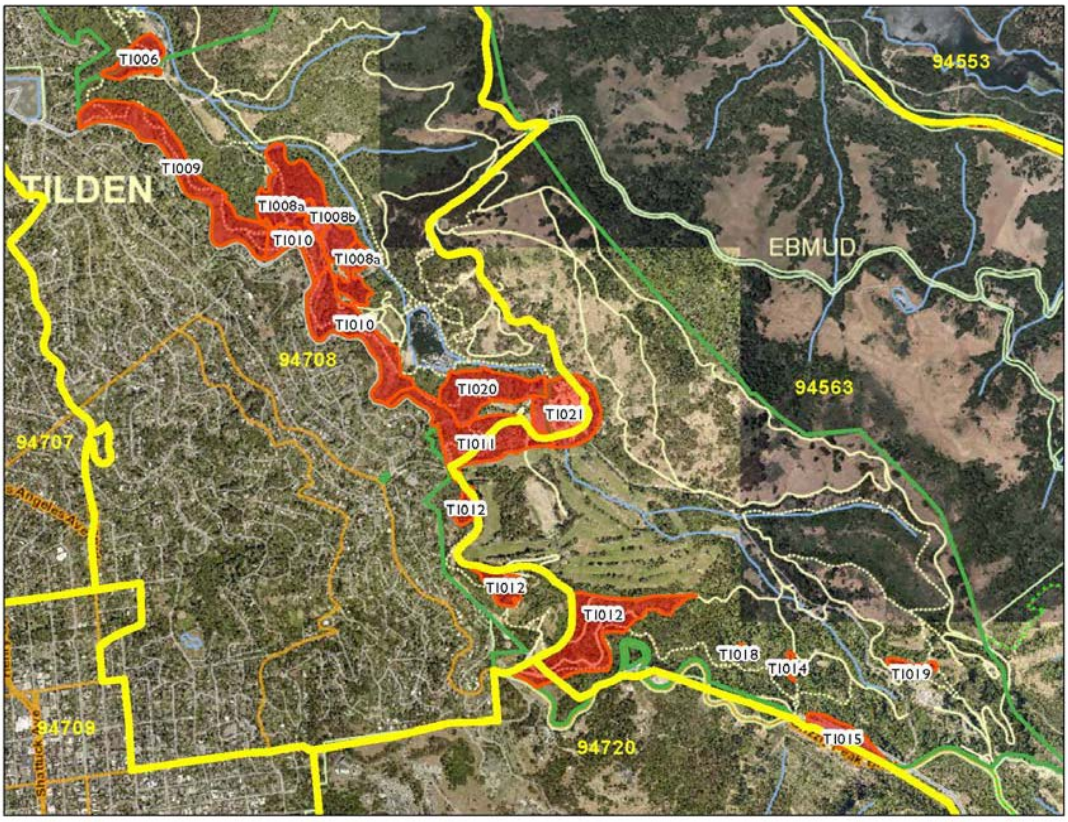


Figure 2 – Continued
Zip Code Maps



The FEMA Burn Return Periods, per the FEMA BCA Software Version 5.3.0, Wildland-Urban Interface Fire module are as follows:

Zip Code 94704 – 42 years,

Zip Code 94705 – 42 years,

Zip Code 94708 – 22 years, and

Zip Code 94563 – 18 years.

For the present BCA, we use the longest return period of 42 years for all of the project areas.

This is accurate for the Claremont project areas which are all in Zip Code 94704 or 94705.

The Tilden project areas are all in in Zip Code 94708 or 94563 with return periods of 18 years or 22 years. Using these shorter return periods would yield benefits about double from those calculated using the 42-year return period. This would raise the total project benefits by about 50%.

The simplification of using the longest return period for all areas – even though it lowers the calculated benefit-cost ratio – was done because the benefit-cost ratio is so high that this simplification makes no meaningful difference in the importance of this project. This project is urgently necessary.

3. The WUI Interface in the Project Area

The following maps compelling document that the proposed project areas are at very high risk for WUI fires. There are enormous numbers of high value buildings near or immediately adjacent to and/or fully intermingled with WUI areas with very high loads of hazardous fuels.

Figure 3
High Hazardous Fuel Areas Adjacent to and Intermingled with Developed Areas
Tilden North Project Area

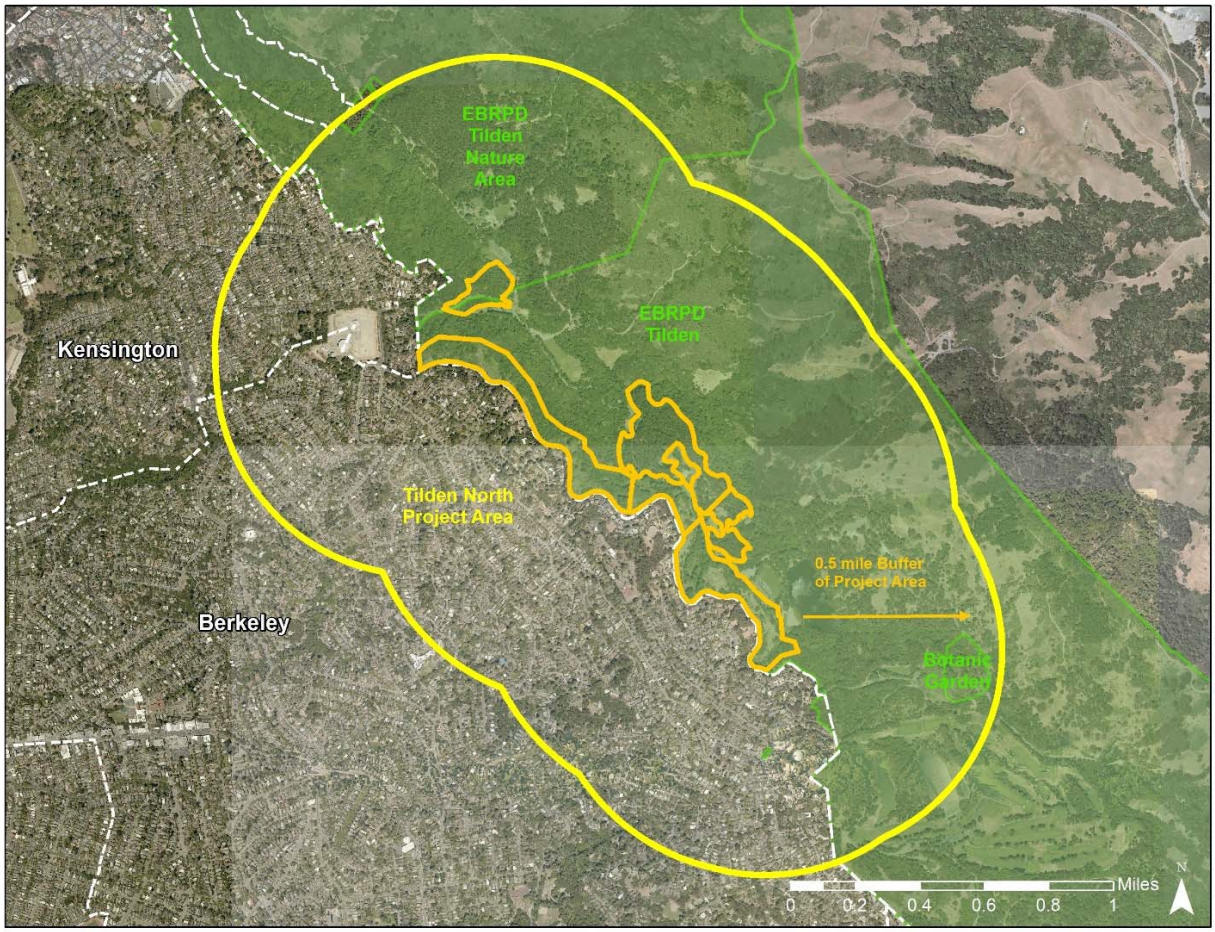


Figure 4
High Hazardous Fuel Areas Adjacent to and Intermingled with Developed Areas
Tilden South Project Areas

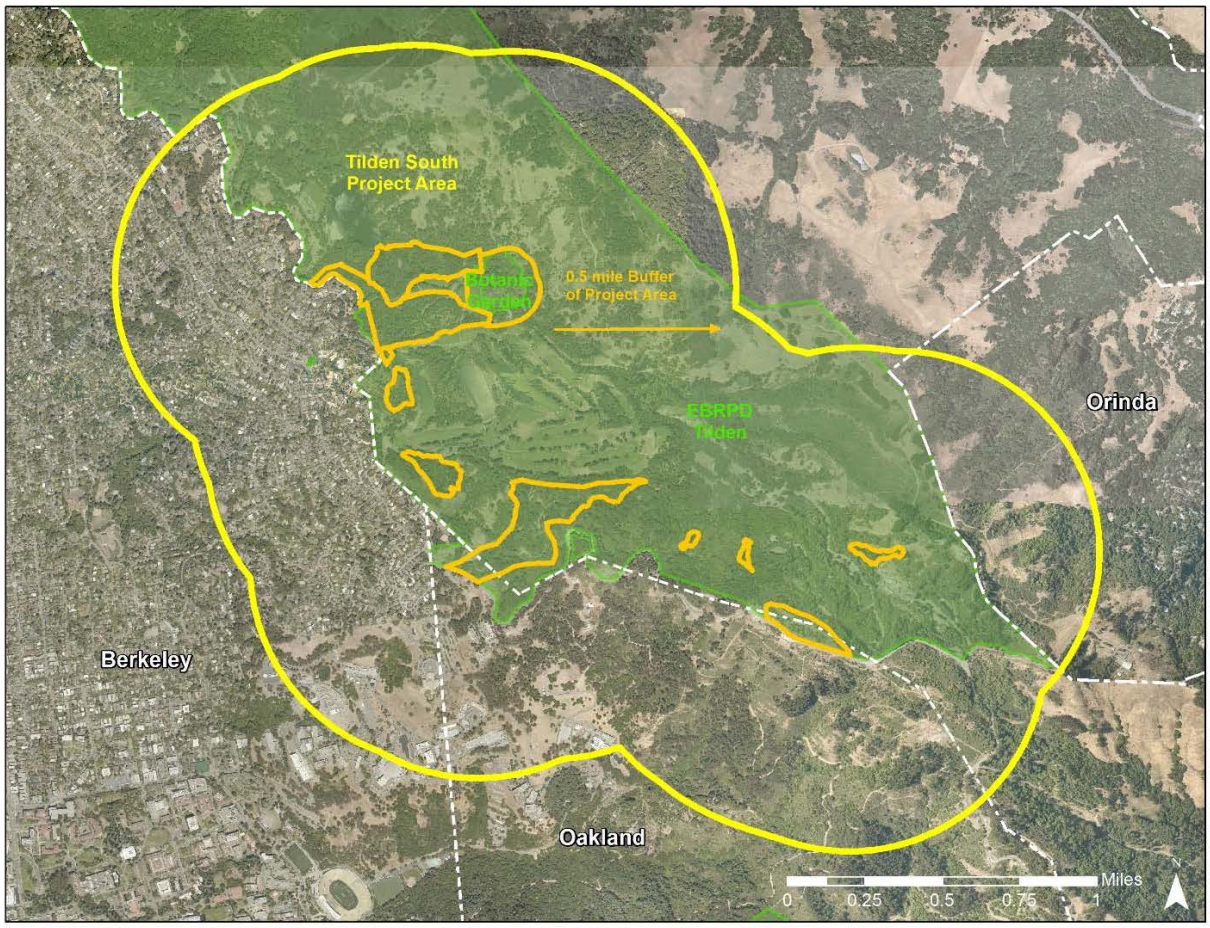
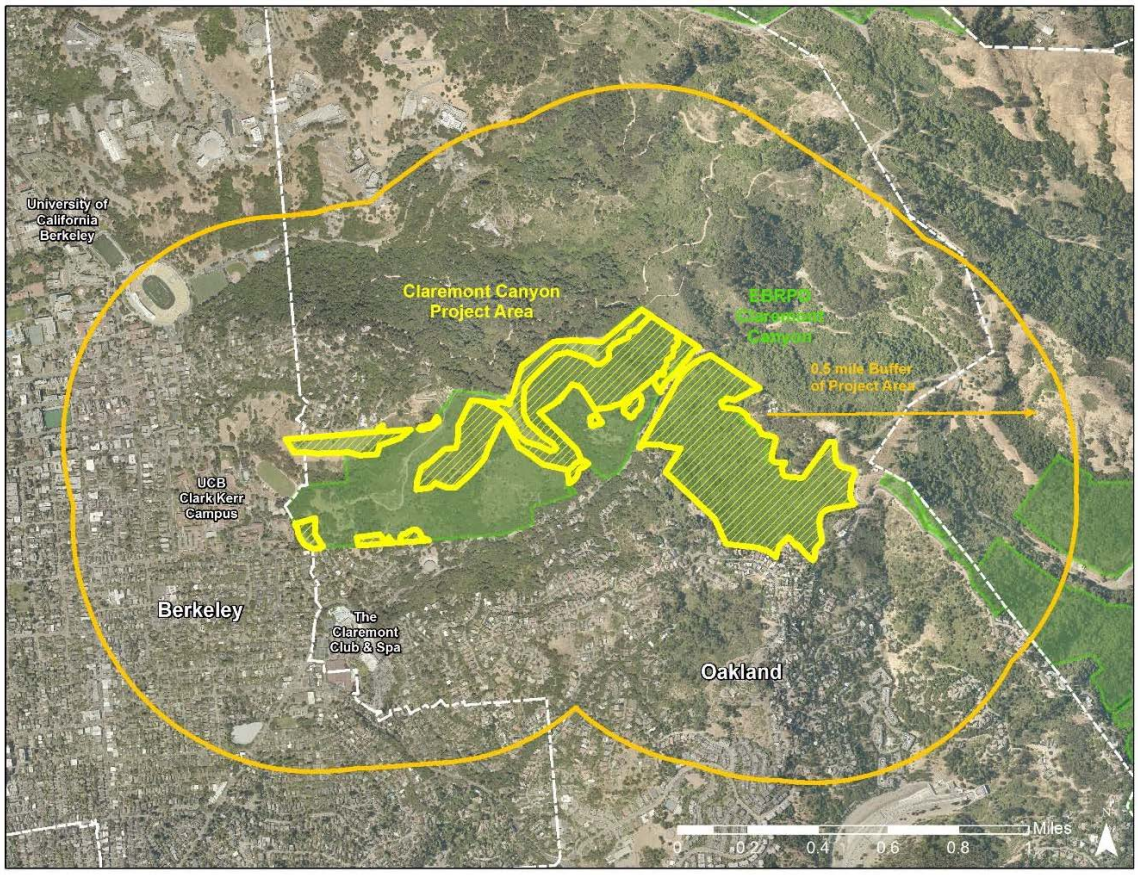


Figure 5
High Hazardous Fuel Areas Adjacent to and Intermingled with Developed Areas
Claremont Canyon Project Areas



4. Proposed Hazardous Fuels Reduction Project

The East Bay Regional Park District has successfully completed and carefully maintained several hazardous fuel reduction projects in the recent past and continues to do so. The proposed scope of work is very similar to the range of methods used successfully in past including mechanical treatments and hand crews to remove trees and brush, along with appropriate supplemental methods, including herbicides and other measures, including goats when appropriate.

The scope of work is fully documented in the grant application. The cost estimate is shown below.

Table 2
Cost Estimate

DATE	JURSIDICTION NAME	DISASTER & PROJECT OR PLANNING #	PROJECT OR PLANNING TITLE
5/2/2021	East Bay Regional Park District	4382, Control No. 0003	Tilden-Claremont Canyon Fuels Management

#	Item Name	Unit Quantity	Unit of Measure	Unit Cost	Cost Estimate Total
1	Claremont: Construction (Tree/Brush Removal)	130.38	AC	$ 11,247.00	$ 1,466,384
2	Tilden: Construction (Tree/Brush Removal)	194.19	AC	$ 11,247.00	$ 2,184,055
3	Environmental Consultant Principal	500	HR	$ 155.00	$ 77,500
4	Environmental Consultant Biologist	3051	HR	$ 105.00	$ 320,355
5	EBRPD Fire Captain (Project Implementation)	510	HR	$ 97.30	$ 49,623
6	EBRPD Fire Fighter (Project Implementation)	354	HR	$ 63.99	$ 22,652
7	EBRPD Resource Analyst (Envirnmntl. Compliance)	2000	HR	$ 66.97	$ 133,940
8	Herbicides (Gallon)	200	EA	$ 86.26	$ 17,252
				Total Project Cost Estimate:	$ 4,271,761

The average annual maintenance costs are estimated to be $129,828, which is for the project area of 324.57 acres. Maintenance costs are estimated as $1,200 per acre based on the Park District's extensive experience with maintenance costs. Maintenance will be completed every three years. The cost for each of the every three years rounds of maintenance cycle is $389,584 – which yields the average annual costs stated above of $129,828.

5. Benefit-Cost Analysis: Data and Methods

There categories of benefits counted included reductions in building damages, contents damages, deaths and injuries, and displacement costs.

The building inventory data for the BCA calculations are based on the following data:

- GIS data to determine the number of buildings within a ½ mile of the hazardous fuel reduction project areas. Counting buildings only within ½ mile is a conservative estimate – FEMA allows counting buildings within 2 miles of project areas. Counting reduced WUI fire losses to buildings within a larger distance would greatly increase the calculated benefits.
- Assessors' data re: building sizes and number of stories. Building size data available are for "livable area" which is somewhat less than the total square footage of each building. This input underestimates the total building value.
- BNi Building News: Home Builder's Costbook 2021 replacement values, using the "low" value for "average" buildings which is the lowest value per square foot. These values likely substantially underestimate the building value at risk in the project area, because many of the homes are higher quality and more expensive than "average" homes.
- The national building replacement value data in the Costbook above is adjusted using the Geographic Cost Factor for Oakland which is 139. This means that building costs in the project area are 39% higher than the national average value.
- The number of people affected by WUI fires is estimated conservatively as 2.5 people per home.
- FEMA Standard Values for per diem lodging and meals for people displaced by WUI files were used.

Building data for 5,469 individual buildings is included in the grant application in this Excel file: **Building Data Calculations_2-17-2021.xlsx**

Summary (aggregated) building data by number of stories is shown in Table 3 on the following page.

Table 3
Building Inventory Data

1-Story	
Building Count	1,861
Total Living Area SF	3,367,466
Average Living Area SF	1,809
Number of Housing Units	1,894
People Per Unit	2.5
Number of People	4,735

2.5 Stories	
Building Count	308
Total Living Area SF	1,020,771
Average Living Area SF	3,314
Number of Housing Units	346
People Per Unit	2.5
Number of People	865

1.5 Stories	
Building Count	868
Total Living Area SF	1,945,911
Average Living Area SF	2,242
Number of Housing Units	901
People Per Unit	2.5
Number of People	2,253

3 or More Stories	
Building Count	188
Total Living Area SF	1,141,305
Average Living Area SF	6,071
Number of Housing Units	865
People Per Unit	2.5
Number of People	2,163

2 Stories	
Building Count	1,683
Total Living Area SF	4,498,508
Average Living Area SF	2,673
Number of Housing Units	2,072
People Per Unit	2.5
Number of People	5,180

Predominantly 1-Story (Estimated)[1]	
Building Count	561
Total Living Area SF	1,013,330
Average Living Area SF	1,806
Number of Housing Units	637
People Per Unit	2.5
Number of People	1,593

TOTALS	
Building Count	**5,469**
Total Living Area SF	**12,987,291**
Average Living Area SF	**2,375**
Number of Housing Units	**6,715**
People Per Unit	**2.5**
Number of People	**16,788**

[1] These buildings estimated to be predominantly 1-story based on the average Total Living Area of 1,806, almost identical to the average size of 1-Story buildings.

There is a total of 5,469 buildings within ½ mile of the project area that were counted for the BCA.

In addition, there are 953 other buildings for which the square foot data were not available and 22 non-residential buildings for which data were insufficient to estimate the replacement values. These 975 buildings were not included in the BCA calculations. The omission of these buildings – about 17% of the total buildings – suggests that the actual BCR value is likely to be about 15% to 20% higher than that calculated using only the 5,469 buildings for which full data were available.

Table 4
Building Replacement Value Estimates

Number of Stories	1-Story	1.5 Story	2-Story	2.5 Story	3+ Stories	1-Story [1]
Total Living Areas (SF)	3,367,466	1,945,911	4,498,508	1,020,771	1,141,305	1,013,330
Average Size per Home (SF)	1,894	2,242	2,673	3,314	6,071	1,806
Replacement Cost per SF	$212.63	$194.98	$166.69	$158.36	$150.44	$212.63
Geographic Cost Modifier	1.39	1.39	1.39	1.39	1.39	1.39
Final Replacement Cost per SF	$295.56	$271.02	$231.70	$220.11	$209.11	$295.56
Replacement Value	$995,273,771	$527,385,080	$1,042,300,255	$224,686,136	$238,656,506	$299,495,457
Total Replacement Value	**$3,327,797,205**					

[1] Predominantly 1-Story (Estimated). See: explanation in Table 3

Notes:

1. Replacement value per SF for 1-story and 2-story buildings use the lowest values for the BNi Building News: Home Builder's Costbook 2021 replacement values, that bracket the average building size shown in Table 3. (the cost/SF for the next large size home).
2. Replacement value per SF for 1.5 Story buildings is the average of the values of 1-story and 2-story buildings.
3. Replacement value per SF for 2.5-Story buildings is estimated to be 5% less than that for 2-story buildings.
4. Replacement value per SF for 3+ Story buildings are estimated to be 10% less than that for 2-story buildings.
5. These values likely significantly underestimate the building value at risk, because many of the homes are higher quality and more expensive than "average" homes. This is especially true for the larger more than 2 story homes.

Benefit-Cost Results

BCA Summary	
Total Standard Mitigation Benefits	$84,735,798
Total Social Benefits	Not Included
Total Mitigation Project Benefits	$84,735,798
Total Mitigation Project Cost	$5,183,619
Benefit-Cost Ration - Standard	16.35
Benefit-Cost Ration - Standard + Social	16.35

In any case, this proposed project is extremely cost-effective with a very high benefit-cost ratio. These high benefit-cost ratios arise from the short FEMA Burn Return Period of 42 years and the extremely high value of homes at risk.

This project is urgently required to protect both property and people in the Oakland-Berkeley Hills and surrounding areas, by substantially reducing the likelihood of a repeat of the 1991 Oakland-Berkeley fire that destroyed over 3,000 homes and killed 25 people.

29TH EDITION

BNi Building News

A DESIGN COST DATA COMPANY

DATA YOU CAN TRUST

HOME BUILDER'S 2021 COSTBOOK

CSI MasterFormat®

ONE STORY AVERAGE

LOW

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	99.81	97.81	95.81	95.32	92.92	90.55	89.60
INTERIORS	95.47	93.56	91.65	91.17	88.88	86.61	85.70
OVERHEAD & PROFIT	21.70	21.26	20.83	20.72	20.20	19.68	19.48
TOTAL	**$216.97**	**$212.63**	**$208.29**	**$207.21**	**$202.00**	**$196.84**	**$194.78**

MEDIUM

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	109.79	107.59	105.40	104.85	102.21	99.60	98.56
INTERIORS	105.01	102.91	100.81	100.29	97.77	95.27	94.27
OVERHEAD & PROFIT	23.87	23.39	22.91	22.79	22.22	21.65	21.43
TOTAL	**$238.67**	**$233.90**	**$229.12**	**$227.93**	**$222.20**	**$216.52**	**$214.25**

HIGH

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	114.78	112.48	110.19	109.61	106.86	104.13	103.04
INTERIORS	109.79	107.59	105.40	104.85	102.21	99.60	98.56
OVERHEAD & PROFIT	24.95	24.45	23.95	23.83	23.23	22.64	22.40
TOTAL	**$249.52**	**$244.53**	**$239.54**	**$238.29**	**$232.30**	**$226.36**	**$223.99**

TWO STORY AVERAGE

LOW

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	85.41	83.71	82.00	81.57	79.52	77.49	76.68
INTERIORS	81.70	80.07	78.43	78.02	76.06	74.12	73.34
OVERHEAD & PROFIT	18.57	18.20	17.83	17.73	17.29	16.85	16.67
TOTAL	**$185.68**	**$181.97**	**$178.25**	**$177.33**	**$172.87**	**$168.45**	**$166.69**

MEDIUM

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	93.96	92.08	90.20	89.73	87.47	85.24	84.34
INTERIORS	89.87	88.07	86.28	85.83	83.67	81.53	80.68
OVERHEAD & PROFIT	20.43	20.02	19.61	19.51	19.02	18.53	18.34
TOTAL	**$204.25**	**$200.17**	**$196.08**	**$195.06**	**$190.16**	**$185.30**	**$183.36**

HIGH

SQUARE FOOTAGE	1500	1750	2000	2250	2500	2750	3000
COSTS							
FRAME	98.23	96.26	94.30	93.81	91.45	89.11	88.18
INTERIORS	93.96	92.08	90.20	89.73	87.47	85.24	84.34
OVERHEAD & PROFIT	21.35	20.93	20.50	20.39	19.88	19.37	19.17
TOTAL	**$213.53**	**$209.26**	**$204.99**	**$203.93**	**$198.80**	**$193.72**	**$191.69**

State	Metropolitan Area	Multiplier
AK	ANCHORAGE	130
AL	ANNISTON	77
	AUBURN	75
	BIRMINGHAM	78
	DECATUR	75
	DOTHAN	75
	FLORENCE	75
	GADSDEN	77
	HUNTSVILLE	76
	MOBILE	76
	MONTGOMERY	76
	OPELIKA	75
	TUSCALOOSA	79
AR	FAYETTEVILLE	73
	FORT SMITH	73
	JONESBORO	74
	LITTLE ROCK	77
	NORTH LITTLE ROCK	77
	PINE BLUFF	75
	ROGERS	79
	SPRINGDALE	74
	TEXARKANA	75
AZ	FLAGSTAFF	80
	MESA	80
	PHOENIX	82
	TUCSON	76
	YUMA	76
CA	BAKERSFIELD	130
	CHICO	136
	FAIRFIELD	136
	FRESNO	139
	LODI	139
	LONG BEACH	133
	LOS ANGELES	133
	MERCED	139
	MODESTO	139
	NAPA	136
	OAKLAND	139
	ORANGE COUNTY	133
	PARADISE	136
	PORTERVILLE	132
	REDDING	136
	RIVERSIDE	133
	SACRAMENTO	136
	SALINAS	139
	SAN BERNARDINO	133
	SAN DIEGO	130

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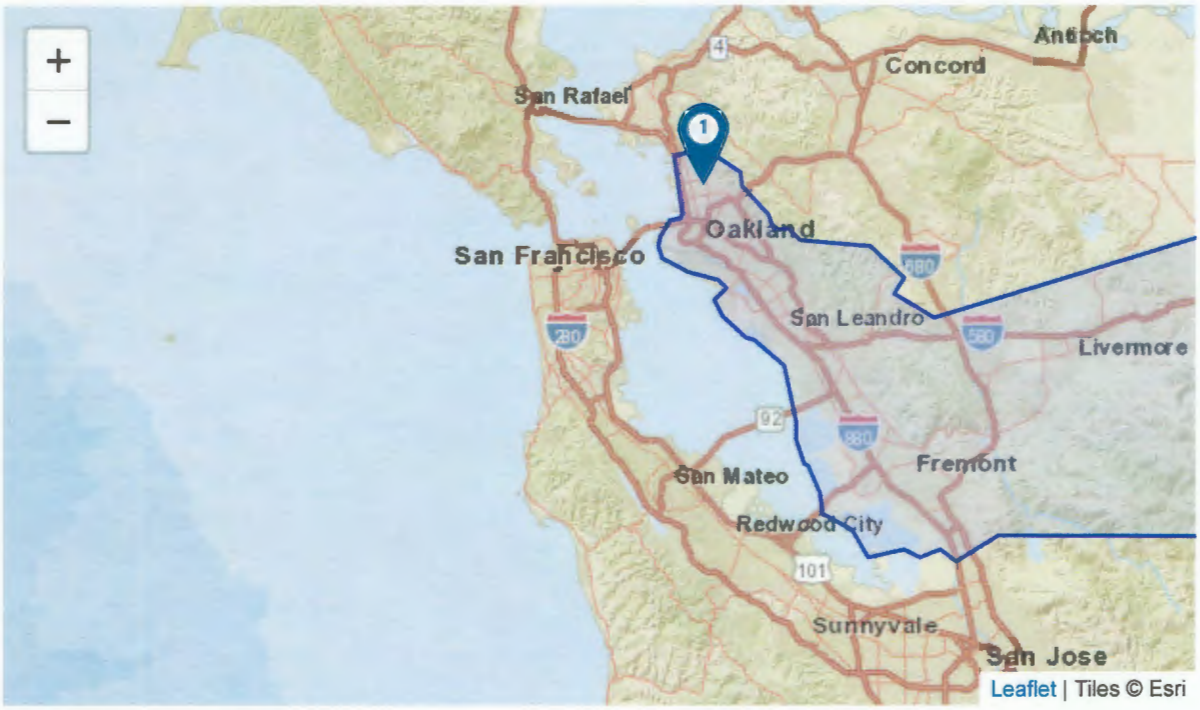
FEMA Benefit-Cost Calculator

V.6.0 (Build 20210414.2142)

Benefit-Cost Analysis

Project Name: Tilden-Claremont Hazardous Fuels Reduction



Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)
1	Hazardous Fuels Reduction @ 37.8634090; -122.2718780		Wildfire	$ 84,735,798	$ 5,183,619	16.35
TOTAL (SELECTED)				**$ 84,735,798**	**$ 5,183,619**	**16.35**
TOTAL				**$ 84,735,798**	**$ 5,183,619**	**16.35**

Property Configuration

Property Title:	Hazardous Fuels Reduction @ 37.8634090; -122.2718780
Property Location:	94704, Alameda, California
Property Coordinates:	37.863409, -122.271878
Hazard Type:	Wildfire
Mitigation Action Type:	Hazardous Fuels Reduction
Property Type:	Residential Building
Analysis Method Type:	Modeled Damages

Cost Estimation

Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Project Useful Life (years):	10
Project Cost:	$4,271,761
Number of Maintenance Years:	10 Use Default:Yes
Annual Maintenance Cost:	$129,828

Comments

Project Useful Life:

The FEMA Standard Value for Project Useful Life of forest canopy is 20 years. For this BCA a conservative value of 10 years was used. The project area has forest canopy with some areas of brush.

Mitigation Project Cost:

See itemized project cost in the subapplication.

Annual Maintenance Cost:

The East Bay Regional Park District has extensive experience with successful hazardous fuels reduction projects. The Annual Maintenance cost is based on 324.57 acres at $1,200 per acre.

Hazard Properties

Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Average Burn Recurrence Interval for 94704:	42 Use Default:Yes
Project Effectiveness:	10

Standard Benefits - Buildilng
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Number of Buildings Protected by Proposed Project:	5469
Total building replacement value (BRV) of all building(s) within proposed project area:	$3,327,797,205

Comments

Number of Buildings:
This BCA includes only the 5,469 buildings within 1/2 mile of the project areas. This is very conservative -FEMA allows counting buildings up to 2 miles from project areas. The number of buildings is based on GIS mapping: see maps in the Benefit-Cost Documentation Report that is included in the application.

Building Replacement Value:
The size (square feet) of living space and the number of stories for each of the 5,469 buildings were extracted from Assessors data. Tables of data for each building are included in the attachments in the subapplication for 1-Story, 1.5-Story, 2-Story, 2.5-Story and 3-Story buildings. Building replacement values per square feet were extracted from the BNI Building News Home Builder's 2021 Cost Book, with interpolations and conservative extrapolation for buildings sizes larger than those included in the Cost Book.

Standard Benefits - Contents
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Value of Building Contents:	$1,663,898,602.5 Use Default:Yes

Standard Benefits - Displacement
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Lodging Per Diem:	$165 Use Default:Yes
Meals Per Diem:	$66 Use Default:Yes
Population Affected:	16799
Total Residential Displacement Cost:	$991,306

Standard Benefits - Other
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Value of Infrastructure vulnerable to fire in project area:	$0
Value of Timber to be sold within proposed project area:	$0
Fire suppression costs for one typical fire within proposed project area:	$0
Other costs mitigated by proposed project:	$0

Comments

Infrastructure Value:
Not included in this BCA.

Timber Value:
Not included in this BCA,

Fire Suppression Value:
Not included in this BCA.

Other Value:
Not included in this BCA.

Standard Benefits - Volunteer Costs
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Number of Volunteers (volunteers/event):	0
Number of Days of Lodging:	0
Expected Annual Volunteer Benefits:	$0

Comments

Number of Volunteers Required:
Number of Volunteers Required were not included in this BCA.,

Standard Benefits - Ecosystem Services
Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Total Project Area (acres):	0
Percentage of Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Marine Estuary:	0.00%
Expected Annual Ecosystem Services Benefits:	$0

Comments

Total Project Area:

Standard Benefits - Ecosystem Services were not included in this BCA.

Benefits-Costs Summary

Hazardous Fuels Reduction @ 37.8634090; -122.2718780

Total Standard Mitigation Benefits:	$84,735,798
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$84,735,798
Total Mitigation Project Cost:	$5,183,619
Benefit Cost Ratio - Standard:	16.35
Benefit Cost Ratio - Standard + Social:	16.35

County	Assessors Parcel Number	Bldg Liv Area	Lot Acres	Lot SqFt	Stories	Use_Type	Number of Housing Units	Project Area
1-Story								
ALA	055 -1862-063-00	1,788	0.144	6278	1	RESID. CONDOMINIUM	2	Claremont Canyon
ALA	053 -1699-034-00	2,964	0.144	6299	1	RESID. CONDOMINIUM	3	Claremont Canyon
ALA	055 -1856-022-00	3,884	0.208	9080	1	RESID. CONDOMINIUM	4	Claremont Canyon
ALA	053 -1697-013-02	1,034	0.07	3072	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	063 -2979-011-00	1,185	0.104	4539	1	RESID. MULTIPLE FAMILY	1	Tilden North
ALA	053 -1698-009-00	1,536	0.137	6000	1	RESID. MULTIPLE FAMILY	3	Claremont Canyon
ALA	052 -1565-079-00	1,715	0.078	3440	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	060 -2475-017-01	1,763	0.3	13103	1	RESID. MULTIPLE FAMILY	2	Tilden South
ALA	060 -2478-009-01	1,776	0.487	21242	1	RESID. MULTIPLE FAMILY	2	Tilden South
ALA	055 -1856-003-00	1,854	0.127	5573	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	055 -1856-002-00	1,919	0.097	4246	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	063 -2961-004-01	1,967	0.163	7130	1	RESID. MULTIPLE FAMILY	2	Tilden North
ALA	062 -2942-035-01	2,059	0.278	12141	1	RESID. MULTIPLE FAMILY	2	Tilden North
ALA	055 -1859-004-00	2,121	0.143	6250	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	063 -2985-016-04	2,135	0.126	5520	1	RESID. MULTIPLE FAMILY	2	Tilden North
ALA	055 -1859-005-00	2,273	0.143	6250	1	RESID. MULTIPLE FAMILY	3	Claremont Canyon
ALA	060 -2475-005-02	2,275	0.218	9500	1	RESID. MULTIPLE FAMILY	2	Tilden South
ALA	055 -1859-028-01	2,343	0.099	4353	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	055 -1847-012-00	2,366	0.126	5520	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	048H-7701-007-12	2,380	0.577	25168	1	RESID. MULTIPLE FAMILY	2	Claremont Canyon
ALA	063 -3110-050-00	2,892	0.179	7820	1	RESID. MULTIPLE FAMILY	2	Tilden North
ALA	055 -1853-007-01	6,481	0.231	10100	1	RESID. MULTIPLE FAMILY	7	Claremont Canyon
ALA	063 -3130-008-00	1,100	0.211	9202	1	RESID. PUD	1	Tilden North
ALA	063 -3140-063-00	1,185	0.141	6160	1	RESID. PUD	1	Tilden North
ALA	063 -3130-005-00	1,200	0.267	11644	1	RESID. PUD	1	Tilden North
ALA	063 -3140-064-00	1,225	0.145	6336	1	RESID. PUD	1	Tilden North
ALA	063 -3160-011-00	1,242	0.156	6834	1	RESID. PUD	1	Tilden South

DATA TABLE CONTINUES FOR MORE THAN 1,000 PAGES

Exhibit C

CONTRACT FOR SERVICES
(Licensed Professionals)

THIS AGREEMENT, made and entered into on this _____ day of _____, between the East Bay Regional Park District ("District") and _____, hereinafter referred to as ("Consultant") (together sometimes referred to as the "Parties").

RECITALS

A. District desires to engage the services of Consultant to provide professional services herein described; and

B. Consultant desires to perform such services for District.

NOW, THEREFORE, in consideration of the mutual agreements herein contained, the Parties hereto agree as follows:

1. Term.

The term of this Agreement shall commence on _____ and shall end on _____. The General Manager or his/her designee may extend the term of this Agreement by providing written notice to Consultant. Time is of the essence in the performance of this Agreement.

2. Scope of Work.

During the term of this Agreement, Consultant shall provide all labor, materials, tools, equipment and services as set forth in **Exhibit A**, attached hereto and made a part hereof ("Scope of Work"). In the event of a conflict in or inconsistency between the terms of this Agreement and **Exhibit A**, the terms of the body of the Agreement shall prevail.

3. Standard of Care.

a. Standard of Care. Consultant agrees to perform the work in a professional manner and in a manner consistent with that degree of skill and care ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality. Consultant warrants and represents that all of the personnel, employees, and subconsultants performing the work under this Agreement shall have sufficient skill and experience to perform the services assigned to them and that its employees and subconsultants have all licenses, permits, and qualifications required to perform the services under this Agreement.

b. Subconsultants. Consultant is as responsible for the performance of its subconsultants as it would be if it had rendered these services itself. Consultant shall not subcontract any portion of the performance contemplated and provided for in this Agreement, other than

to the subconsultants noted in Consultant's proposal, without prior written approval of the District. In the event that District, in its sole discretion, desires the reassignment of any persons performing work under this Agreement, Consultant shall, upon receiving notice from the District, immediately reassign such person or persons.

c. Materials. Any construction materials and manufactured items called for by Consultant's documents shall be currently available and suitable for their intended use to achieve design intent.

4. Representatives.

The representative of Consultant who will make any presentations, attend any public hearings, supervise all service, and be the first point of contact in providing all services under this Agreement shall be _____. The representative of District who will monitor this Agreement and be responsible for its interpretation and/or modification shall be _____.

5. District-Provided Studies or Surveys.

Consultant shall make a recommendation to the District regarding the completeness or sufficiency of any survey or specialized study provided to Consultant, or the need for any study or survey that the Consultant believes is required for the Project that is not included in the Consultant's Scope of Work. Consultant may rely on the information provided by District but only to the extent such reliance is consistent with Consultant's obligations under this Agreement.

6. Acceptance.

The District's review, approval, or acceptance of Consultant's work shall not relieve Consultant from responsibility for error and omissions in Consultant's work. Consultant shall, at no cost to District, satisfactorily correct any and all errors, omissions, deficiencies, or conflicts in the documents prepared by Consultant promptly upon discovery or notice. The obligations of Consultant to correct defective or nonconforming work shall not limit any other obligations of Consultant.

7. Time of Performance.

Consultant acknowledges that all time limits stated in this Agreement are of the utmost importance to District. Consultant's work shall be scheduled and performed to meet agreed-upon deadlines, as set forth in the Scope of Work. Consultant shall provide and maintain Project staffing levels as necessary to perform the services under this Agreement within the time provided in the Scope of Work. The total time scheduled for full completion of Consultant's services shall not exceed the durations shown in the Scope of Work, unless mutually agreed upon in writing by Consultant and District.

8. Payment.

District hereby agrees to pay Consultant a sum not to exceed $_____, notwithstanding any contrary indications that may be contained in Consultant's proposal, for services to be performed and reimbursable costs incurred under this Agreement. In the event of a conflict between this Agreement and the Scope of Work, attached as **Exhibit A,** or Consultant's compensation rate schedule attached as **Exhibit B,** regarding the amount of compensation, the text of the Agreement shall prevail. All reimbursable expenses incurred by Consultant as part of this Agreement will be reimbursed at actual cost and in no event shall expenses be advanced by District to Consultant. Such compensation shall be full payment to Consultant (including expenses) for performance of said services; provided, however, that in no event shall the sum of total compensation paid Consultant and reimbursable expense exceed the amount not to exceed amount stated in this section without a written amendment signed by both Parties.

Consultant shall submit his/her compensable hours and reimbursable expenses monthly, and District shall make payments on the approved compensation and reimbursable expenses within forty-five (45) days. In no event shall Consultant submit any invoice for an amount in excess of the maximum amount of compensation provided in this Agreement, unless this Agreement is modified prior to the submission of such an invoice by a properly executed change order or amendment.

Consultant and District acknowledge and agree that compensation paid by District to Consultant under this Agreement is based upon Consultant's estimated costs of providing the services required hereunder, including salaries and benefits of employees and subcontractors of Consultant. Consequently, the parties further agree that compensation hereunder is intended to include the costs of contributions to any pensions and/or annuities to which Consultant and its employees, agents, and subcontractors may be eligible. District therefore has no responsibility for such contributions beyond compensation required under this Agreement.

9. Termination of Agreement for Convenience.

District may terminate the whole or any part of this Agreement for convenience and without cause at any time. In such event, District shall give written notice of such termination. In the event of termination under this section, Consultant shall have the right to expend reasonable additional time to assemble work in progress for the purpose of proper filing and closing the job. Prior to expending said time, Consultant shall present to District, a complete report of said proposed job closure and its costs, and District may approve all or any part of said expense. Such additional time shall not exceed ten percent (10%) of the total time expended to the date of notice of termination. All charges thus incurred and approved by District, together with any other charges outstanding at the time of termination, shall be payable by District within thirty (30) days following submission of a final statement by Consultant.

10. Consultant as Independent Contractor.

It is expressly agreed that in the performance of the services necessary to carry out this

Agreement, Consultant shall be, and is, an independent contractor, and is not an agent or employee of District. Consultant has and shall retain the right to exercise full control and supervision of the services, and full control over the employment, direction, compensation and discharge of all persons assisting him/her in the performance of his/her services hereunder. Consultant shall be solely responsible for all matters relating to the payment of his/her employees, including compliance with social security, withholding, and all other regulations governing such matters, and shall be solely responsible for his/her own acts and those of his/her subordinates, sub-consultants, agents and employees.

11. Brokers: Compliance with Federal, State and Municipal Statutes.

Consultant warrants that he/she has not employed nor retained any broker, agent, company or person other than bona fide, full-time employees of Consultant working solely for Consultant, to solicit or secure this Agreement, and that he/she has not paid nor agreed to pay any broker, agent, company, nor persons other than bona fide employees any fee, commission, percentage, brokerage fee, gifts, or any other consideration, contingent upon or resulting from the award of this Agreement. Consultant shall indemnify, defend, protect and hold harmless District, its directors, officers, and employees from such claims.

12. Compliance with Laws.

Consultant shall comply with all federal, state, and local laws and regulations applicable to his/her work hereunder. Consultant shall use its professional judgment and expertise to verify interpretations of applicable law, codes, regulations, and ordinances, from the appropriate Government Agency(s) and authorities having jurisdiction over the Project. Such efforts will be undertaken in accordance with the acceptable standard of care for this type of Project. Where applicable, Consultant shall comply with all mitigation measures identified in the Project's environmental review documents.

13. Grant Funding.

To the extent that this Agreement may be funded by fiscal assistance from another governmental entity or public grant program, Consultant and any subconsultants shall comply with all applicable rules and regulations to which District is bound by the terms of such fiscal assistance program.

14. Nondiscrimination.

During the performance of this Agreement, Consultant and Consultant's sub-consultants agree as follows:

a. Contractor and Contractor's subcontractors will not discriminate against any employee or qualified applicant for employment on the basis of any legally protected classification including but not limited to sex, race, gender identity, creed, color, ancestry, religion, national origin, ethnic group identification, age, disability, medical condition, genetic information, marital status, or sexual orientation. Contractor and any subcontractors agree to comply with all nondiscrimination requirements for

public contracting under State and Federal law. Contractor and Contractor's subcontractors will take affirmative steps to ensure that qualified applicants are employed and that employees are treated during employment without regard to their sex, race, gender identity, creed, color, ancestry, religion, national origin, ethnic group identification, age, disability, medical condition, genetic information, marital status, sexual orientation or any other legally protected classification. This equal treatment will apply but not be limited to, the following: upgrade, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provision of this non-discrimination clause.

b. Contractor and Contractor's subcontractors will, in all solicitations or advertisements for employees placed by or on behalf of Contractor, state that all qualified applicants will receive consideration for employment without regard to sex, race, gender identity, creed, color, ancestry, religion, national origin, ethnic group identification, age, disability, medical condition, genetic information, marital status, sexual orientation, or any other legally protected classification.

c. Contractor and Contractor's subcontractors will send to each labor union or representative of workers with which he/she has a collective bargaining agreement or contract or understanding, a notice advising the labor union or workers' representative of Contractor's commitments under this non-discrimination clause.

15. Labor Code/Prevailing Wages.

To the extent applicable, Consultant and Consultant's subconsultants shall comply with the requirements of the California Labor Code including but not limited to hours of labor, nondiscrimination, payroll records, apprentices, workers' compensation, and payment of prevailing wages as determined by the Director of California Department of Industrial Relations, pursuant to the Director's authority under Labor Code Section 1770 et seq. To the extent applicable, Consultant shall post a copy of the prevailing rate of per diem wages at each job site. Consultant shall forfeit fifty dollars ($50) for each calendar day or portion thereof for each worker paid less than the stipulated prevailing rates for any public work done under the Agreement by it or any subconsultant.

An error on the part of an awarding body does not relieve the Consultant from responsibility for payment of the prevailing rate of per diem wages and penalties pursuant to Labor Code Sections 1770-1775. The District will not recognize any claim for additional compensation because of the payment by the Consultant for any wage rate in excess of prevailing wage rate set forth. The possibility of wage increases is one of the elements to be considered by the Consultant. Consultant shall defend, indemnify and hold harmless the District for any costs, claims and expenses arising from the failure of Consultant or Consultant's subconsultants to pay applicable prevailing wage rates.

16. Indemnification.

a. Separate Professional Liability (PL) Indemnity. To the fullest extent permitted by law, including without limitation California Civil Code Section 2782 and 2782.8, and with respect to the performance of professional services, Consultant agrees to indemnify and hold harmless District, its officers, employees, authorized agents/volunteers, and invitees (collectively, the "District Indemnitees"), from and against any claims, damages, losses, demands, liabilities, judgments, settlements, expenses, and costs (including reasonable and necessary attorneys' fees, costs and expenses) to the extent caused by Consultant's negligent acts, errors or omissions or willful misconduct in the performance of services under this Agreement and anyone for whom Consultant is legally liable. Consultant has no obligation to pay for any of District Indemnitees defense related cost prior to a final determination of liability, or to pay any amount that exceeds Consultant's finally determined percentage of liability based upon the comparative fault of Consultant.

b. Separate Other than Professional Liability (OPL) Indemnity. As respect to its operations, other than the performance of professional services, Consultant agrees to indemnify, hold harmless and defend District with counsel approved by District, the District Indemnitees, from and against any damages, liabilities, judgments, settlements, costs, claims, demands, actions, suits, losses, and expenses (including reasonable and necessary attorneys' fees, costs and expenses) arising out of the death or bodily injury to any person or destruction or damage to any property, to the extent caused by Consultant's negligent acts, errors or omissions or willful misconduct in the performance of services under this Agreement and anyone for whom Consultant is legally liable.

c. Common PL & OPL Indemnity Provisions. Consultant's obligations under this Section 16 shall not apply when (1) the injury, loss of life, damage to property, or violation of law arises from the gross negligence or willful misconduct of the District or its officers, employees, agents, or volunteers and (2) the actions of Consultant or its employees, subcontractor, or agents have contributed in no part to the injury, loss of life, damage to property, or violation of law. It is understood that the duty of Consultant to indemnify and hold harmless under Section 16(b) includes the duty to defend as set forth in Section 2778 of the California Civil Code. Acceptance by District of insurance certificates and endorsements required under this Agreement does not relieve Consultant from liability under this indemnification and hold harmless clause. This indemnification and hold harmless clause shall apply to any damages or claims for damages whether or not such insurance policies shall have been determined to apply. By execution of this Agreement, Consultant acknowledges and agrees to the provisions of this Section and that it is a material element of consideration.

d. In the event that Consultant or any employee, agent, or subcontractor of Consultant providing services under this Agreement is determined by a court of competent jurisdiction or the California Public Employees Retirement System (PERS) to be

eligible for enrollment in PERS as an employee of District, Consultant shall indemnify, defend, and hold harmless District for the payment of any employee and/or employer contributions for PERS benefits on behalf of Consultant or its employees, agents, or subcontractors, as well as for the payment of any penalties and interest on such contributions, which would otherwise be the responsibility of District.

17. Insurance.

a. Consultant shall procure and keep in force during the term of this Agreement, at Consultant's own cost and expense, the following policies of insurance with companies licensed to do business in the State of California, which are rated at least "A" or better by A.M. Best Company and which are acceptable to District. Consultant shall, fifteen (15) days prior to the commencement of this Agreement and prior to the termination of any policy, supply District with a certificate, on the District's certificate of insurance form, showing that such insurance is in force.

(1) Consultant shall, at its sole cost and expense, maintain Statutory Workers' Compensation Insurance and Employer's Liability Insurance for any and all persons employed directly or indirectly by Consultant. The Statutory Workers' Compensation Insurance and Employer's Liability Insurance shall be provided with limits of not less than one million dollars ($1,000,000) per accident. In the alternative, Consultant may rely on a self-insurance program to meet those requirements, but only if the program of self-insurance complies fully with the provisions of the California Labor Code. Determination of whether a self-insurance program meets the standards of the Labor Code shall be solely in the discretion of the District. The insurer, if insurance is provided, or the Consultant, if a program of self-insurance is provided, shall waive all rights of subrogation against the District and its officers, officials, employees, and volunteers for loss arising from work performed under this Agreement.

(2) Commercial General Liability ("CGL") (bodily injury and property damage) on an occurrence basis in an amount not less than one million dollars ($1,000,000) per occurrence and at least two million dollars ($2,000,000) in the aggregate, including premises and operations (including off-site operations), blanket contractual liability, broad form property damage, products and completed operations, owner's and Consultant's protective liability, (and if one or more of the following is applicable) personal injury, coverage for explosion, collapse and underground hazards, non-owned watercraft protection and indemnity, U.S. longshore and harbor workers coverage, pollution liability, liquor liability, and saddle animal liability.

(3) Automobile Liability (bodily injury and property damage) in an amount not less than one million dollars ($1,000,000) per occurrence extending to owned, non-owned and hired vehicles and including contractual liability covering all liability assumed under Agreement.

(4) Professional Liability Insurance (errors and omissions), including contractual

liability, in an amount not less than one million dollars ($1,000,000) per occurrence and two million dollars ($2,000,000) in the aggregate. Such coverage may be written on a claims-made basis.

b. Each of the above policies must contain a provision that the policy shall not be cancelled or the terms or conditions thereof materially changed without thirty (30) days' prior written notice to District. No cancellation provision in any insurance policy shall be construed in derogation of the continuous duty of Consultant to furnish the required insurance during the term of this Agreement.

c. Upon written request by District, the insurer or his/her agent will furnish a copy of any policy cited above, certified to be a true and complete copy of the original.

d. The policies listed under a(1) above shall contain a waiver of subrogation in favor of the District.

e. The policies listed under a(2) and a(3) above shall name the District as an additional insured with respect to the operations performed under this Agreement.

f. The coverage afforded on behalf of District under a(2), a(3) and a(4) above shall be primary insurance and any other insurance available to District under any other policies shall be excess over the insurance outlined above.

g. Upon written request of District, annual loss reports will be supplied to District. The loss report will include a list of all incidents/claims submitted against the insurance company and the estimated reserved and paid value of the claims.

h. District reserves the right to require reasonable increases in the limits of coverage from time to time during the term of this Agreement.

i. Policies should be written on an occurrence basis. Only by special permission of District may a claims-made form be used. The retroactive date on any policy written on a claims-made basis shall be the effective date of this Agreement or prior. The retroactive date of any subsequent renewal of such policy shall be the same as the original policy, provided that the extended reporting or discovery period shall not be less than thirty-six (36) months following expiration of such policy.

j. Consultant certifies that he/she is aware of the provisions of Section 3700 of the California Labor Code, which requires every employer to be insured against liability for Workers' Compensation or to undertake self-insurance in accordance with the provisions of that Code. Consultant shall comply with the provisions of Section 3700 of the Labor Code before commencing the performance of the work under this Agreement.

k. Consultant shall require and verify that all subconsultants maintain insurance meeting all the requirements stated herein.

l. In case of the breach of any provision of this section, District may, in addition to any other remedies it may have, at District's option, take out and maintain, at the expense of Consultant, such types of insurance in the name of the Consultant as District may deem proper and may deduct the cost of taking out and maintaining such insurance from any sums which may be found or become due to Consultant under this Agreement or may demand Consultant to promptly reimburse the District.

18. Default.

In the event that Consultant defaults in any obligation of Consultant under this Agreement, or Consultant defaults in the performance of any of the terms and conditions of this Agreement, and Consultant does not cure its failure to perform to the satisfaction of the District within ten (10) days (or such time authorized by the District in writing) after written notice by the District, District may, at its option, declare this Agreement to be in default and, at any time thereafter, may do any one or more of the following:

a. Enforce performance of the Agreement by Consultant.

b. Immediately terminate Consultant's services under this Agreement.

c. Perform the obligations of the Consultant, whereupon Consultant shall reimburse District for any amounts paid or expenses incurred by District, or pay District any expenses and/or damages incurred by District in the performance of such obligations, District's increased cost in performing the work, together with interest at the maximum rate of interest allowed by law on demand by District. District at its option may deduct any sum due to District from sums to be paid by District to Consultant.

d. The above remedies are in addition to any other remedies at law or equity District may have. Consultant shall pay or reimburse District for all of District's costs and expenses, including reasonable attorneys' fees incurred in enforcing its rights hereunder.

19. Consultants Books and Records/Audit.

Consultant and Consultant's subconsultants, if any, shall maintain any and all ledgers, books of account, invoices, vouchers, and any other records or documents pertaining to charges for services, expenditures and disbursements to District under this Agreement for a minimum of three (3) years, or such longer period required by law, from the date of final payment to Consultant by District. Any records or documents required to be maintained under this section shall be made available to District for inspection and copying upon request. In accordance with California Government Code Section 8546.7, if the Not to Exceed Amount exceeds ten thousand dollars ($10,000), this Agreement and the Consultant's books and records related to this Agreement shall be subject to the examination and audit of the State Auditor, at the request of District or as part of any audit of the District, for a period of three (3) years after final payment under the Agreement.

20. Assignment.

District and Consultant recognize and agree that this Agreement contemplates personal performance by Consultant and is based upon a determination of Consultant's unique personal competence, experience, and specialized personal knowledge. Moreover, a substantial inducement to District for entering into this Agreement was and is the professional reputation and competence of Consultant. Consultant shall not assign or otherwise transfer any rights, duties, obligations or interest in this Agreement or arising hereunder to any persons or entities whatsoever without the prior written consent of District and any attempt to assign or transfer without such prior written consent shall be void. Consent to any single assignment or transfer shall not constitute consent to any further assignment or transfer.

21. Advice of Counsel/Attorneys' Fees.

If either party prevails against the other in a legal action concerning any aspect of this Agreement, such successful party shall be entitled to recover its reasonable attorneys' fees and costs incurred in such action from the losing party.

Both parties have had a full and complete opportunity to have the Agreement reviewed by legal counsel, and no presumption or rule that ambiguity shall be construed against the drafting party shall apply to the interpretation or enforcement of this Agreement.

22. Notices.

If either party shall desire or be required to give notice to the other, such notice shall be given in writing, and shall be personally delivered or sent by prepaid U.S. certified or registered postage, return receipt requested, addressed to the recipient as follows:

DISTRICT: East Bay Regional Park District
Attention: _____
2950 Peralta Oaks Court
Oakland, CA 94605
Phone: _____
Email: _____

CONSULTANT: _____
Attention: _____
Address: _____
_____
Phone: _____
Email: _____

Either party may change its address by giving notice to the other in the manner provided herein.

23. Ownership of Work.

All reports, data, maps, models, charts, studies, surveys, photographs, plans, specifications, or

any other documents in electronic or any other form (collectively "documents and materials"), that Consultant prepares or obtains pursuant to this Agreement shall be the property of the District to be used, reused or disposed of by the District in its sole discretion without the permission of Consultant. In the event of early termination of this Agreement and not withstanding any dispute regarding payments, the District retains its ownership of the documents and materials and retains the right to receive and use any documents or materials pursuant to this Agreement.

24. Digital Files.

In addition to any other format required in the Scope of Work, Consultant shall provide copies of all deliverables on compact disk in a digital format. Files shall be compatible with software used by the District. Any necessary conversion to formats compatible with District software to comply with this section shall be performed at no additional cost to the District.

25. Payment of Taxes, Tax Withholding.

Consultant is solely responsible for the payment of employment taxes incurred under this Agreement and any similar federal or state taxes. During the term of this Agreement and for three (3) years after the termination of this Agreement, Consultant shall maintain in its files a valid California Franchise Tax Board form 590 ("Form 590"), as may be amended, or other valid, written evidence of an exemption or waiver from withholding for Consultant and all subcontractors receiving compensation under this Agreement. Consultant accepts sole responsibility for withholding taxes from any non-California resident subcontractor and shall submit written copies of any Form 590 and/or documentation of compliance with Consultant's withholding duty to District upon request.

26. Confidential Information.

All ideas, memoranda, specifications, plans, procedures, drawings, descriptions, computer program data, input record data, written information and other documents or data either created by or provided to Consultant in connection with the performance of this Agreement shall be treated as confidential by Consultant. Such materials shall not, without the prior written consent of District, be used by Consultant for any purposes other than the performance of the services. Such materials shall not be disclosed to any person or entity not connected with the performance of the services under this Agreement. Nothing furnished to Consultant which is generally known, or has become known, to the related industry shall be deemed confidential.

27. Governing Law.

This Agreement shall be construed and interpreted in accordance with the laws of the State of California. In the event that either party brings any action the trial of such action shall be venued exclusively in the state courts of California in the County of Alameda or in the United States District Court for the Northern District of California.

28. No Waiver.

The waiver of any breach of a term or requirement of this Agreement does not constitute a waiver of any other breach of that term or requirement or any other term or requirement of this Agreement.

29. Conflicts of Interest.

Consultant declares that Consultant has no interest and shall not acquire any interest, direct or indirect, financial or otherwise, which would conflict in any manner or degree with the performance of services hereunder. Consultant further declares that in the performance of this Agreement no subconsultant or person having such interest shall be employed. No officers or employee of the District with responsibility for review, approval of or carrying out of the work to be performed shall be hired by Consultant during the term of this Agreement.

30. Entire Agreement.

This Agreement contains all of the agreements and understandings of the parties pertaining to the subject matter contained herein and supersedes all prior, contemporaneous agreements, representations and understandings of the parties. This Agreement cannot be amended or modified except by written agreement of all the parties. In the event that the terms or conditions of any Exhibits to this Agreement conflict, directly or indirectly, with this Agreement, the provisions of this Agreement shall control.

31. Severability.

The unenforceability, invalidity or illegality of any provision shall not render the other provisions unenforceable, invalid or illegal.

32. Counterparts.

This Agreement may be executed in counterparts, and/or by electronic signature, and/or by fax, and/or by scan and email, and all so executed shall constitute one agreement which shall be binding upon all parties hereto, notwithstanding that the signatures of all parties do not appear on the same page. A facsimile signature, electronic signature, and/or scanned and emailed signature shall be binding upon any party as though it were an original.

[Signatures on Following Page]

IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed by their respective officers, duly authorized as of the day, month, and year first hereinabove written.

EAST BAY REGIONAL PARK DISTRICT	**CONSULTANT**
By: _____	By: _____
_____ Print Name	_____ Print Name
_____ Title	_____ Title
Date: _____	Date: _____

EXHIBIT A – SCOPE OF WORK

EXHIBIT B – RATE SCHEDULE