MORAGA-ORINDA FIRE DISTRICT



STANDARDS OF COVER

"Determining the distribution and concentration of fixed and mobile resources of the Moraga-Orinda Fire District to reduce community risk in the Town of Moraga and City of Orinda"

November 2016

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Moraga-Orinda Fire Protection District

Mission Statement

With pride and professionalism, the Moraga-Orinda Fire District will provide the highest level of emergency and public service to the needs of our community.

Core Values

Service, Honor, Integrity

Board of Directors

Stephen Anderson, President

Fred Weil, Vice President

Kathleen Famulener, Secretary

Brad Barber, Treasurer

Alex Evans, Director

Acknowledgments

Stephen Healy, Fire Chief

Sean Perkins, Battalion Chief

Jerry Lee, Battalion Chief

Steve Rodgers, *DNI*, Fire Captain (ret.)

Uriel Garcia, GIS Specialist

Richard Olsen, Director (ret.)

Paul Rottenberg, *FireStats*, *LLC*

Center for Public Safety Excellence/CFAI

INTRODUCTION

This document is a report that shall determine and define the "Standards of Cover" (SOC) for the Moraga-Orinda Fire District (District). The Commission of Fire Accreditation International (CFAI) defines the process, known as "deployment analysis," as a written procedure, which determines the distribution and concentration of fixed and mobile resources of an organization. The purpose for completing this documentation is to assist the District, ensuring a safe and effective response force for fire suppression, emergency medical services, homeland security, and specialized response situations.

Creating an *Integrated Response Management Plan Standards of Cover* requires that a number of areas be researched, studied, and evaluated. This report will provide an overview of the community, the District, risk assessment, critical task analysis, service level objectives, distribution and concentration measures. The District will provide documentation of reliability studies and historical performance through charts, tables, maps, and graphs.

The last District Standards of Cover report was produced in 2006. When staff reviewed the report, similarities and differences between the 2006 and 2016 reports were observed:

Similarities: 1) Used CFAI model, 2) focused on developed areas v. undeveloped areas, and 3) used of the latest software and data available.

Differences: 1) Updated CFAI reference materials, which included different "total" response time measurements; 2) updated and applied definition of population densities; 3) access to sophisticated GIS network modeling and maps; 4) availability of data to analyze time-on-task, response capacity, call concentration, and response patterns; 5) increased focus on community risks and risk-reduction programs; 6) integration of updated and improved operational policies; and 7) a commitment to setting goals that are reasonably attainable.

During development of this report, updated editions of the CFAI Standards of Cover and Self-Assessment Manual were published (6th and 9th). Rather than abandon the year of work that had already been completed, the new editions were reviewed and some elements were incorporated into this report. Two significant changes accompanied the new editions: 1) CFAI reverted to "Urbanized Areas" v. distinct categories, such as "Metro", "Urban", "Suburban", etc.; and 2) the 6th edition deemphasizes fire risk and focuses on relative competencies to improve services where gaps exist. The terms "Benchmark" and "Baseline" were also deemphasized and referenced in the glossary as superior performance and target performance measures.

The report includes policy recommendations.

EXECUTIVE SUMMARY

Prior to updating the SOC, the District conducted an extensive literature review. During this process, several SOCs from accredited agencies were studied. These yielded a basic framework (CFAI), but were presented in different ways. For example, some agencies have a SOC with significant elements of a strategic plan and voluminous context. Considerable effort was made in developing this report to provide the necessary data and context, providing policy makers (Board of Directors) with enough information to make informed decisions regarding resource deployment through budget allocations. This document is also intended to inform the public about District response time performance, District capabilities, capacities, and assets.

As with the 2006 SOC, the District utilized the CFAI analysis model, which yielded an excellent framework and outcomes for the report. This report was based on the model from the CFAI 5th edition Standards of Cover and 8th edition Self-Assessment Manual. The District chose CFAI because it represents the gold standard in the fire service. The District then took the model and adapted it to align with community expectations, reasonable performance goals, and fiscal constraints. As is indicated throughout the report, there are many standards, models, organizations, software programs, and data points to be considered.

Of the four (4) goals from the 2006 SOC, two are inter-related, were implemented and then discontinued (Medic-44/45 staffing configuration); one has been dismissed (second ladder truck in District); and one cannot be assessed (turn-out times, due to 2006 data being unavailable). Looking forward, the recommendations within this report touch on all these issues, have been updated, and remain relevant service delivery topics.

For this report, the District evaluated response performance from 2011 through 2015. This data yielded many findings, which resulted in seven (7) recommendations. These recommendations are summarized on page 14 of this report.

From 2006 through 2015, the call volume increased from 2,645 to 3,341 calls per year (21%). This increase in service demand creates a corresponding increase in overall “time-on-task”, which is the percentage of time that a fire company is unavailable while committed to a call. Presently, the range for time-on-task is from 2% to 11%. The inverse of this measurement is the time a company is “available” to respond to incidents (89% to 98%). This represents excellent emergency response capacity within the District.

This report should be reviewed in conjunction with the District’s Strategic/Business Plan, Long-range Financial Plan, Long-range Capital Plans, and budgets.

OVERVIEW OF METHODOLOGY, KEY FINDINGS, AND POLICY DIRECTION

Background

One of the challenges the fire service has historically faced is how to adequately define the reasonable levels of service for the community it protects. As part of the CFAI process, a Standards of Cover (SOC) document is developed and adopted by the agency having jurisdiction (AHJ). This SOC is designed to provide elected officials and residents an overview of information about District operations and efforts to provide community risk management and safety. It is not intended to be a stand-alone document, but rather to be used in conjunction with the District's budgets; strategic plan, business plan, and long-range financial plans. The analysis in this SOC reviews the adequacy of the existing deployment system, historical response times, incident types, the times incidents occur, community growth patterns, and identifies key findings based upon analytics.

While developing this SOC, it became clear that the District needed to evaluate and update its service level goals. The District completed this based on national standards such as the CFAI accreditation model, the ISO grading schedule, and historical response data. While the SOC provides an overview of risk assessment, deployment of resources, and an analysis of current performance, the District's strategic/business plan outlines the resources needed to support the service demands within the community.

Policy Framework

Currently, there are no federal or state laws directing the level of fire service response times and/or outcomes. However, a number of regulations dictate that these services be done with the safety of responders and community in mind. The communities within the District have made investments in it; principally through tax revenue, but also through volunteerism and cooperation with community risk-reduction initiatives. The result has been a well-trained and well-equipped work force, capable of responding to all types of emergency incidents in safe and effective manner.

CFAI Systems Methodology Approach

The diversity of challenges within each community makes it difficult to create a "one size fits all" solution. Therefore, it is not surprising that a federal or state consensus has never been reached. In 1996, to address this situation, the International Association of City Managers (ICMA) and the International Association of Fire Chiefs (IAFC) formed CFAI.

The CFAI process uses a "systems" approach for deployment rather than a singular prescriptive formula. In a comprehensive approach, each agency should be able to match local needs (risk and expectations) with the costs of various levels of service. In an informed public policy debate, each governing body "purchases" the fire and EMS protection the community wants, needs, and can afford.

Service Level Deployment

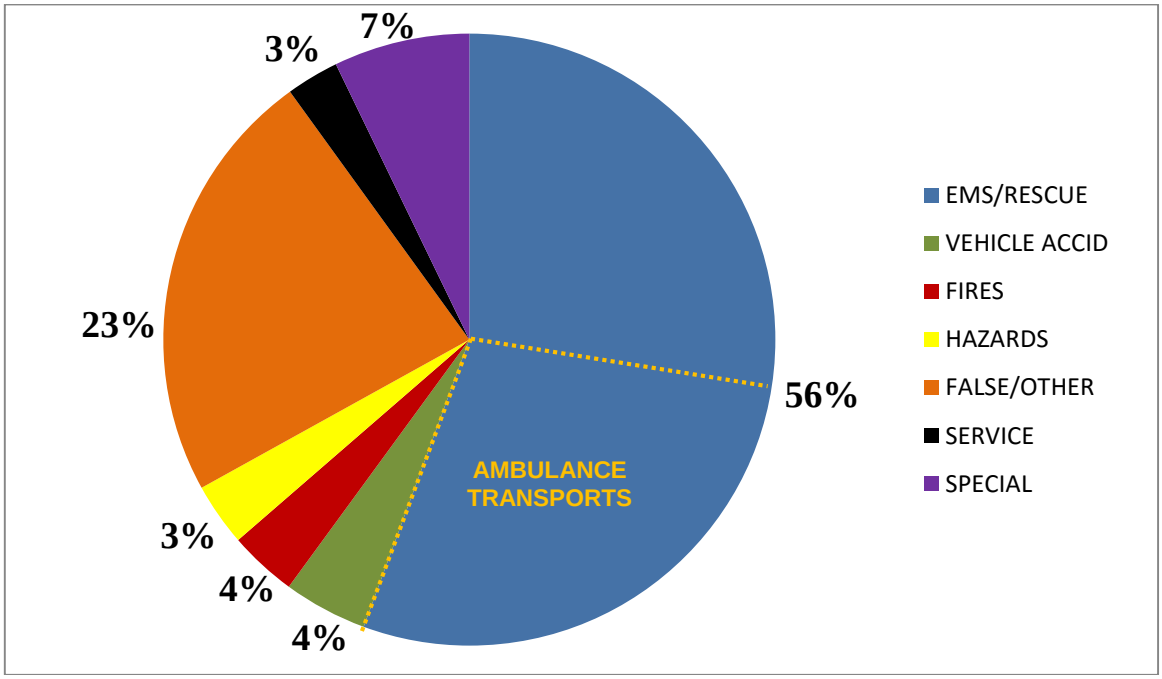
The goal of resource deployment is to respond with the appropriate number of people and equipment within a reasonably acceptable time. The distribution and concentration of resources must be strategically located across the community. "Distribution" is the geographic location and number of fire stations, equipment, and personnel for all-hazard incident initial intervention. Traditionally, square miles, population density, and call volume dictate distribution. "Concentration" is the number and spacing of resources needed to assemble an "effective response force" in

relation to critical tasks within a defined timeline. This report analyzed distribution and concentration as they relate to current and past demands, trends, and historical response times.

The District provides a high level of service to the communities of Moraga, Orinda, and unincorporated areas of the County. Each of the communities are dynamic and diverse, occasionally requiring specialized services such as wildland firefighting, technical rescue, water rescue, subterranean rescue, homeland security-related issues, and hazardous materials mitigation. Through economic recessions, the District has continued to provide these services. Over the past several years, the District has modified its operational staffing patterns in an effort to maintain the expected level of service while maintaining fiscal solvency.

From 2011 to 2015, medical emergency responses increased by 15.4%, structure fire responses remained flat, and vegetation fire responses increased and then decreased. Incident types from 2015 are illustrated in the following graph:

MOFD Incident Types: 2015



Notes: Examples of “Hazards” are wires down, hot objects, and fuel leaks; examples of “Service Calls” are assisting invalids, pick-ups-and-put-backs, and water leaks; examples of “Special Calls” are police standbys and homeland security.

Key Findings

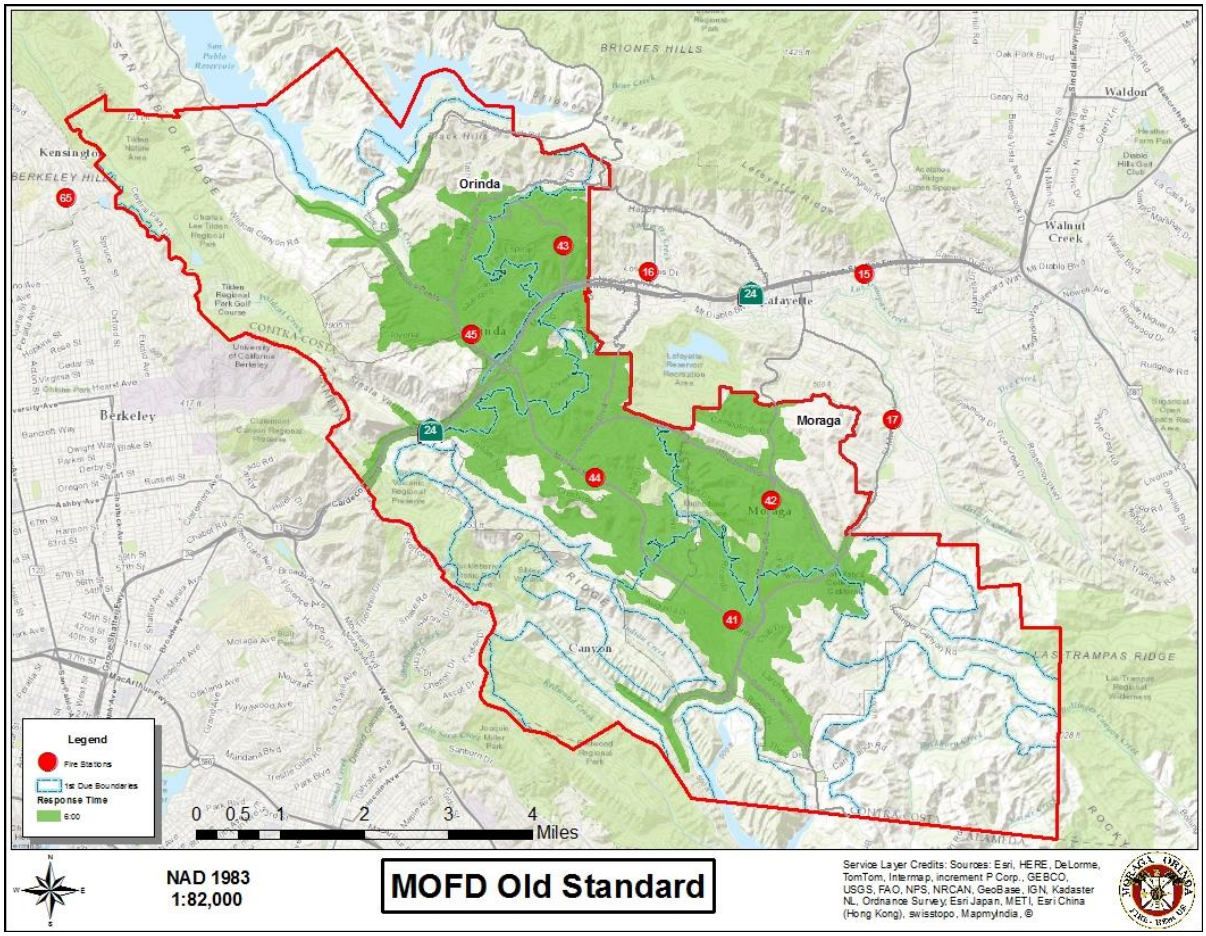
Key findings were as follows:

1. The methodology from the 2006 SOC was excellent; based on an earlier CFAI model.

    a. The graphic displays within the 2006 SOC appear dated, but only because the technology at that time did not allow the same mapping features and detail represented in the 2016 report.

    b. In 2006, the District used the population density designations of “Urban” and “Rural”. The response time goal of six minutes (6:00) using the 90% percentile has not been realized because it applies to an “Urban” performance standard in a predominantly “Suburban” area. As early as 2007, it was obvious that this standard, as written, was not being achieved when using the 90th percentile as a benchmark (“Superior Service Goal”) because performance for the six minute (6:00) was only 60.1%. of incidents that were reached within six minutes (6:00). However, median response time for EMS calls was five minutes and twenty-two seconds (5:22). This underscores the importance of evaluating more than just one or two statistical measurements and how any statistic can be misleading.

Map-1: 2006 CFAI Response Time Standard (6 minutes)



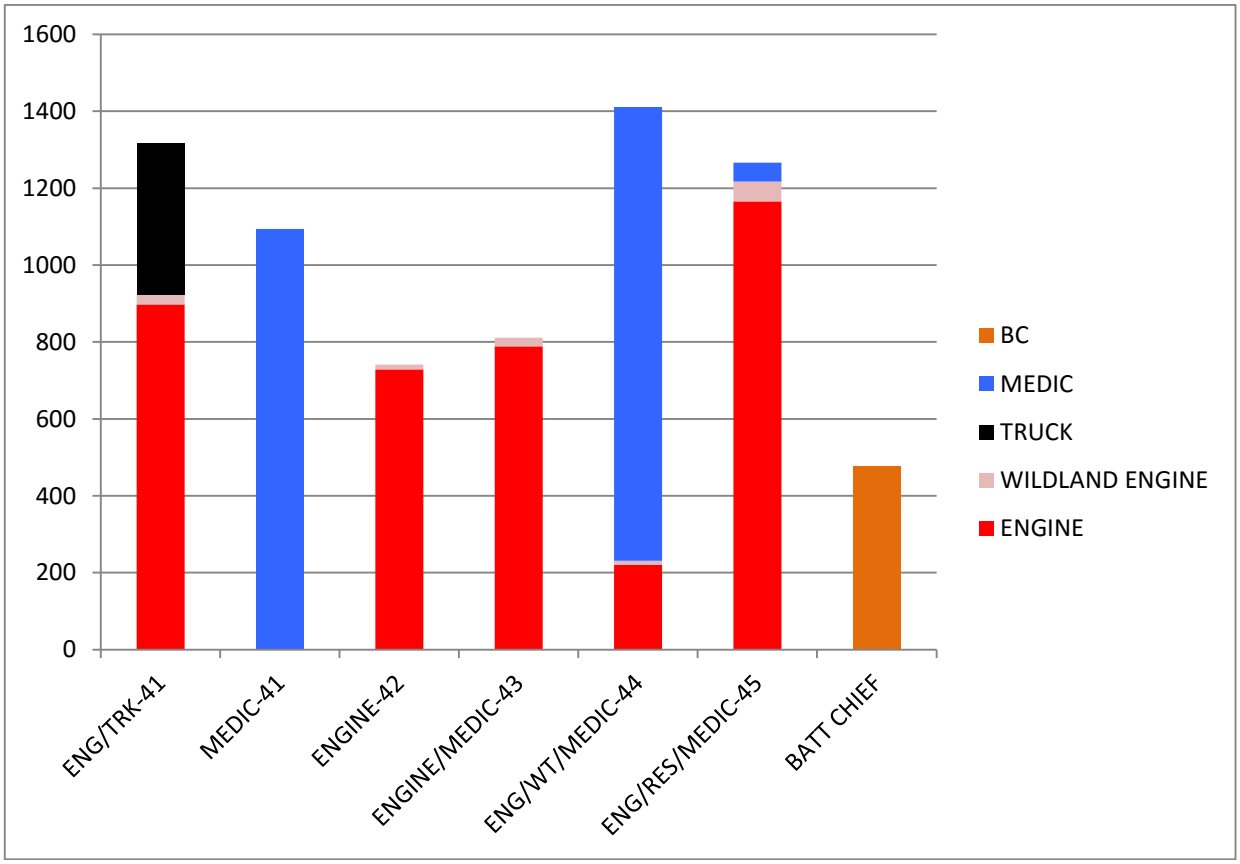
2. From 2011 through 2015, the response counts and times (within City/Town limits) for "first-arriving" fire or ambulance companies were as follows:

Unit/Incident Type	Count	Median Response Time	90th Percentile
EMS Engine/Truck	8,979	4:46	8:18
EMS Ambulance	7,482	5:41	10:18
Structure Fires	37	7:56	13:27
Vegetation Fires	62	5:02	8:34

Source: Tableau

Notes: 1) For EMS incidents, a seven minute (7:00) standard was applied for the 90th percentile data; 2) for fires, a seven minute and twenty second (7:20) standard was applied to the 90th percentile data; 3) for structure fires and vegetation fires, the median response time is a more appropriate measure of performance than the average because the data sets are too small and therefore subject to skewed data; 4) slight skewing of the EMS times is present due to extended response times when a 3rd ambulance responded to an incident. This sometimes requires a crew to return to their fire station to staff the ambulance, resulting in a delay.

In 2015, response counts by unit were as follows:



Turn-out Times:

Unit/Incident Type	Median Turn-out Time	90th Percentile
EMS	1:27	2:31
Structure Fires	1:59	3:49
Vegetation Fires	2:10	5:42

Source: Tableau

Notes: Turnout-Time performance has not meet the Benchmark ("Superior") standard for as long as the data has been available, primarily due to four (4) factors: 1) the software in the Mobile Data Terminals (MDTs) on the fire apparatus is outdated and has poor connectivity to the dispatch computer, 2) the number and complexity of personal protective equipment ensembles required to be worn to different incident types, 3) outdated policies regarding turnout procedures, 4) aging station alerting systems. Although turnout times were identified in the 2006 SOC as an area for improvement, no data exists from 2006. Comparing overall response times gives some indication of performance improvements or deficiencies. Remedies are in-progress for all of the aforementioned factors.

3. From 2011 through 2015, ambulance response locations, counts, and response times (within City/Town limits) were as follows:

Unit	Incident Location	Count	Median Response Time	90th Percentile
Medic-41	Moraga	3,118	4:46	7:50
(Moraga)	Orinda	830	7:32	12:27
Medic-44	Orinda	1,240*	7:15	11:28
(S. Orinda)	Moraga	227	8:27	12:16
Medic-45	Orinda	1,777**	5:35	9:27
(N. Orinda)	Moraga	290	10:08	13:00

Source: Tableau

Notes: 1) * Medic-44 is the primary ambulance in Orinda (2014 – Present). Data from that time period was used and excluded 2011-13; 2) ** Medic-45 was the primary ambulance in Orinda from 2011 through 2013. Data from that time period was used and excluded 2014-15; 3) Community of Canyon: Average of 7.6 EMS incidents per year; median ambulance response time was nine minutes and thirty-four seconds (9:34).

Response times in Orinda have always been longer than those in Moraga due to the topography, which causes the street routes to be oblique and therefore less direct. However, it is also evident that deploying the primary ambulance for Orinda from Station-44 (rather than Station-45) has resulted in increased response times. This is partially off-set by two factors: 1) first-arriving paramedics continue to arrive quickly to all emergencies on

fire engines, which are located at every station, and 2) the added fire suppression capacity gained by keeping Engine-45's crew available as a fire suppression/rescue resource.

4. Areas beyond the six (6) or seven (7) minute response time goals have been present since the inception of the District and remain today. Possible remedies for these deficiencies are discussed in the policy recommendations at the end of the report.

5. Ladder truck service is presently inadequate in Orinda due to the location and type of truck. A remedy for this is already in progress and is discussed within this report (see pages 64-66).

6. For the 2016 SOC, updated CFAI models were utilized. Several population densities were identified within the District including: *Metropolitan, Urban, Suburban, Rural,* and *Wilderness*. The District used the "Suburban" standard to develop the 2016 SOC response time goals because the population densities within Moraga and Orinda average between 1000 and 1999 people per square mile. This also most closely resembles the majority of the District's populated service area (see page-17 for further detail).

   The CFAI standard response time for suburban zones is seven minutes (7:00) for EMS responses and seven minutes and twenty seconds (7:20) for fires and other hazards.

7. Response capability, capacity and reliability within the District remain excellent.

   a. The District has the capability to handle all routine emergencies including fire, rescue, hazards conditions, and emergency medical. Paramedic ambulance service enhances first-responder paramedic engine company responses and is an important asset to the District and community. Additionally, firefighter-paramedics count towards engine company staffing for ISO class ratings.

   b. Response capacity within the District is excellent. Presently, there are between 18 and 23 firefighters on-duty each day to respond to an average of 9.2 incidents per day. Additional staffing is added during wildland season using a risk-based model.

   c. "Time-on-task", measured as the percentage of time District units are unavailable yielded a range of 2% to 11%.

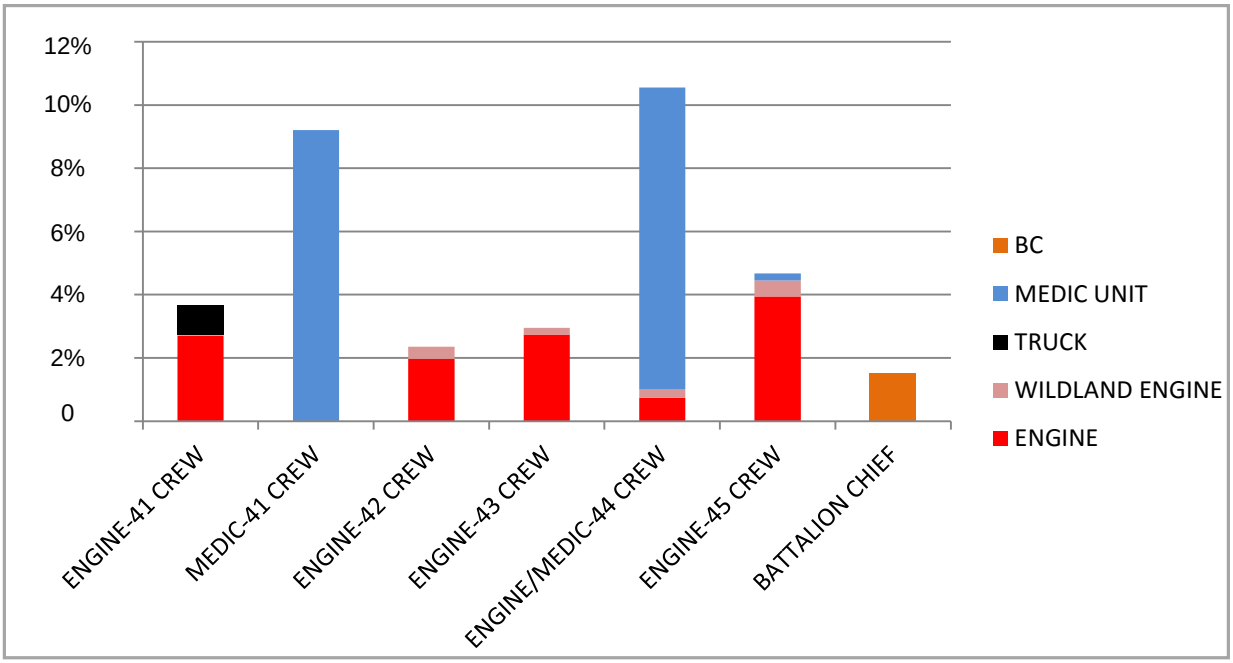
      i. In 2015, primary District ambulances were unavailable 9% to 11% of the time.
      ii. In 2015, fire engines (and ladder truck) were available 3% to 5% of the time

   d. District "reliability", measured as the percentage of time District units are available, yielded a range of 89% to 98%.

      i. In 2015, primary District ambulances were available 89% to 91% of the time
      ii. In 2015, fire engines (and ladder truck) were available 95% to 98% of the time.

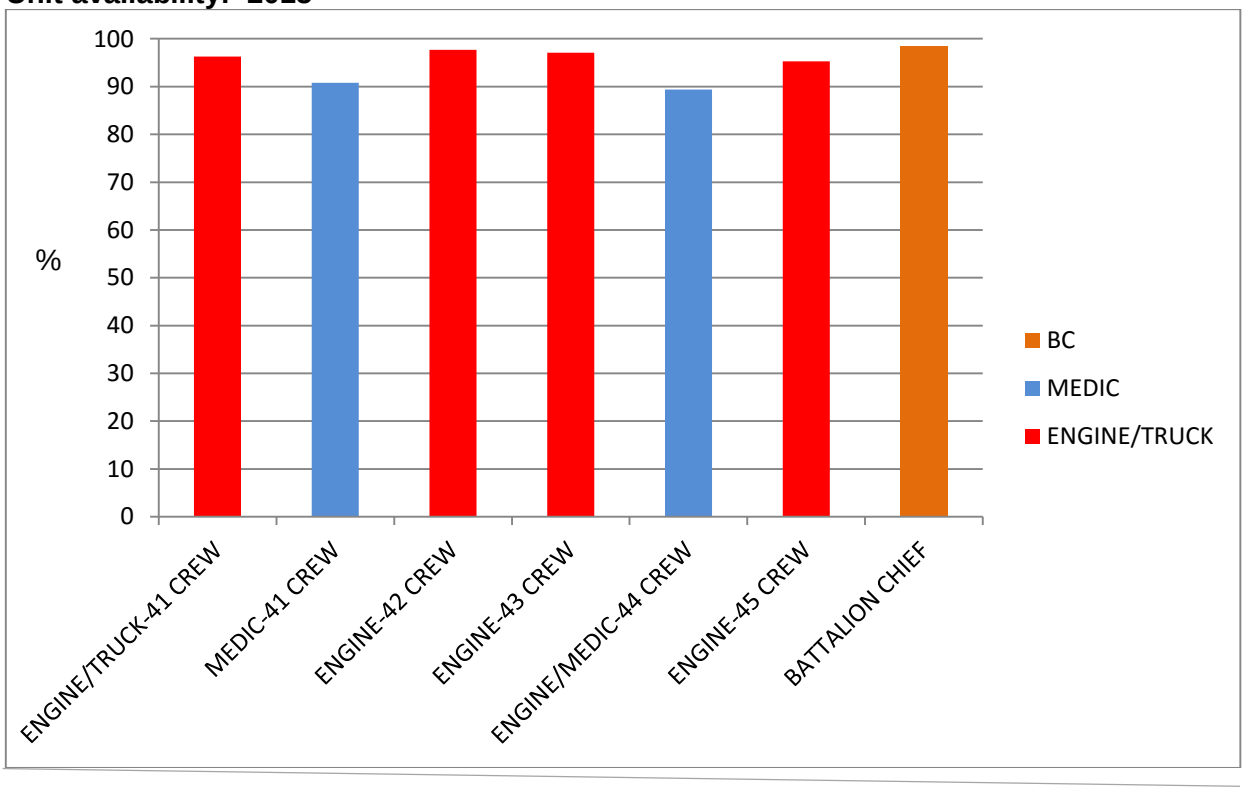
These statistics are reflected in the following charts:

Unit Time-on-Task: 2015



Source: Tableau

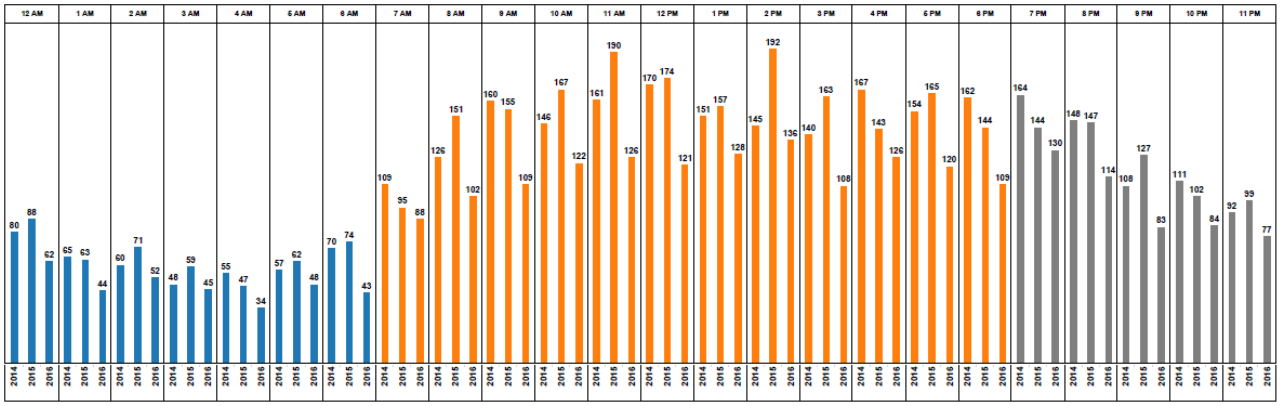
Unit availability: 2015



Source: Tableau

The following charts depict the time-of-day and day of week in which incidents occur. Although statistically insignificant, they are always of interest to stakeholders:

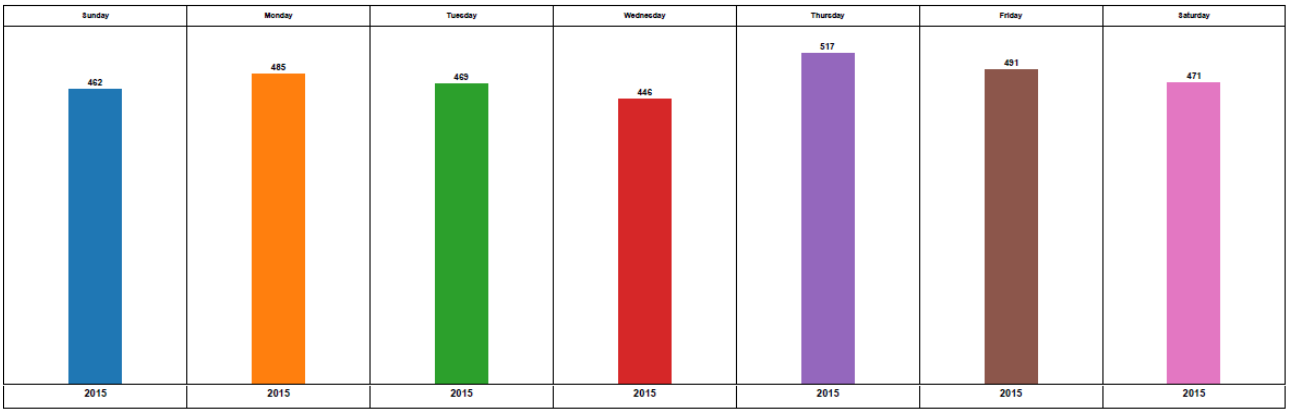
Time-of-Day for Incidents: 2014 – 2016



Source: Tableau

Note: Data was only available for the past three (3) years. Therefore, to increase the data set, 2014-2016 data was used. The 2016 data set is incomplete, which gives the appearance of reduced incident counts during 2016.

Day-of-Week for Incidents: 2015



Source: Tableau

Note: 2015 data was used

Policy Recommendations

Recommendation-1*

Assess the feasibility of staffing Medic-45 as an independent ambulance company at Station-45.

Recommendation-2

Increase critical task abilities by increasing effective response force to identified High/Special Risk Hazards by adding additional companies to the 1st-Alarm assignment. Continue to utilize and assess further developing flexible-staffing models to improve service delivery.

Recommendation-3

Explore use of customized personal protective equipment (PPE) ensembles that can be worn within the fire stations and other factors to improve turn-out times for vegetation fires.

Recommendation-4

Expand CPR, AED, and *PulsePoint* community outreach

Recommendation-5

Continue to utilize the metrics found in the CFAI Standards of Cover standards as a benchmark to measure future performance of service levels.

Recommendation-6

Continue to monitor "Call-Processing" times

Recommendation-7*

Community interest topics:

1. Assess feasibility of approaching homeowners in the Dalewood neighborhood to determine interest in a Community Services District (CSD) assessment to fund an additional fire station in northeast Orinda.

2. Assess feasibility of adding a roadway between Miner Road and Dalewood Drive in Orinda to improve response time to the Dalewood neighborhood.

3. Assess feasibility of moving Station-41 from current location to the corner of Moraga Way and Moraga Road. This would slightly improve response times to the Sanders Ranch neighborhood.

4. Assess feasibility of adding a roadway between Sanders Drive and Sanders Ranch Road in Moraga to significantly improve response time to the Sanders Ranch neighborhood.

5. Continue to monitor water distribution system and assess means to improve in low flow and low pressure areas.

Note: *Will require budgetary approval

SECTION I – COMMUNITY BASELINE & OVERVIEW

Community Overview

The Moraga-Orinda Fire Protection District (MOFD) predecessor districts were county-dependent districts.

The Orinda Fire Protection District was formed in 1933 and was served by volunteers until 1940. It grew from one fire station with one piece of equipment staffed by volunteers to three fire stations by the 1940s. A five-person Board of Fire Commissioners was appointed to administer the affairs of the Fire District. The geographical area was described as the follows: "…it encompassed the area from Tilden Park on the north to Del Rey School on the south and from the county line on the west to a point close to the Russel Tree Farm on the east…"

Services provided in the 1960s were firefighting, fire prevention, and fire education. The staffing for each station was a 2-person crew; each was trained in advanced first aid. Total personnel on-duty was 6 firefighters. In the 1960s, the Orinda Fire Protection District needed to relocate its outdated fire station on Avenida De Orinda, because it was often flooded during heavy rain storms. In1968, Orinda voters approved a $400,000 bond issue and the current 14,000 square foot fire station in the Orinda Village (Station-45) was commissioned in 1969.

Moraga was served by a volunteer unit of the Eastern Contra Costa County FPD from 1946 until 1968, when the Moraga Fire Protection District was formed. In 1970, Moraga voters rejected a proposal to annex to the Contra Costa County Fire District.

Orinda Fire Station (circa 1920s)

The Moraga-Orinda Fire Protection District was formed on July 1, 1997 as a fully integrated, independent special district. It was formed through consolidation of the Moraga Fire Protection District and the Orinda Fire Protection District, to provide more efficient fire protection and emergency medical services to the communities of Moraga and Orinda and the surrounding unincorporated areas, including the communities of Canyon and Bollinger Canyon.

Today, the District is located nine (9) miles east of San Francisco in southwest Contra Costa County, CA. It is bordered by the Cities of Berkeley and Oakland to the west, the City of Lafayette to the east, and large open spaces, reservoirs, and regional parks to the north and south. The District is a fully-paid, "all-risk" fire service agency with 64 regular employees, 6 temporary employees and 20 volunteers, including the Board of Directors. It encompasses 42 square miles, protecting approximately 38,500 residents in a combination of urban city centers; consisting of a combination of metropolitan, urban, suburban, and rural residential housing-density areas; a major college campus; and a mix of large regional parks, open spaces, reservoirs, and recreation areas. The district responded to 3,341 incidents in 2015 from five (5) fire stations, which house five engine companies, one (cross-staffed) truck company, four ambulances (3 cross-staffed), and one Battalion Chief.

The District protects significant critical infrastructure and several target hazards and high-risk parcels including Saint Mary's College of California, several senior assisted living facilities, four reservoirs, a

major power grid, two large natural gas transmission lines, a major 8-10 lane freeway, six transportation tunnels (four vehicle and two train), and thousands of high-value single-family homes. There are approximately 14,091 parcels within the District. The District has identified specific target hazard areas and occupancies within the Fire District boundaries. These areas and occupancies were selected based on the potential fire hazard level, risk potential, and the number of occupants that may require assistance during an emergency.

The far north end of the Fire District contains a large recreational area that includes boating access to a major reservoir. Other target hazards include the Orinda Senior Village Apartments (Orinda), the Monteverde Senior Apartments (Orinda), the Orinda Convalescent Hospital (Orinda), Moraga Royal Assisted Living (Moraga), Aegis Assisted Living (Moraga), and the Rheem Convalescent Hospital (Moraga).

Large areas to the north of Highway-24 are part of the Very High Fire Hazard Severity Zone (VHFHSZ).

Note: The term “wildland-urban intermix” refers to a specific type of wildland-urban interface in which the homes or other structures are intermixed with wildland fuels, as opposed to a distinct area of wildland fuel adjacent to a developed area (wildland interface or “WUI).

Commercial Development

The District is comprised of many occupancy classifications that are of concern for emergency responders. These may be classified as “Target Hazards” and/or “High-risk Parcels”. In the City of Orinda, Highway-24 (an 8-10 lane freeway) and BART bisect the commercial area. The Bay Area Rapid Transportation (BART) station and freeway access ramps are located within the commercial zone of the City of Orinda. The remainder of the City of Orinda is a majority of single-family residences, churches, and schools. Many of these residential areas have narrow, steep, and winding roadways within an intermix of heavy vegetation and large homes.

To the south of the commercial zone in Orinda, continues residential single-family homes with a few smaller commercial buildings. The VHFHSZ continue south to Hall Drive. The City of Orinda limits continue to Ivy Drive with flatter terrain, wider roadways, and a public high school.

The southern portion of the District includes the Town of Moraga, Bollinger Canyon, and the community of Canyon. The southwest area of the Town of Moraga has a concentration of single-family homes, large open and undeveloped space and heavy vegetated wildland. The Town of Moraga’s central light commercial areas include Rheem Valley and the Moraga Way/School Street commercial developments. Concentrated areas of single-family homes are distributed throughout the Town with the majority of multi-unit residential structures located on Donald Drive, Ascot Drive, Ascot Court, Camino Peral, and Alta Mesa.

South of Saint Mary’s College there are large areas of undeveloped open space with single family dwellings, undeveloped roadways, and limited or no water supply. A public high school is located in northeast Moraga.

The Community of Canyon is located in the southwest portion (unincorporated Contra Costa County) of the District. This community is situated within a heavy vegetated area with limited access. Many roadways are under-developed and there is no public water supply available for fire hydrants. The Community of Canyon is home to a post office and a K-8 school.

Educational Facilities

The District has a total of 12 public schools, one private high school, and one private college. The Town of Moraga has three (3) elementary schools, one (1) intermediate school, and one (1) public high school. The City of Orinda has four (4) elementary schools, one (1) intermediate school and, one (1) public high school. The community of Canyon has one (1) public K-8 school.

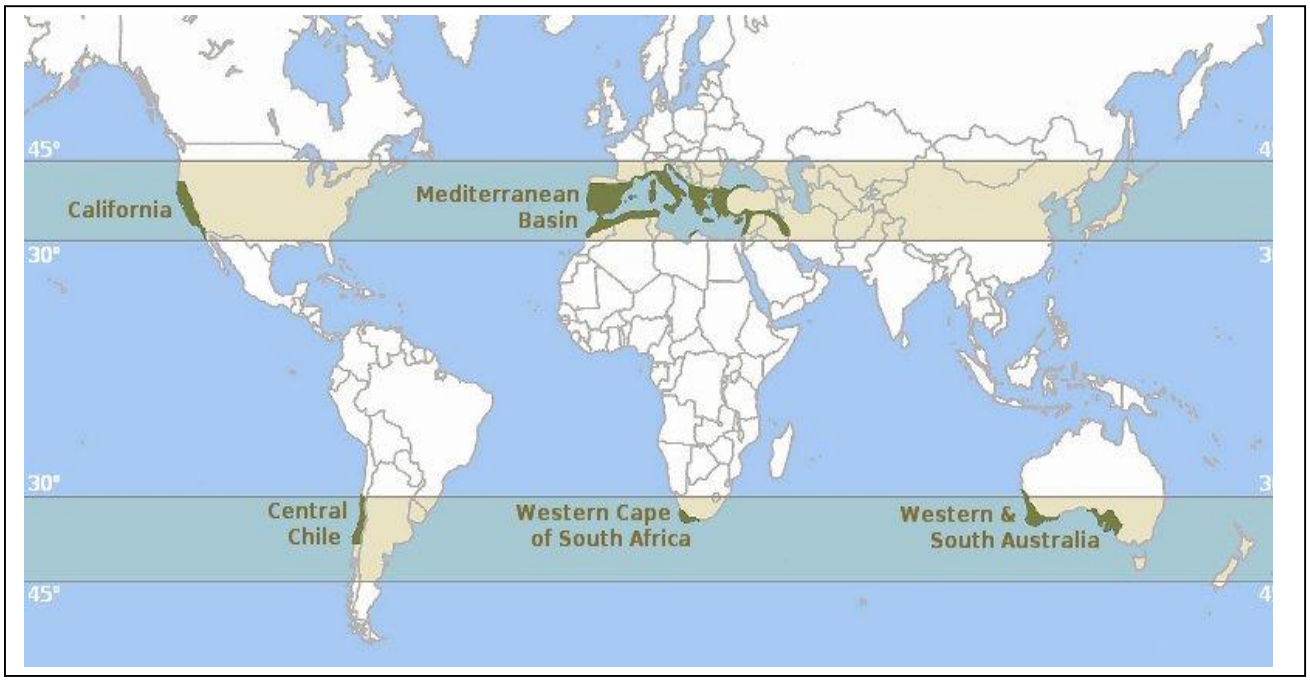
Saint Mary's College is located in southeast Moraga with over 4,200 students. This private college includes two large sports complexes, a three-story science building, an historical chapel, a student union, and 14 residential student living buildings (dormitories). The dormitories house approximately 1,200 students. The dormitories are all protected by fire sprinklers, as are most of the buildings on-campus. The college accounts for approximately 2.5 percent of the incidents within the District.

Climate, Topography and Vegetation

The District lies in a Mediterranean Climate Zone characterized by hot, dry summers, and wet winters, which make it prone to fires; frequently caused by either human activity or lightning. During the summer months, morning fog is common, which typically dissipates by late morning or early afternoon. Afternoon winds are common when the marine layer lifts. Most of the annual rainfall occurs during the winter; snow is very rare. Annually, the District averages 26 days of 90 °F or higher temperatures, 40 nights of 32 °F or lower, and 59 days with measureable precipitation. Due

to a prolonged drought (2013 to present), portions of the District remain vulnerable to a large vegetation fire because larger fuels, such as trees, remain dry and stressed.

Mediterranean Climate Zones



Topographical features also have a significant influence on fire spread. Valleys, drainages, chutes, saddles, and ridgetops all influence the rate of fire spread and are heavily affected by a fire originating below. Generally, fire naturally spreads upslope four (4) times faster than it does downslope (under equal conditions of fuel and wind).

Topography also has a considerable effect on wildland fire behavior and on the ability of firefighters to take action to contain and extinguish a fire. A fire starting in the bottom of a canyon or drainage may expand quickly to the ridge-top before first-arriving firefighters arrive. Rough topography greatly limits road construction, road standards, and accessibility by ground equipment. The steep hills surrounding the District present a significant challenge for fire suppression forces.

The District is located in a “Chaparral Biome”. In its natural state, chaparral is characterized by infrequent fires, with intervals ranging between 10–15 years to over a hundred years. Mature chaparral (stands that have been allowed greater intervals between fires) is characterized by nearly impenetrable, dense thickets. These plants are highly flammable. They grow as woody shrubs with hard and small leaves, are non-leaf-dropping (non-deciduous), and are drought-tolerant. After the first seasonal rains following a fire, the landscape is dominated by soft-leaved, non-woody annual plants, known as fire followers, which die back with the summer dry period.

The *California Interior Chaparral and Woodlands Eco-Region* covers 24,900 square miles in an elliptical ring around the California Central Valley. It occurs on hills and mountains ranging from 300 to 3,000-feet in elevation. It is part of the Mediterranean forests, woodlands and scrub biome. Many of the plants are pyrophytes, or “fire-loving”, adapted (or even depending on) fire for reproduction, recycling of nutrients, and the removal of dead or senescent vegetation. Many plant and animal species in this ecoregion are adapted to periodic fire.

The District's chaparral vegetation includes chamise, manzanita, buckeye and ceanothus. Oak Woodlands are the most widespread, with blue oak dominating, but also includes scrub oak, coast live oak canyon live oak, valley oak, and interior oak. Native open grass lands are the primary understory within the woodlands.

All vegetation in the District reaches some degree of flammability during the dry summer months and, under certain conditions, during the winter months. For example, as chaparral ages, twigs and branches within the plants die and are held in place. A stand of 10 to 20 year-old brush usually has enough dead material to produce rates of spread about the same as in grass fires when the fuels are completely dry.

In severe drought years, additional plant material may die, contributing to the fuel load. There will normally be enough dead fuel load that has accumulated in 20 to 30-year old brush to give rates of spread about twice as fast as in a grass fire. Under moderate weather conditions that produce a spread rate of one-half foot per second in grass, a 20- to 30-year old stand of chaparral may have a rate of fire spread of about one foot per second. Fire spread in old brush (40 years or older) has been measured at eight times faster than grass, (4-feet per second). Under extreme weather conditions, the fastest fire spread rate in grass can be 12 feet per second or about eight miles per hour. Residential structures within the wildland intermix or interface is therefore at greater threat from a wildfire.

Community Demographics

According to the 2010 United States Census, the District had a combined population of 33,659. The population racial makeup of the District was 79% White, 75.4% White alone non- Hispanic, 13.2% Asian, 5.8% Hispanic, 4.7% two or more races, 0.3% American Indian, Hawaiian, and Alaska Native, and 0.9% African American. The Veteran population of the District was 1,991. The Census estimated that by 2014 the District population will increase by 7% or 2,356.

Based on the 2014 Census, with an inflation factor for 2015, the estimated population within the District is 38,500, which includes 1,200 resident students at Saint Mary's College. The Census reported that there are 12,558 housing units of which 10,737 (85.5%) are owner-occupied. The median value of owner-occupied housing units was $1,337,500. The average number of persons per household is 2.65. Education rates in the District include 98.2% who have graduated high school and of those 76.35% have a Bachelor's degree. The Median household income is $157,185. Those living below the low-income level is 3.1% of the population.

The US Census estimates that 20% of the population in Orinda is age 65 or older and 19.1% in Moraga.

Demographic Worksheet

		MORAGA	ORINDA
<u>Economic Characteristics</u>			
Most common Jobs		Management Sales	Management Sales
Commute Time (Mean)		28.1 minutes	26.5 minutes
Largest Employers		St. Mary's College Local Government US Post Office Safeway Foods	Local Government US Post Office Safeway Foods
Unemployment Rate		4.6%	1.0%
Income Range	(average)	$121,839	$192,531
<u>Housing Profile</u>			
Home age (average)	(1950-59) (1960-69) (1970-79) (1980-89)	 40.8% 32.7% 10.7%	34.3% 17.6% 13.9% 8.0%
Recent construction		Minimal	Minimal
Sprinklers & Detection Equip.		All new construction and remodels over 50%	
Types of Residential Construction		Type-5	Type-5
Rented Residential Properties		18.4%	8.5%
House Prices	(average)	$1,238,000	$1,437,000

Source: *US Census Bureau; pre-course work National Fire Academy, Community Risk Reduction Course (R-274).*

Notes: 1) Growth in Moraga and Orinda has been minimal over the last 20 years. Factors inhibiting growth include strict open space ordinances, a lack of available land, generalized community opposition to growth (including commercial development), and the cost of construction; and 2) there will be little change in the next decade, particularly in light of the 2008 economic downturn and housing inventory.

Population Density

Within the District, there are clusters of populations that are considered *Metropolitan, Urban, Rural,* and *Wilderness*. Those ranges are categorized by CFAI as follows:

Class	Population/square mile
Metro	3,000 or more
Urban	2,000 to 2,999
Suburban	1,000 to 1,999
Rural	1 to 999
Wilderness	0

The average overall population density within the municipal boundaries (not including the unincorporated areas) is 1,750 people per square mile.

Therefore, the overall District population density is considered a “Suburban” according to the CFAI definition contained within the *Fire & Emergency Service Self-Assessment Manual (FESSAM), 8th Edition*.

Within the municipal boundaries, populations are distributed as follows:

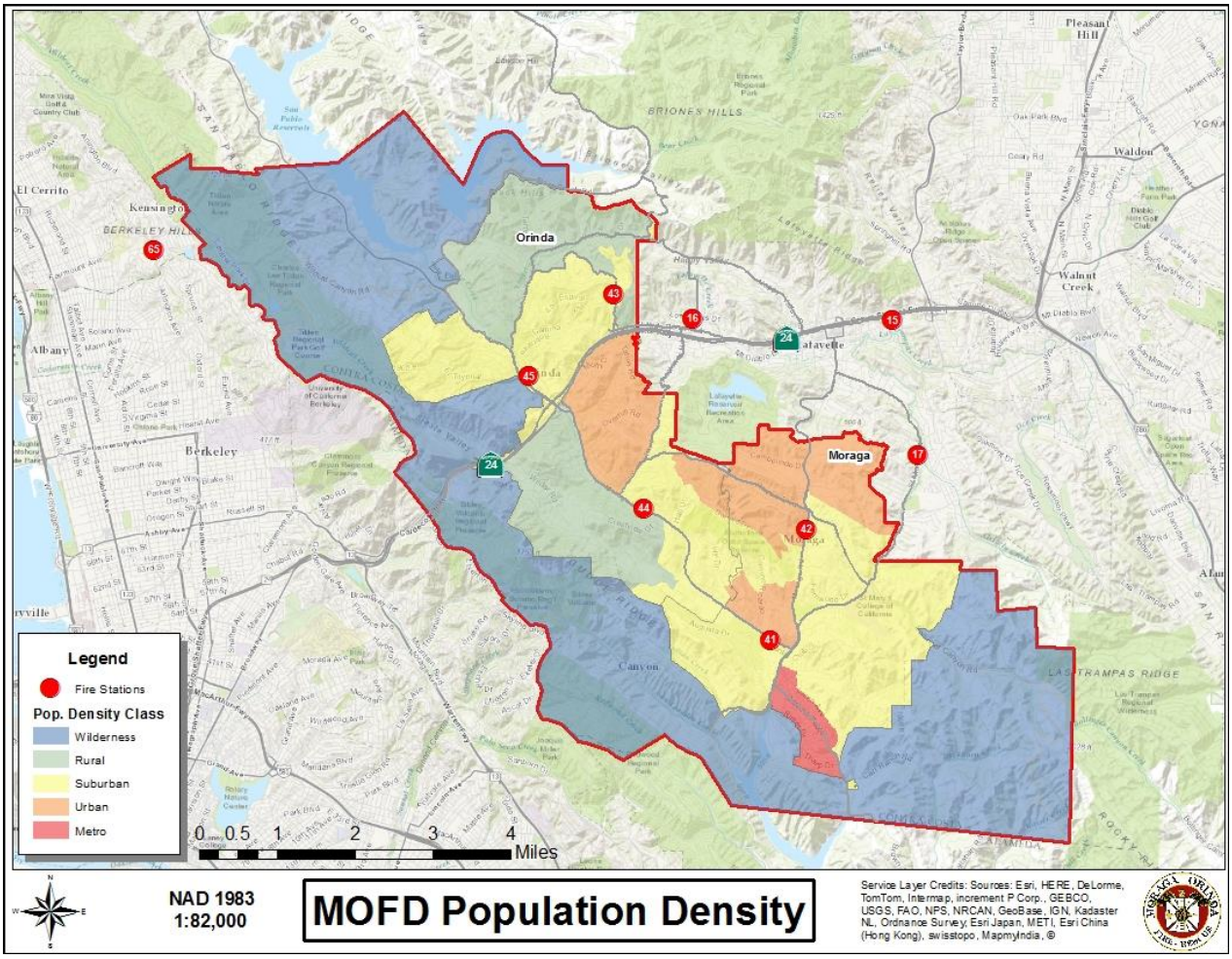
- Metropolitan 3%
- Urban 29%
- Suburban 44%
- Rural 24%

If the wilderness population density zones are included in these calculations, they are distributed as follows:

- Metropolitan 2%
- Urban 15%
- Suburban 23%
- Rural 12%
- Wilderness 48%

See Map-2

Map-2: MOFD Population Density



Source: *US Census Bureau; MOFD GIS Network*

Note: Population densities were developed using census tracts. Within each census tract, there may be pockets with population densities outside the range depicted on the map.

Governance Model

The Moraga-Orinda Fire Protection District is an independent special district, which is a unit of local government, separate from cities and counties that provide public services such as fire protection, waste disposal, water supply, electric utilities, and libraries. A special district is defined as, "any agency of the state for the local performance of governmental or proprietary functions within limited boundaries" and provides a limited range of services within that defined geographic area.

The principal act that governs the District is the Fire Protection District Law of 1987. It empowers the district to provide fire cause determination, fire protection, rescue, emergency medical services, hazardous materials response, ambulance service, and any other services relating to the protection of lives and property.

The District is governed by a 5-person Board of Directors that are elected every four (4) years. It is funded through property taxes and a special parcel tax known as the “Fire Flow Tax”. The name

"Fire Flow Tax" does not appropriately identify the intended use of this tax assessment. The term "fire flow" is an insurance industry term used to identify the amount of water needed to extinguish a fire based on the size of the building. The District uses the same formula to determine the amount of tax based on the size of the taxpayer's residence. In recent years, the District has used the Fire Flow Tax revenues as well as to address pressing equipment and facility needs, fire apparatus and fire station replacements, and operating costs.

Current Levels of Service

The District provides an integrated all-risk response to the communities of Moraga, Orinda, and the unincorporated county areas of Canyon and Bollinger Canyon. Services include, but are not limited to, emergency medical services, ambulance transportation fire suppression, technical rescues, vehicle accidents, water rescue, and hazardous material incidents. The District delivers these services from five (5) strategically located fire stations, with five engine companies, one truck company (cross-staffed) and four ALS transport ambulances (3 cross-staffed).

The District has an on-duty minimum staffing level of 18 to 23 that is risk-based depending on season, weather conditions, and/or other factors. There are three (3) fire stations in Orinda and two (2) fire stations in Moraga. Each fire station is staffed with a minimum of three (3) personnel who are assigned to fire engines, a fire truck, and ambulances. All District engines, trucks, and ambulances have at least one (1) paramedic; often two or three. Station-41 in Moraga has five (5) firefighters on-duty each day and Station-45 in Orinda has four to seven (4-7) firefighters on-duty each day. Stations 42, 43, and 44 are considered "satellite" stations, with a minimum crew of three (3). A Battalion Chief is included in these staffing totals to provide operational and administrative oversight, as well as command and control at significant emergencies.

A critical factor in developing an SOC is to look at the overall system to see if it is meeting the established service level objectives. This approach allows the District to analyze the workload and measure the performance of those companies based upon the identified service level objectives. By doing so, it will assist the District to identify any areas of weakness, where additional stations, personnel or equipment may be needed, based upon the workload (time-on-task and overall response capacity).

Resources within Response Area

The District covers 42 square miles, with 22 square miles within the Town limits of Moraga and the City limits of Orinda. The remaining 20 square mile area lies within the unincorporated portions of Contra Costa County. Within the City and Town boundaries, the District is protected by one engine company for every 4.4 square miles.

Shortly after the District was formed in 1997, the Operations Division began acquiring, creating, and updating operational policies. Absent from these policies was a plan for major earthquake operations. At that time, senior staff understood the threats, risks, and vulnerabilities, as well as the need for policy development and an integrated response with cooperating agencies. Effort was focused on emergency planning, building and strengthening relationships with cooperating agencies, the development and hardening of DOCs and EOCs, seismic upgrades and/or replacement of fire stations, and the need to further expand Community Emergency Response Teams (CERT).

Since 1997, all four focus areas were addressed; and with considerable success. Both the City and Town now have fully functional EOCs and back-up facilities, MOFD has a dedicated DOC, training occurs regularly, and the regional CERT group has over 560 members; with MOFD being the sponsoring agency. A District Earthquake Operational Response Policy was established in 2013,

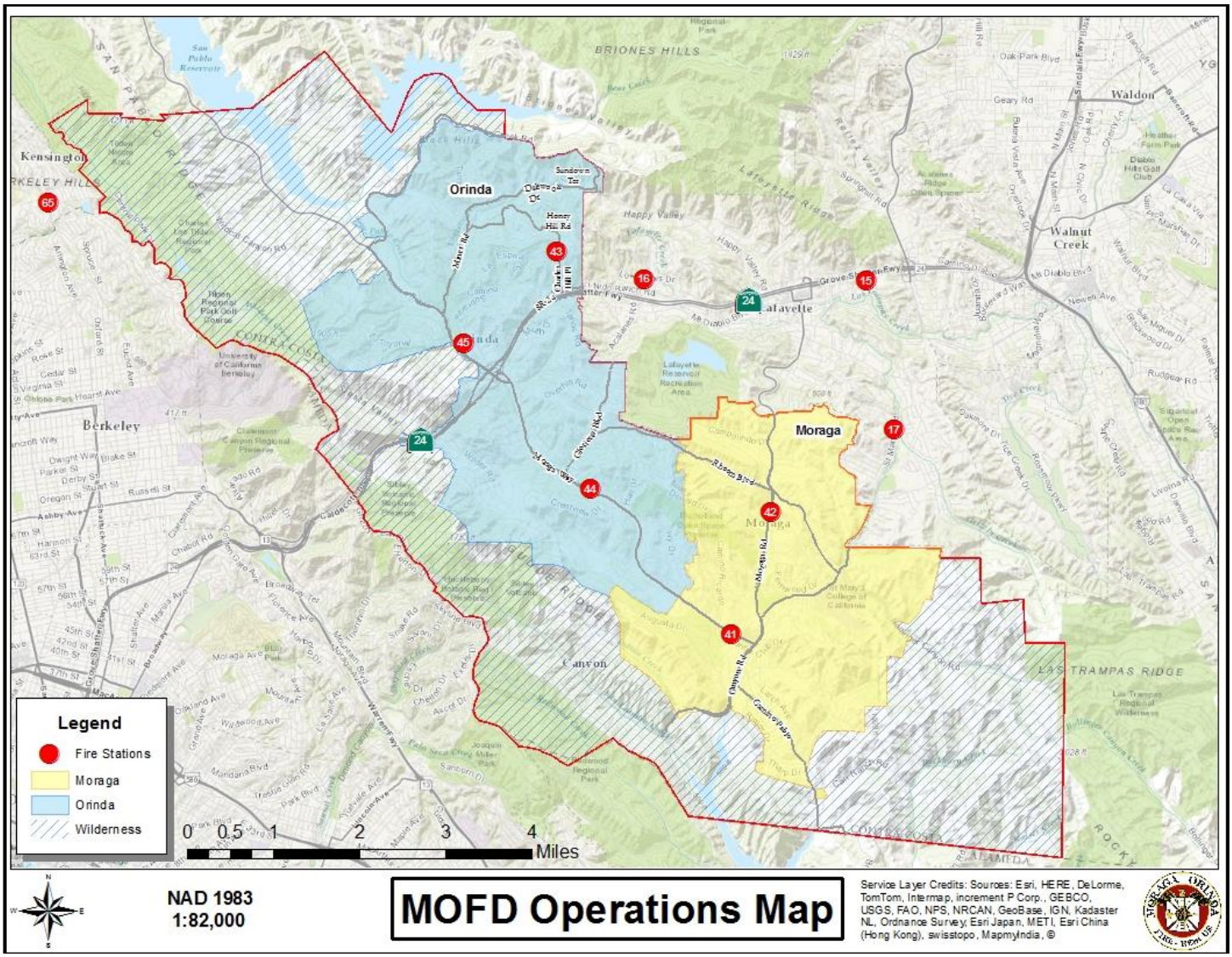
which was followed by a county-wide policy in 2014. By late 2017, three (3) of the District's fire stations will be modern and hardened against the threat posed by a major earthquake.

In addition to the facilities, half of the District's front-line apparatus fleet is scheduled for replacement in 2017/18.

District Assets

The following is a summary of the District's boundaries and fire station and support services locations, and fire apparatus:

Map-3: MOFD Operations Map



Note: 1) the District boundary is depicted with a red line; 2) the community of Canyon and portions of Bollinger Canyon are outside the municipal boundary of the Town or Moraga so they are shown within the wilderness zone. Population densities and response are more accurately depicted within other maps.

Fire Station 41
1284 Moraga Way
Moraga, CA 94556

Station-41 was built in 1967 and is in poor condition. It is too small to appropriately accommodate the five (5) personnel it currently houses and lacks modern amenities, such as gender separation for crews. It serves a "first-due" area of western Moraga and southern Orinda that includes a mixture of residential occupancies, commercial occupancies, senior assisted living facilities, and Saint Mary's College. The station is scheduled to be extensively remodeled, beginning in 2019.

The following apparatus and equipment are located at this location:

- Type-I Fire Engine (ALS)
- Type-III Wildland Fire Engine (ALS)
- 93-foot Aerial Ladder Truck (ALS)
- Ambulance (ALS)

Note: "ALS" indicates advanced life-support capabilities (Paramedics).

STATION 41 RESOURCES RESPONSES – 2015

Resources	Response Totals	Average Daily Response
Medic 41	1,094	3.0
Engine 41	898	2.5
Truck 41	394	1.1
Engine 341	26	0.07
Station Total	2,412	6.7

Source: Tableau

STATION 41 RESOURCES AND ANNUAL RESPONSES (2011 – 2015)

Resources	Response Totals	Average Annual Response	Average Daily Response
Medic 41	5,654	1,131	3.1
Engine 41	4,213	843	2.3
Truck 41	1,687	337	0.9
Engine 341	113	23	0.06
Station Total	11,667	2,333	6.4

Source: Tableau

5-Year Response Trend: Medic-41 slightly decreasing; Engine/Truck-41 slightly increasing. Medic-41's call volume will decrease slightly if Medic-45 is reactivated as a primary ambulance because its first-due area will increase in size.

Fire Station 42
555 Moraga Road
Moraga, CA 94556

Station-42 was built in 2001 and is in excellent condition. It houses three (3) personnel and serves a "first-due" area of eastern Moraga that includes a mixture of residential occupancies, commercial occupancies, and a public high school. The only negative feature of the station is that it only has three bedrooms (not 4) and they are too far from the apparatus bay, which negatively affects the crew's turn-out time during rest periods.

The following apparatus and equipment are located at this location:

- Type-I Rescue Fire Engine (ALS)*
- Type-III Wildland Fire Engine (ALS)
- Ambulance (ALS)
- Type-I Fire Engine (reserve)
- Mobile Air Unit

Note: * Rescue engines are equipped with vehicle extrication equipment and additional rope rescue capability.

STATION 42 RESOURCES RESPONSES – 2015

Resources	Response Totals	Average Daily Response
Engine 42	729	2.0
Engine 342	12	0.03
Station Total	741	2.0

STATION 42 RESOURCES AND ANNUAL RESPONSES (2011 – 2015)

Resources	Response Totals	Average Annual Response	Average Daily Response
Engine 42	3,209	642	1.76
Engine 342	73	15	0.04
Station Total	3,282	656	1.8

5-Year Response Trend: Engine-42 increasing.

Fire Station 43
20 Via Las Cruses
Orinda, CA 94563

Planned Opening: October 2017

The original Station-43 was built in 1952 and was in very poor condition. It was demolished in 2016. A new station, with four (4) bedrooms, will be completed by the end of 2017 at the original site. The original and new station typically house three (3) personnel and serves a “first-due” area of northeast Orinda that includes primarily residential occupancies and portions of Highway-24. The fourth bedroom will accommodate a fourth crew member if needed during ‘Red-Flag’ events if.

The following apparatus and equipment are located at this location:

- Type-I Rescue Fire Engine (ALS)*
- Type-III Wildland Fire Engine (ALS)**
- Ambulance (ALS)**

Notes: 1) * Rescue engines are equipped with vehicle extrication equipment and additional rope rescue capability; 2) ** Type-III Engine and Ambulance are presently relocated to other stations during station reconstruction.

STATION 43 RESOURCES RESPONSES – 2015

Resources	Response Totals	Average Daily Response
Engine 43	789	2.2
Engine 343	22	0.06
Medic 43	0	0
Station Total	811	2.3

STATION 43 RESOURCES AND ANNUAL RESPONSES (2011 – 2015)

Resources	Response Totals	Average Annual Response	Average Daily Response
Engine 43	3,083	617	1.7
Engine 343	71	14	0.04
Medic 43	0	0	0
Station Total	3,154	631	1.7

5-Year Response Trend: Engine-43 increasing. This trend will decrease when Station-16 is reoccupied in northwest Lafayette.

Fire Station 44
295 Orchard Road
Orinda, CA 94563

Located in the middle of the District, Station-44 was built in 2006. It is in excellent condition. It houses three (3) personnel and serves a “first-due” area of southern Orinda that includes primarily residential occupancies, portions of downtown Orinda, and Highway-24. The only negative feature of this station is that there are only three bedrooms (not 5), and the classroom is significantly undersized.

The following apparatus and equipment are located at this location:

- Type-I Fire Engine (ALS)
- Ambulance (ALS)
- Type-II Tactical Water Tender (2500 gal.)*

Note: *Pump capacity of 1000 gallons per minute (GPM) at 150 psi with ability to pump and roll

STATION 44 RESOURCES RESPONSES – 2015

Resources	Response Totals*	Average Daily Response
Medic 44*	1,180	3.2
Engine 44	220	0.6
Water Tender 44	11	0.03
Total	1,411	3.8

** Implemented mid-2014, year 2015 has complete annual data only. Average annual response used in annual five-year total.*

STATION 44 RESOURCES AND ANNUAL RESPONSES (2011 – 2015)

Resources	Response Totals*	Average Daily Response
Medic 44	2156	1.2
Engine 44	2,013	1.1
Water Tender 44	40	0.02
Total	4209	2.3

5-Year Response Trend: Engine-44 decreasing; Medic-44 significantly increased (2014 – present); overall station activity significantly increasing due to deployment of Medic-44 as the primary ambulance in Orinda. This trend will revert if Medic-45 is reactivated as a primary ambulance. A new aerial ladder truck is scheduled to begin deployment from Station-44 in 2018.

Fire Station 45
33 Orinda Way
Orinda, CA 94563

Station-45 houses four to eight (4-8) personnel depending on a risk-based staffing model. It is in good condition. It serves a "first-due" area that includes northwest Orinda, commercial and residential occupancies, the BART station and tunnels, the Caldecott Tunnel Complex, Highway-24, 98% of Tilden Park, and two reservoirs. Presently, some senior management personnel use offices at this station due to the administration building in Moraga being undersized.

The following apparatus and equipment are located at this location:

- Type-I Fire Engine (ALS)
- Type-III Wildland Fire Engine (ALS)
- Ambulance (ALS)
- State of California OES Type-I Fire Engine
- Technical Rescue Trailer
- Type-II Rescue Boat
- Command Vehicle

Note: This station houses a District Operations Center (DOC), which can be activated in the event of a major emergency.

STATION 45 RESOURCES RESPONSES – 2015

Resources	Response Totals*	Average Daily Response
Engine 45	1,166	3.2
Engine 345	51	0.14
R345**	6	0.02
Medic 45	49	0.13
Boat 245	0	0
Battalion 4	478	1.3
Station Total	1,701	4.8

** Five years (2011-2015), ** implemented 2015, has complete annual data only*

STATION 45 RESOURCES AND ANNUAL RESPONSES (2011 – 2015)

Resources	Response Totals*	Average Annual Response	Average Daily Response
Engine 45	4,618	924	2.5
Engine 345	155	31	0.09
R345**	6	3	0.008
Medic 45	3045	610	1.68
Boat 245	0	0	0
Battalion 4	175	35	0.1
Station Total	8008	1603	4.4

5-Year Response Trend: Engine-45 increasing; Medic-45 significantly decreased (2014 – present); Battalion-4 significantly increasing. Overall station activity significantly increasing. If Medic-45 is staffed as the primary ambulance in Orinda, the response totals for Station-45 are projected to increase.

Fire Administration
1280 Moraga Way
Moraga, CA 94556

The fire administration building can be used as a back-up DOC in the event of a major emergency within the District. The building is presently undersized and has required relocation of some senior staff members to Station-45 in Orinda. The District plans to expand the size of this building in 2019.

Fire Training Site
1284 Moraga Way
Moraga, CA 94556

The rear parking lot at Station-41 serves as the primary training grounds for the District. Future plans for the Station-41 / Admin / Training site include adding storage space for reserve apparatus, improving the training grounds, and concurrently remodeling the fire station and administrative facility in 2019. In 2012 and 2016, the District was penalized by the ISO due to the training facility being undersized.

The District continues look for alternative training sites that are larger and more centrally located.

MOFD Apparatus and Specialized Vehicles

YEAR	DESCRIPTION	AGE	CURRENT LOCATION	REPLACE DATE
	ENGINES - STRUCTURE PROTECTION			
1996	ENGINE TYPE 1 SPARTAN 3D (REPLACE W/TRUCK)	**20**	**44**	**2017**
1998	ENGINE TYPE 1 SPARTAN, HI TEC (REPLACE W/ 2017)	**18**	**45**	**2017**
1998	ENGINE TYPE 1 SPARTAN, HI-TEC (REPLACE W/ 2017)	**18**	**42**	**2017**
2008	ENGINE TYPE 1 PIERCE	**8**	**43**	**2028**
2012	ENGINE TYPE 1 PIERCE	**4**	**41**	**2032**
2017	ENGINE TYPE 1	**0**		**2037**
2017	ENGINE TYPE 1	**0**		**2037**
	ENGINES - WILDLAND			
2002	ENGINE TYPE 3 WESTATES	**14**	**42**	**2022**
2002	ENGINE TYPE 3 WESTATES	**14**	**43**	**2022**
2008	ENGINE TYPE 3 PIERCE	**8**	**45**	**2028**
2010	ENGINE TYPE 3 PIERCE	**6**	**41**	**2028**
	AERIAL LADDER TRUCKS			
1989	TRAINING TILLER TRUCK - SEAGRAVE 100'	**27**	**41**	**TBD**
2001	AERIAL LADDER SPARTAN/LTI-93	**15**	**41**	**2018**
2017	TILLER TRUCK - 100' (REPLACES E-44)	**0**		**2033**
	SPECIALIZED APPARATUS			
1999	TECHNICAL RESCUE UNIT	**17**	**45**	**TBD**
2009	WATER TENDER / PIERCE-KENWORTH	**7**	**44**	**2034**
2011	RESCUE BOAT	**5**	**45**	**2030**
2011	TRAILER RESCUE - ALL RISK	**5**	**45**	**2030**
	AMBULANCES			
2002	AMBULANCE FORD	**14**	**RESERVE**	**N/A**
2008	AMBULANCE BRAUN	**8**	**42**	
2008	AMBULANCE BRAUN	**8**	**45**	**2020**
2015	AMBULANCE NAVISTAR TERRASTAR LEADER	**1**	**41**	**2028**
2015	AMBULANCE NAVISTAR TERRASTAR LEADER	**1**	**44**	**2028**
2017	AMBULANCE	**0**		**2028**
2017	AMBULANCE	**0**		**2028**
	COMMAND VEHICLES			
2007	COMMAND FORD	**9**	**41**	**2016**
2008	COMMAND CHEVY	**8**	**45**	**2020**
2008	COMMAND CHEVY	**8**	**45**	**2020**
2008	COMMAND CHEVY	**8**	**45**	**2020**

Notes: Yellow highlight indicates vehicles proposed for replacement in 2017.

Community Expectations and Performance Goals

When the District was formed in 1997, one of the primary goals was to improve service delivery, particularly in Orinda. Both predecessor districts wanted economies-of-scale by integrating the administrative functions, including fire prevention services and revenue sharing. District ambulance service was established in Orinda in 1997 as part of the consolidation, which significantly reduced ambulance response times. In summary, the five (5) primary goals of the merger were: 1) provide comparable services in both communities, 2) deploy paramedics in Orinda, 3) provide District operated ambulances in Orinda, 4) improve the condition of fire apparatus in Orinda, and 5) improve the condition of Orinda fire stations, specifically seismic hardening.

Rapid response has always been the goal of the District, although Orinda's response times have always been about a minute more than Moraga's. This is due to the topography, which causes the street routes to be oblique and therefore less direct. Moving Station-45 north would improve response times to the northeast portion of the District, but place it further from the critical infrastructure; many high-risk parcels, Highway-24, and the aggregate majority of the emergency responses in north Orinda (see Map-4 on page-44).

The performance goal of a six (6) minute response time to all emergencies 90 percent of the time, established during the 2006 SOC, has not been attained with the current 5-station model because the six minute standard is based on an "urban" standard, while the majority of the District is "suburban". To achieve the six minute standard, two fire stations would need to be moved and/or roadways would need to be added connecting neighborhoods in north Orinda and south Moraga. Overall community tolerance for roadway additions through neighborhood streets and private property would likely be very low.

SECTION II – RISK ASSESSMENT

General Assessment, Risk Assessment and Values at Risk

To better understand the difference between the terms, “risk”, “threat”, and “vulnerability”, the following definitions are assigned:

- Risk — A risk is the statistical probability of an event occurring. The potential for loss as a result of a threat exploiting a vulnerability. This cannot be controlled.
- Threat — Anything that can exploit a vulnerability causing damage or destruction. The physical effects (or forces) of an event on people, property, and/or infrastructure. For example, shaking from an earthquake or heat from a fire.
- Vulnerability — A weakness in a system or physical asset. This is the one variable that can be minimized through planning and coordination, hardening of assets, and response force, and capabilities.

Together, these terms can be viewed in the context of any emergency as follows:

Threat + Vulnerability = Risk (T + V = R)

The District covers a broad geographic and population base consisting of metropolitan, urban, suburban, rural, and wilderness service areas. Matching the distribution and arrival of resources to obtain maximum effectiveness to control a fire, mitigate a medical emergency or effectuate a rescue is a challenge for the District. If resources arrive too late (or are under-staffed) the emergency will continue to escalate, resulting in a loss and negative outcomes. Arriving quickly with adequate resources to complete critical tasks is imperative to the success of an emergency delivery system.

It is recognized within the fire service that an emergency service evaluation must take into consideration both the frequency and severity of the most common emergencies within the District. Medical emergencies are the most frequent and require a rapid response from paramedics on fire engines and ambulances. Rescue emergencies, such as vehicle accidents with entrapment, also require rapid response with multiple crews to control the scene, perform rescue operations, and provide medical care. Structure fires, particularly those involving high-life safety occupancies, senior living facilities and convalescent hospitals, require the timely arrival of numerous fire companies to perform rescue, prevent conflagration, limit property damage, and provide for firefighter and civilian life-safety.

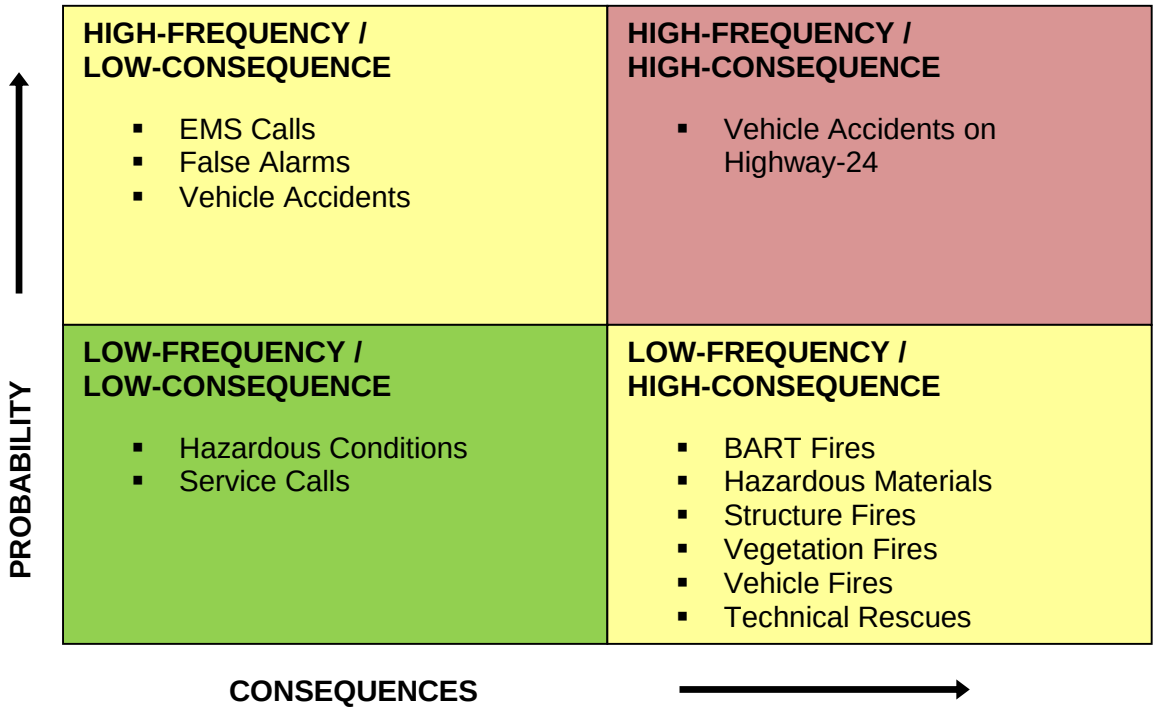
The District is expected to respond to a wide range of complex emergency needs. It is necessary to establish or adopt a method for identifying risks and expected outcomes; based upon that risk assessment and anticipated workload, a standard of response is developed. Policy decisions must be made regarding the distribution and concentration of resources in relation to the potential demand placed upon them by the risk level within the community. The purpose of the SOC process is to utilize empirical evidence and rational discussion in order for the Board of Directors to make informed public policy decisions regarding budget allocations.

The District must assess risks based upon the potential frequency (probability of an incident occurring) and consequence (potential impact should an event occur). For example, a terrorist act has a low probability, however, if a terrorist act occurs, the damage, loss of life, and the psychological impact are potentially very high. This same outlook regarding risk assessment can

also be applied to natural disasters. For example, a strong earthquake does not occur within the District every year, but when it does, the damage could be great. Conversely, medical emergencies happen every day. The potential effects on the individual from medical emergencies to the community as a whole is insignificant, but the effect on the person can greatly affect the quality of their life. To design future deployment strategies, the District must be able to compare the potential frequency, potential damage, and their effect on the individual or community as a whole.

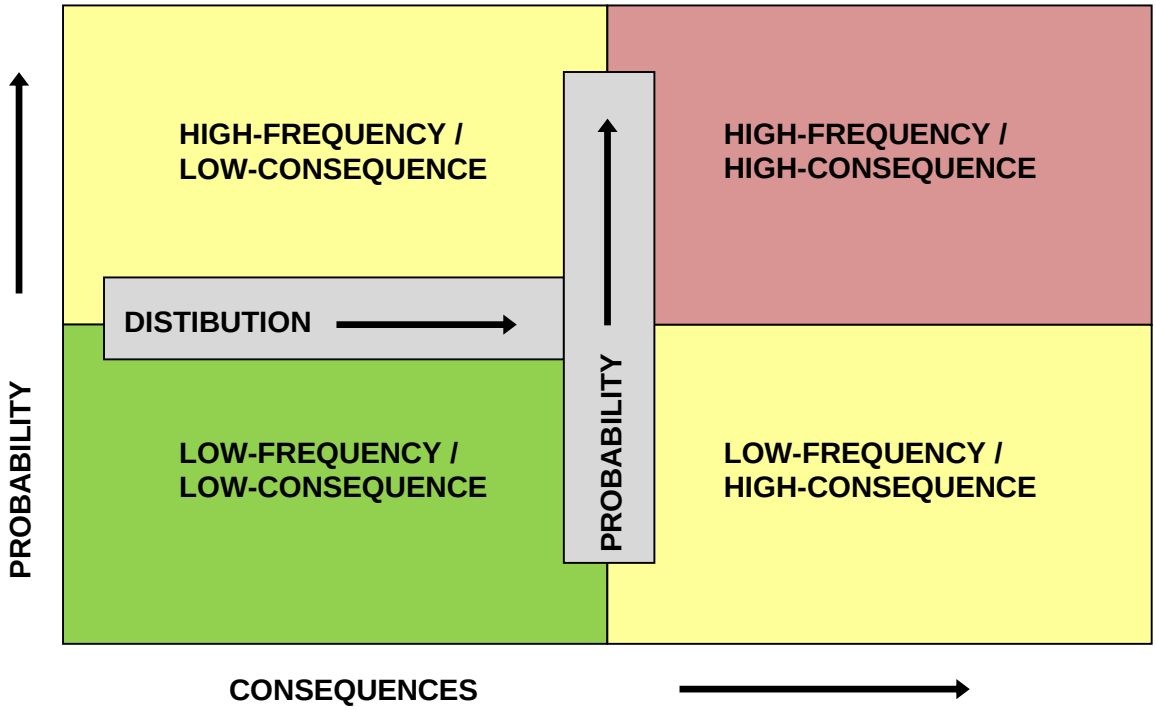
Risk management is the analysis of the chance of an event occurring and the resulting damage that could occur as a result of the event. The challenge in community risk management does not lie solely in the work necessary to assess the probabilities of an emergency, but in the policy-maker level as well. It is policymakers (Board of Directors) who will ultimately determine the level of service to be delivered based on senior staff's recommendations and the expectations and influence of the community.

The evaluation of fire risks must take into account the frequency and severity of fires and other significant incidents. Determining risk by analyzing past statistical information and projected growth in the service area is an essential component of a strategic plan. Risk assessment can fall into different quadrants, which impose different requirements for the commitment of resources to safely and effectively mitigate the incident. These are represented in the following "Frequency-Consequence" matrix:



The relationship between probability and consequence and the District's service level goals determine the needed concentration and distribution of resources. "Distribution" is defined as the number of resources placed throughout the District. "Concentration" is defined as the number of resources needed in a given area within the District. This varies depending on many factors including the number of incidents, the vulnerabilities (risk-assessment based) within the area, the availability and reliability of companies, and the predicted response time for those companies. The challenge is to find the balance for the distribution and concentration of resources identified to

effectively and efficiently meet the service level needs within the District. The distribution and concentration needs in relation to the frequency-consequence matrix are depicted in the following matrix:



In summary, the higher frequency incidents require increased distribution (more companies within a smaller area) and the higher consequence incidents require more personnel to mitigate.

Resource Management

A critical element in the assessment of any emergency service delivery system is the ability to provide adequate resources for anticipated fire suppression situations, medical emergencies, and other anticipated events. Each emergency requires varied staffing and resource deployment to be effective. Properly trained and equipped fire companies must arrive, deploy, and mitigate the event within specific timeframes if successful emergency event strategies and tactical objectives are to be met. Higher-risk properties require more resources to safely and effectively mitigate the emergency. More resources are required for the rescue of persons trapped within a high-risk building with a high-occupant load, than for a low-risk building with a low-occupant load.

As can be seen from the Probability/Consequence Matrix, each quadrant of the chart demands different requirements for the commitment of resources to safely and effectively mitigate the emergency.

The objective is to have a distribution and concentration of resources that is able to reach a majority of events in the shortest period of time to begin to mitigate the emergency. There are many factors that affect the District risk level, and factor into the methods chosen to deploy resources throughout the community. They include:

- Historic call patterns
- Distribution of where incidents are occurring within the District
- Time of day when incidents are occurring
- Ability of occupants to take self-preserving actions
- Construction features predominately used within a given area
- Degree of use of built-in fire protection
- High hazard structures and critical infrastructure
- Lack of needed fire flow (water)
- Business type, the activity that occurs within that business, and its contents

Evaluating Community Risk

The purpose of a risk assessment is not only to evaluate risks and hazards in the District's response area, but also to provide a basic methodology to evaluate existing response coverage. The process begins with the identification of community hazards and risks.

Evaluation of such factors determines the number of personnel needed to conduct the critical tasks necessary to contain the event in an acceptable timeframe. The level of service provided by an agency should be based on the agency's ability to cope with various types and sizes of emergencies that the agency can reasonably expect to encounter. This process starts with examining the most common risks within the District, the potential fire problem, target hazards, critical infrastructure, and an analysis of historic call data.

A "hazard" is defined as a source of potential danger or an adverse condition. A "risk' "is the statistical probability of an event occurring. The potential for loss as a result of a threat exploiting a vulnerability. This cannot be controlled.

The "probability" of an event is then multiplied by the significance of the consequence (impact) of the event. Therefore: (Risk = Probability x Impact). To determine the overall community risk and vulnerability, several areas must be assessed.

It is important to provide a description of the scope, complexity, and relationship of the various risk factors within the District, and the method used to evaluate these risks. The information compiled regarding the factors of community risks/hazards will help determine the needed management and response capability. Resources committed for risk management, response, and mitigation of risk events that occur will determine the overall community vulnerability when an adverse event occurs. Timely emergency response is critical with respect to fires, rescues and medical emergencies (especially cardiac arrest, heart attacks, and strokes). Emergency events occur at all hours, all days and under all conditions. The fire service's response to these unpredictable conditions has been to develop a methodology for being prepared to respond in a timely manner when they occur. The operative word is "timely" and the corresponding consequence of predicting outcome and measuring performance.

Populations at Risk

As a community risk-reduction initiative, the District plans to begin an outreach program with Seniors in alignment with existing organizations. This program could lead to voluntary home inspections in an effort to identify fall and fire hazards within homes.

The following tables summarize the high-risk population groups with the District:

High-Risk Population Groups

High-Risk Group	Current Population Size	Current Geographic Distribution	Projected Geographic Growth (10)
Children <6	Orinda: 2.4%	6.2% CT-3522.02	None
	Moraga: 3.5%	All	None
Low-income Households	Orinda: 0.7 – 13.8%	13.8% CT-3540.02 Single Parents	Slight increase
	Moraga: 0.6 – 4.0%	CT-3521.02 St. Mary's College	None
Adults over age 65	Orinda: 20.0%	23.4% CT-3522.02	Slight increase
	Moraga: 19.1%	All	Slight increase
People affected by Disabilities		Orinda CT-3540.02	None
		Moraga CT-3522.01	None
Non-English Speaking	1%	Orinda CT-3540.02	None
	1%	Moraga All	None

Source: US Census Bureau (2015); pre-course work National Fire Academy, *Community Risk Reduction Course* (R-274).

The five (5) groups represented in these tables have been identified by the US Fire Administration (USFA) as being particularly at risk from fire. As can be seen in the following table, the District recognizes that the largest group is those age 65 and older. This population accounts for the majority of EMS service within the District and is at greater risk when fires occur.

Fire/Injury Impact

High-Risk Group	How Fire and Preventable Injuries are Affecting Local-level Groups		
Children <6	Vehicle Accidents		
Low-income	N/A	Population sample too small (0.7%)	
Adults over age 65	Falls leading to death within 5 years	Moraga: 19.1% Orinda: 20.0%	Target Group
People affected by Disabilities	N/A	Population sample too small (1.0%)	
Non-English Speaking	N/A	Population sample too small (<1.0%)	

Source: US Census Bureau; pre-course work National Fire Academy*, Community Risk Reduction Course* (R-0274).

A 3-year survey was conducted to identify the causes of significant structure fires within the District. This yielded even distribution among the represented population groups. Electrical and heating related fires remain difficult to mitigate because private dwelling inspections are only allowed on a voluntary basis. This is a nation-wide issue.

Fire Risk Assessment

Causes	Frequency	Rate of Rise	Geographic Distribution	Cost	Population Experiencing
Arson	10%	None	Even distribution	5.9%	*
Heating	35%	Even distribution	Even distribution	44.7%	Even distribution
Electrical	30%	Even distribution	Even distribution	12.3%	Even distribution
Smoking	5%	None	N/A	38.5%	N/A
Other	20%	None	Even distribution	4.0%	Even distribution

Source: US Census Bureau; pre-course work National Fire Academy*, Community Risk Reduction Course* (R-0274).

Notes: N = 20. * 50% Asian – Suicide by self-ignition; otherwise, no distinction between housing, social or economic factors; Frequency: One significant structure fire every 36.5 days (average)

As a function of Community Risk Reduction analysis, the top-3 three incident types that could lead to the largest loss of life were identified. These are summarized in the following table:

Man-Made & Naturally Occurring Risks

Incident Type	Past History	Area Most Affected	Projected Frequency	Potential Future Losses	Current Preparedness
Major Wildland Fire	N/A	Homeowners in North Orinda	Within next 20 years	200-400 homes destroyed; 20 deaths	Multiple Initiatives*
Major Earthquake	1906, 1989	Homeowners in North Orinda	Within next 20 years	500 homes destroyed; 30 deaths	Multiple Initiatives**
Terrorism	N/A	Not reported	Infrequent	Infrastructure damage; fatalities	Multiple Initiatives***

Source: US Census Bureau; pre-course work National Fire Academy*, Community Risk Reduction Course* (R-0274).

Notes: * Initiatives: *FireWise* Program; fuel hazard mitigation program; public education (K-5); staffing patterns; ** Initiatives: Urban Search and Rescue training and team participation; Earthquake Operations Plan; *** Initiatives: Terrorism training program (AWR-160); Operating Action Guidelines.

Building Infrastructure & Building Risk Values

There are 14,091 parcels within the District, which are distributed as follows:

- Town of Moraga 6,089 (43.2%)
  - Includes 389 in Bollinger Canyon
- City of Orinda 7,791 (55.3%)
- Community of Canyon 211 (1.5%)

Of the 14,091 parcels, 2,085 are within the VHFHSZ (14.8%). See Map-14.

The District has a total of 4,657 businesses with 2,928 in the City Orinda and 1,729 in the Town of Moraga. The building density average within the City and Town limits is 207 buildings per square mile.

The District has identified risk levels for each type of occupancy within City and Town. All District emergency response vehicles have mobile data terminals (MDT's) which use computer aided dispatch premise information for identified occupancies as well as Special Evolution Plans.

Occupancy-type risks are divided into the following four classifications defined below:

- Low Risk Occupancies
- Moderate Risk Occupancies
- High Risk Occupancies
- Special Risk Occupancies

Important factors to address when evaluating fire loss consequences include the potential for death, serious injury, property damage, business interruption, and environmental damage. To address such concerns, the District collected information on each "value at risk" (occupancy and address) and that information was used in a to profile risk. The District uses the Uniform Building Code to regulate building construction within the District.

The Uniform Building Code divides occupancies into 11 "occupancy classifications" and they are:

- Group A: Assembly
- Group B: Business
- Group C: Camps
- Group E: Educational (K-12)
- Group F: Factory and Industrial
- Group H: Hazardous
- Group I: Institutional
- Group M: Mercantile
- Group R: Residential
- Group S: Storage
- Group U: Utility

There are several sub-categories for "R" occupancies. Occupancy types can also be mixed as is the case with apartments over ground floor businesses, mid-rises, and high-rises (B/R.2)

The following matrix lists occupancy risk according to occupancy type:

Building Occupancy Risk Matrix

HIGH RISK		**SPECIAL RISK**	
▪ Convalescent Hospitals	I	▪ Mid-rise	B and/or R.2
▪ Factories and Hazardous	F	▪ High-rise	B and/or R.2
▪ Hazardous	H	▪ Tunnels	S
▪ Institutional	I		
▪ Senior Assisted Living Facilities	R.2.1		
LOW RISK		**MODERATE RISK**	
▪ Apartment Buildings	R.2	▪ Factory w/ sprinklers	F
▪ Business	B	▪ Public Assembly	A
▪ Mercantile	M	▪ Storage with sprinklers	S
▪ Schools (K-12)	E	▪ Single family residences in VHFHSZ*	R.3
▪ Single-family residences	R.3		

Notes: Due to their vulnerability to vegetation fires within the intermix, the District has chosen to re-classify single-family homes (R.3) that lie within the VHFHSZ as “Moderate” risk, rather than “Low” risk as part of the SOC process.

Data collected from the County Assessor’s office listed the number of occupancies in the Fire District to include:

▪	A	Assembly Occupancies:	30
▪	B	Business Occupancies:	308
▪	E	Educational Occupancies:	20
▪	F	Factory and Industrial Occupancies:	0
▪	H	Hazardous Occupancies:	3
▪	I	Institutional Occupancies:	4
▪	M	Mercantile Occupancies:	24
▪	R.1	Hotel/Motel Occupancies:	0
▪	R.2	Apartments Occupancies:	793
▪	R.2.1	Supervised Residential Occupancies:	4
▪	R.3	Single-family Home Occupancies:	11,355
▪	R.4	Assisted Living Occupancies:	0*
▪	S	Storage Occupancies:	5

Note: *Assisted living facilities may be classified as either R.2.1 or R.4.

Based upon evaluation, the following occupancies within the District are show as a percentage of total occupancy types:

Building Occupancy Risk

Group	Class	Percentage
High	F, H, I, R.2.1	0.08%
Moderate	A, F, R.3*, S	11.8%
Low	B, E, M, R.2, R.3**	88.1%
Special	S	0.04%

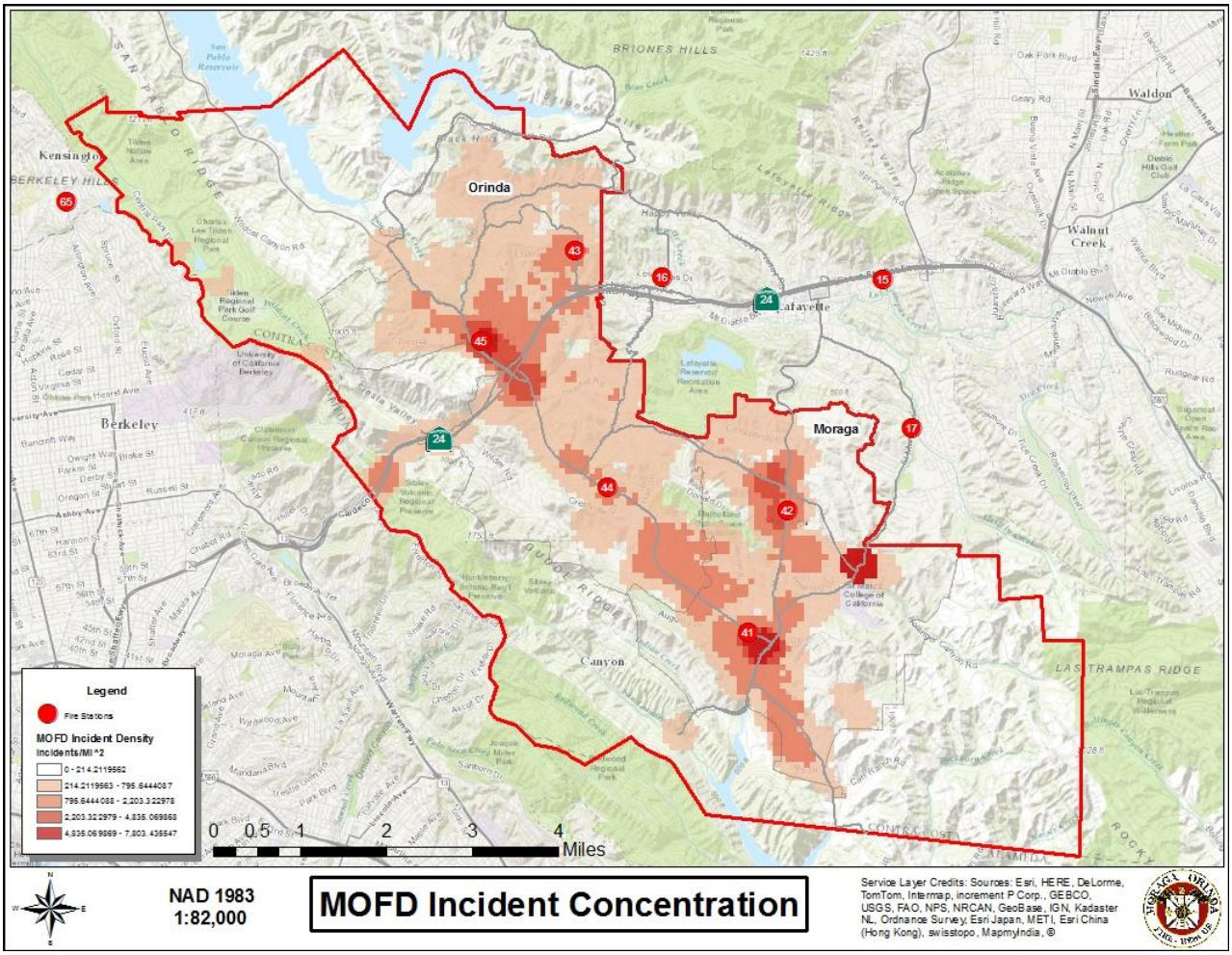
Notes: *Residential properties within the VHFHSZ; ** Residential properties outside the VHFHSZ

The majority of the occupancy types in the City and Town are low risk. The developed business areas (2 in each community) are in close proximity to fire stations. Aerial ladder truck service in Orinda is presently poor due to the placement of the truck in the southern area of the District. This will be corrected in 2018 when the District takes delivery of a new ladder truck, which will be centrally located within the District.

Homes within the VHFHSZ were designated as moderate risk due to their vulnerability to vegetation fires. This vulnerability is minimized with a very aggressive fuel reduction program, excellent awareness and cooperation from the community, excellent staffing levels, heavy first-alarm deployment, and the deployment of additional firefighters during wildfire season.

The greatest “risk” to residents remains a poor outcome (quality of life) from a medical emergency. The District provides paramedic first-response on all apparatus with the goal of reaching all medical emergencies within minutes. The District’s response capacity and the location of its fire stations have resulted in excellent service. However, there are gaps in the service area as the result of additional development on the periphery of fire station response zones. Absent increased revenue, building and staffing additional fire stations and/or roadways, some areas will remain beyond the response time goal of 7:20. The number of incidents within these areas is very low (see Map-4).

Map-4: MOFD Incident Concentration



As depicted in Map-4, most of the emergency incidents occur in proximity to the fire stations, with the exception of Station-44, which has a very low call volume within its first-due response area.

This is a public policy issue for the Board of Directors and senior staff going forward. Large housing developments that were approved in previous decades with no remedy for response times have caused a disparity in response time performance. Presently, senior staff opposes developments beyond reasonable response times.

SECTION III – STANDARDS, GOALS & OBJECTIVES

Standards for Measuring Performance

There are several standards that can be used to measure emergency response performance. The District's last Standards of Cover document used many of the same sources as were used in 2016.

National Fire Protection Association (NFPA) 1710

NFPA 1710 standard was first adopted in 2000, revised in 2004 and 2010. Technical committee members are appointed by NFPA to represent several fire and governmental organizations. This standard represents the first organized approach to developing a standard, defining levels of service, deployment capabilities, and staffing levels for those substantially career fire departments. Research work and empirical studies in North America were used by the committee as a basis for developing response times and resource capabilities for those services being provided, as identified by the fire service. NFPA 1710 provides a template for developing an implementation plan with respect to the standard. The Commission on Fire Accreditation International (CFAI) has adopted these standards to define the standards of cover for fire agencies.

Insurance Service Office (ISO) Grading Schedule

For a broad spectrum of commercial and personal lines of insurance, ISO provides statistical, actuarial, underwriting, and claims information and analyses; consulting and technical services; policy language; information about specific locations and communities; fraud-identification tools; and data processing. In the United States and around the world, ISO serves insurers, reinsurers, agents, brokers, self-insurers, risk managers, insurance regulators, and other government agencies. Not all insurance companies use the ISO grading schedule when determining insurance premiums.

Since the middle of the 19th century, U.S. property insurance companies have funded initiatives aimed at loss prevention and fire mitigation. In an effort to minimize or prevent fire losses, one of the industry's tools is the Public Protection Classification (PPC™) program administered by ISO. The PPC program evaluates a community's public fire-protection capability and assigns a protection-class rating from 1 to 10. Class 1 represents exemplary fire protection; Class 10 means that the area's fire-suppression program does not meet ISO's minimum criteria.

The Fire Suppression Rating Schedule

In 1980, ISO introduced a new version of the schedule, now known as the *Fire Suppression Rating Schedule* (FSRS), as the basis for the PPC system. The FSRS assigns credit points to recognize a community's performance on measures related to fire suppression. The schedule objectively evaluates each item and uses the evaluations in a mathematical calculation of the amount of credit. Using the FSRS, ISO develops a PPC number for each community. The number represents the average class of fire protection for small to moderate-size buildings; the vast majority of all buildings in nearly all cities. The system compares the average available protection with the average protection needed for such buildings.

Determining the PPC for a Community

ISO's evaluation of a community's fire suppression system includes a review of the dispatch center, the District, and water supply infrastructure. A community's strengths and/or weaknesses relative to specific criteria in each of those categories will determine the community's public protection classification. Communities can have different combinations of strengths and weaknesses yet still receive the same PPC. Therefore, the PPC number alone does not fully describe all the features and capabilities of an individual District. Generally, the classification numbers suggest the following:

- Classes 1 through 8 indicate a fire suppression system with a credible dispatch center, District, and water supply.

- Class 8B recognizes a superior level of fire protection in an area lacking a creditable water supply system. Such an area would otherwise be Class 9.

- Class 9 indicates a fire suppression system that includes a creditable dispatch center and District but no creditable water supply.

- Class 10 indicates the area's fire suppression program does not meet minimum criteria for recognition.

For many jurisdictions, ISO publishes a "split class," such as "3/9". In such jurisdictions, all properties within 1,000 feet of a water supply (usually a fire hydrant) and within five road miles of a fire station are eligible for the first class (Class 3 in the example). Properties more than 1,000 feet from a water supply (usually a fire hydrant) but within five road miles of a fire station are eligible for Class 9. All properties more than five road miles from a fire station are Class 10.

Recently, ISO changed the split class numbering representing those classes previously designated as "9" or "8B". Those classes would now be 3/3X or 3/3Y respectively.

Proposed Revisions to the FSRS

The FSRS is the basis for the ISO's public fire protection classification activities nationwide. The FSRS focuses review on three specific areas of operation—the dispatch center, fire District, and water supply. Although it is essential to consider these criteria in the community planning process, do not mistake these evaluations as a measurement of the quality of services being provided. While the FSRS has an important place in the community risk assessment model, it should not be the only criteria utilized in the evaluation process. The FSRS schedule is currently under review and is scheduled to be updated in the near future.

The Effect of PPC on Insurance Premiums

ISO provides insurance companies with public protection classifications and associated details, including fire station locations, response area boundaries, the location of hydrants, and other water supply details. But because insurance companies, not ISO, establish the premiums they charge to policyholders, it is difficult to generalize how an improvement or deterioration in PPC will affect individual policies, if at all.

However, ISO's studies have consistently shown that, on average, communities with superior fire protection have lower fire losses than do communities whose fire protection services are not as comprehensive. Consequently, the PPC *generally* does play a role in the underwriting process for many insurance companies.

The following table illustrates the different Public Protection Classifications based on percentage credited to the assessed jurisdiction.

ISO PPC Schedule

Class	Percentage Credited During Evaluation		
1	90.00	to	105.50
2	80	to	89.99
3	70	to	79.99
4	60	to	69.99
5	50	to	59.99
6	40	to	49.99
7	30	to	39.99
8	20	to	29.99
9	10	to	19.99
10	0	to	9.99

A PPC class 1 represents outstanding fire protection, while an 8 represents significant deficiencies. Of the more than 48,000 fire departments nation-wide, only 178 have a Class “1” designation.

Hazard classes now assigned “X” or “Y” were previously designated as “9“ or “10”, and represent those areas that are five (5) miles or more from the nearest fire station and/or have no water supply within 1000 feet.

When the District was formed in 1997, the rating in Orinda improved from “4” to “3”.

From 1997 through 2016, the District was an ISO Class “3/9”.

After review by ISO in late 2016, the District’s ISO classification is scheduled to change to a “2/2X” in April of 2017. The rating of “2” is assigned to all properties within the City of Orinda and the Town of Moraga. The rating of “2X” denotes only the properties within the unincorporated areas of the District where there are no fire hydrants within 1000 feet of a property. The rating of “2” represents excellent fire protection within Moraga and Orinda, particularly considering the terrain it protects. As of 2015, only 2.8% of fire service agencies nationwide had a rating of “2” or better.

Evaluating Fire Service Suppression Capabilities

The “Flashover Point” has been used for decades when evaluating fire station location, types of apparatus and staffing levels for structural fire suppression. Because this is a significant threat to life and property, it is the event that the service level is intended to prevent from occurring. For decades, the generally accepted time in which flashover occurs has been six (6) to 10 minutes, however, recent studies indicate that it can occur in as little as two (2) minutes, depending on the fuels present at or near the area of origin. Fires progress in a geometric fashion whereby an added increase in time of response results in fire damage growing in factors of multiplication. This is because as a fire builds up it can go through different stages of development. This buildup can be plotted on a timeline, the results of which are not linear, but logarithmic.

Firefighters encounter a wide variety of conditions at each fire. Some fires will be at an early stage and others may have already spread throughout the building. This variation in conditions

complicates attempts to compare District capability. A common reference point must be used so that the comparisons are made under equal conditions. With respect to fire suppression, service-level objectives are intended to prevent the flashover point from occurring, which is a particular point of a fire's growth that makes a significant shift in its threat to life and property. Fire suppression tasks must be simultaneous, quick, and coordinated with adequate resources to contain and control the fire. Matching the arrival of resources within a specific time period is one of the primary objectives of developing a comprehensive Standards of Cover report.

The stage of fire buildup that is of critical concern with respect to service delivery is flashover. Flashover occurs when the fire gases and products of combustion that have accumulated during the first phases of burning simultaneously ignite. The flashover will generally spread the fire throughout the structure and make the likelihood of saving life and property very doubtful. This is due to flashover's sudden change from a tenable atmosphere with good visibility and moderate heat to an atmosphere where death can occur within seconds. The stages leading up to flashover will vary depending on the fuel, nearby combustibles, such as carpets, furnishings, and plastics, and the surrounding air (availability of oxygen).

Stages of Fire Growth

Virtually all structure fires progress through a series of identifiable stages:

Stage 1: The Ignition Stage	The ignition of a fuel source takes place. Ignition may be caused by any number of factors, from natural occurrences such as lightning to human caused, including arson.
Stage 2: The Flame Stage	The fuel initially ignited is consumed. If the fire is not terminated in this stage, the fire will progress to the smoldering stage or go directly to flashover, depending on the availability of oxygen.
Stage 3: The Smoldering Stage	The fuel continues to heat until enough heat is generated for actual flames to become visible. It is during this stage that large volumes of smoke and toxic gases are produced and the stage where most fire deaths occur. Temperatures rise to over 1,000 degrees Fahrenheit in confined spaces, creating the hazard of "backdraft" or smoke explosion. This stage can vary in time from a few minutes to several hours. When sufficient oxygen is present, the fire will progress to the free-burning phase.
Stage 4: Free Burning or "Flashover" Stage	The fire becomes free burning and continues to burn until the fire has consumed all contents of the room of fire origin, including furnishings, wall and floor coverings, and other combustible contents. Research into the flashover phenomenon has not yet yielded criteria that precisely measure when a flashover will occur. Indicators of flashover are easily observable by firefighters and the public, and can be easily recorded and retrieved for future evaluation.

Both scientific tests and field observations have shown when flashover is experienced, fire growth is exponential and can quickly overwhelm firefighting resources. Those observations concluded:

- Flashover occurs at a temperature between 1,000 and 1,200 degrees Fahrenheit. These temperatures are well above the ignition points of all common combustibles in residences, businesses, and industries. When this temperature range is reached, all combustibles are immediately ignited. Human survival after this point is highly improbable without specialized protective equipment. Modern firefighting protective ensembles, including full turnouts and SCBA, will only protect a Firefighter for 15-20 seconds,

- At the point of flashover, lethal fire gases (carbon monoxide, hydrogen sulfide, cyanide) increase explosively. People exposed to these gases, even when not directly exposed to the fire, have drastically reduced chances of survival.

- Flashover can occur within a relatively short period of time. Precisely controlled scientific tests indicate that flashover can occur in as little as two minutes from the flame stage. On the other hand, field observations of actual fires indicate that total room involvement can take as long as 20 minutes or more. There is no way to ascertain the time to flashover since it is not possible to determine when a fire started. Nevertheless, a correlation can be drawn between the importance of rapid intervention in the prevention of flashover.

The number of times that fires are controlled before flashover depends on the entire fire protection system and is not solely dependent on emergency response forces. Built-in fire protection, community risk reduction strategies, public education, extinguishment by citizens, and the type of fuel on fire are all factors that affect flashover. Even when fires are not extinguished by firefighting forces, these personnel often provide other services, ranging from smoke removal to the restoration of built-in fire control systems. The objective is to ensure that all components of the fire protection system, from public education - to built-in fire protection systems - to manual fire suppression, are maintained at a level to provide adequate service and the performance of each is periodically evaluated.

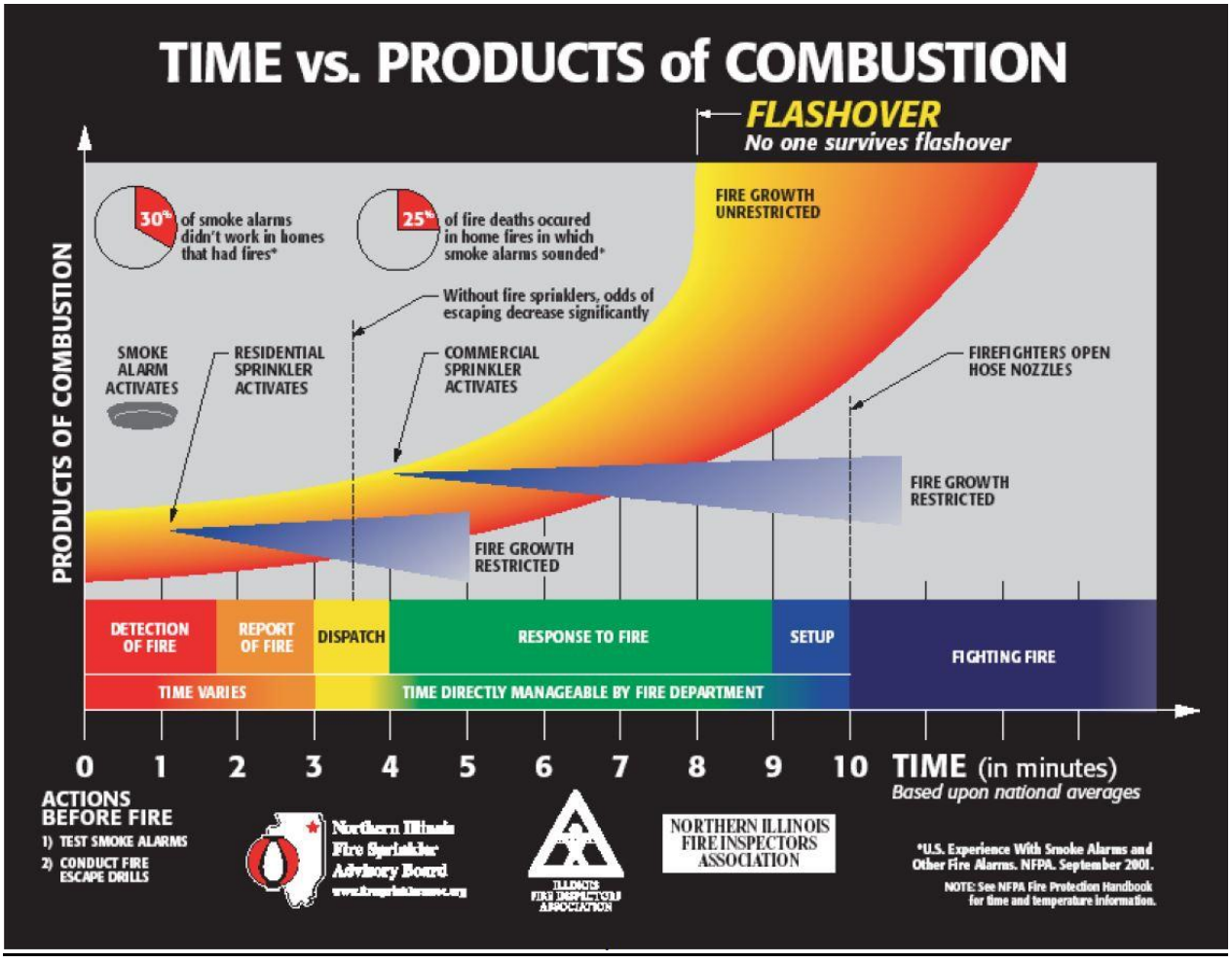
The flashover stage of a fire marks a big turning point in fire conditions that escalate the challenge to a fire district's resources. First, no living thing in the room of origin will survive, so the chance of saving lives drops dramatically. Second, flashover creates the need for much larger quantities of water to control the fire. A post-flashover fire burns hotter and moves faster, compounding the search and rescue problems in the remainder of the structure at the same time that more firefighters are needed to extinguish the fire.

The Compounding Effects and Significance of Flashover

The following chart and graph depicts the differences between pre and post-flashover firefighting operations utilizing the time-temperature curve:

Pre-Flashover	Post-Flashover
Limited to one room	May spread beyond room-of-origin
Requires smaller hoselines	Requires larger hoselines
Search & Rescue generally simple	Search & Rescue compounded by heat and smoke
Initial arriving units can mitigate	Requires multiple units to mitigate
Building frame remains generally intact	Building frame becomes damaged
Risk of injuries are moderate	Risk of injuries are high

In the 1950s, ceiling temperatures in burning rooms reached 1400-degrees F within 12 to 15 minutes. In the 1990s, the temperatures had increased to 2000-degrees F within 3-7 minutes. This is due to the materials now found in occupancies, particularly plastics. As indicated in the graph below, the stage of the fire affects staffing and equipment needs. The District's ability to coordinate and organize responding personnel and equipment is an essential basis of consideration for a response coverage study. It should be noted that this graph was produced in 2001.



The topography, suburban/rural character, and street access configuration of the District create significant challenges for response and mitigation; particularly in North Orinda. Without significant staffing increases and additional fire stations, it is unrealistic to expect the District to reach all fires before flashover. Inversely, not all fires progress to flashover for a variety of reasons. Given that some fires will reach flashover before the District can arrive on scene, either because the materials involved are volatile, because the fire accelerated with flammable liquids, or because the fire went unreported, it is unreasonable to expect the District can save every life or stop all significant property loss.

A response coverage study allows policy makers to make reasonable and objective decisions that maximize the potential for saving life and property with the limited resources that are available. The District must be cautious not to over-promise service delivery and remember that the response system is not designed for extraordinary events.

Evaluating Emergency Medical Capabilities

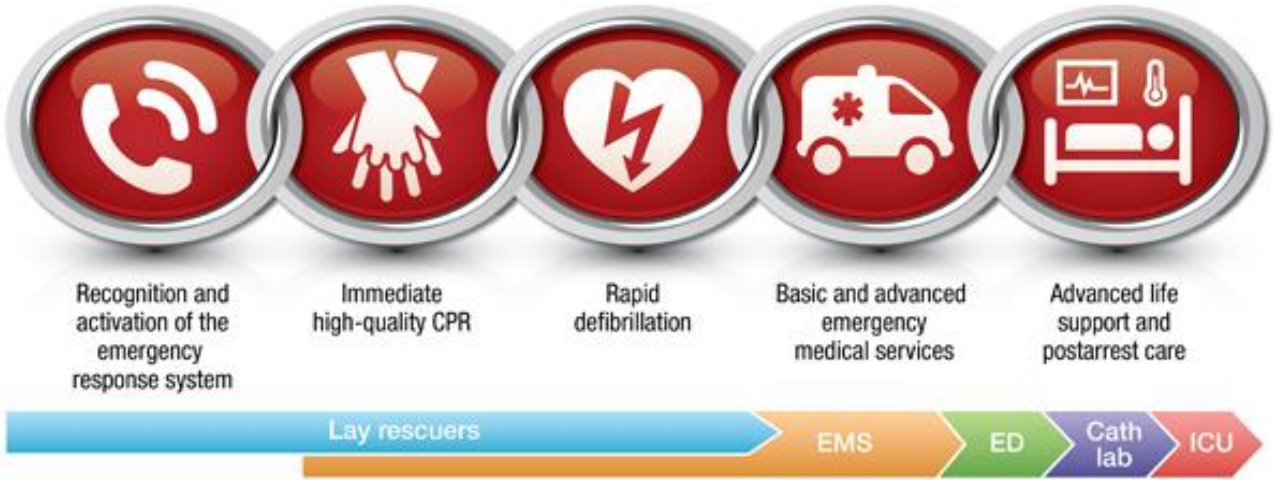
Like structure fires, outcomes from a medical emergency also have multiple variables, which include: 1) the underlying health of the patient, 2) the nature of the present illness or injury, 3) early recognition of the emergency, 4) a timely response by advanced life-support (ALS) providers, 5) basic and advanced care in the field, 6) transportation to the appropriate receiving facility, equipped to properly handle the scope of the emergency, 6) access to comprehensive care (if required).

In 2015, 56% of the District's responses were for medical emergencies and/or rescues. Of these, about one-half required transportation to a hospital in a District ambulance. Of these, over 30% require advanced life support compared to approximately 15 to 20% for other Bay Area fire agencies. Of those calls requiring advanced life support, over 65% of the calls are on behalf of residents over the age of 65.

For the purposes of this study, three (3) life-threatening scenarios are discussed: 1) sudden cardiac arrest, 2) other medical emergencies requiring advanced life-support in the pre-hospital setting (e.g.) heart attack and stroke, and 3) severe traumatic injuries requiring emergency surgery. These categories represent some of the more dire emergencies, but it should be noted that there are many other situations, which are equally serious that also affect patient outcomes and quality of life.

Sudden Cardiac Arrest

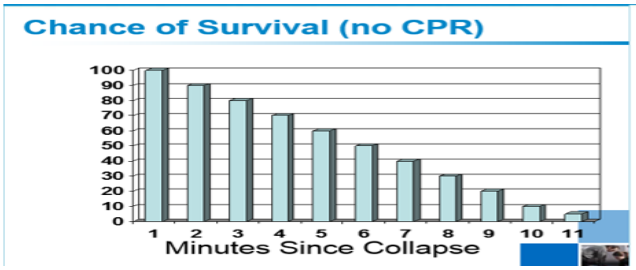
Irrespective of immediate CPR, rapid defibrillation, and a rapid ALS response, one-third of all adults who suffer a cardiac arrest will not survive. This is primarily due to the fact that if certain coronary arteries become completely clotted, the chances of survival are nearly zero. The remaining two-thirds of those who suffer a cardiac arrest cling to a fragile daisy chain of events necessary for them to survive. If *any* of these links are broken, their chances of survival will rapidly diminish.

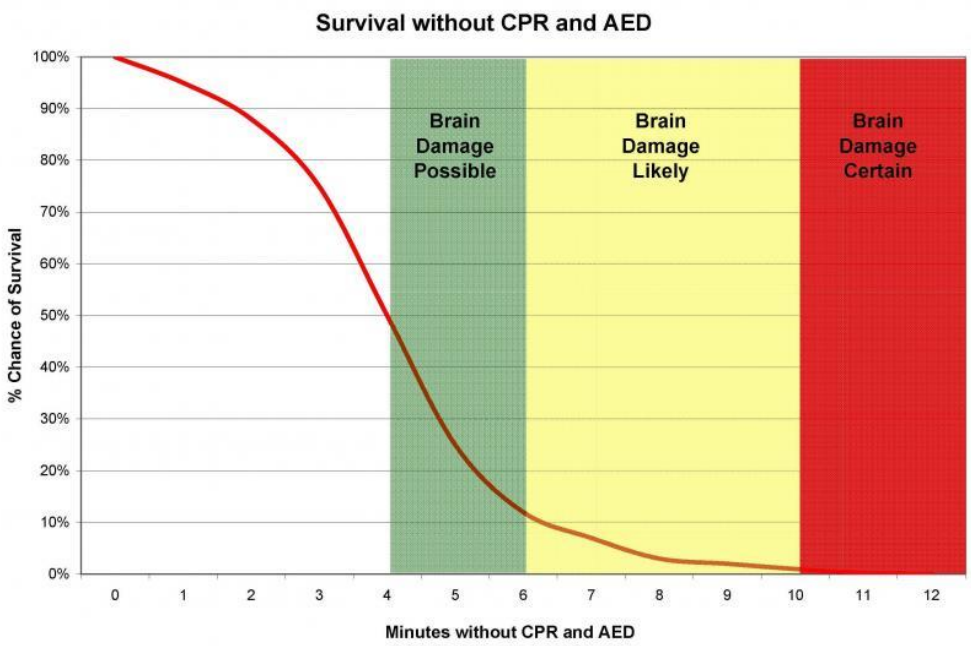


In 2014, the American Heart Association (AHA) released nation-wide data on out-of-hospital cardiac arrests, which indicating the following:

- The number of out-of-hospital cardiac arrests was 326,200
- The average survival rate was 11% and survival with good neurologic function was 8%
- Nearly one in three victims survives when the arrest is witnessed by a bystander
- Of the 19,300 bystander-witnessed cases in which individuals had a heart rhythm that could be treated effectively with a defibrillator, 31% percent survived.
- Because the brain can only be without oxygen for a short period of time, rapid intervention is necessary to prevent brain death from occurring. These interventions occur in sequence as follows as depicted below.

As described in the AHA data, immediate CPR and defibrillation significantly improve the chances of survival from heart damage or brain death. The following charts provide dramatic visual representations of this data:





Sources: American Heart Association

In a cardiac arrest situation, survivability dramatically decreases beyond four minutes without appropriate intervention. Intervention includes early recognition and bystander CPR. From a response perspective, the service-level objective is to provide advanced medical intervention within a six-minute timeframe, as brain damage is very likely to occur at six (6) minutes without oxygen. A sudden cardiac arrest victim who is not defibrillated within eight to ten minutes has virtually no chance of survival.

The shortest possible response times create the highest probabilities of resuscitation. An important evaluation point lost on most agencies is the time crews reach the patient's side. Often the clock stops when the vehicle arrives or stops at the address. The key to a successful outcome is the point the patient is actually contacted. The District's emergency medical response deployment model is based on early arrival of an at least one Paramedic (often more) in the shortest time possible. This is accomplished with engine-based paramedics, supported by paramedic ambulances. Because every MOFD apparatus and ambulance has a paramedic, the patient will receive a paramedic no matter which unit arrives first. This deployment model is the gold standard in California and throughout many modern countries around the world.

Although the public health initiative for Public Access Defibrillation (PAD), placing "smart" defibrillators (AEDs) in the community for use by trained laypersons is gaining momentum, the numbers of public access AEDs are few, and survival is often still dependent on early activation of the 911 systems and early arrival of EMS personnel.

Heart Attacks and Strokes

Optimal outcome requires rapid response, assessment, ALS care and transport to definitive care by prehospital providers. Rapid EMS response may offset some of the common delays in recognition of a medical emergency by the patient or bystanders. Clot-dissolving (thrombolytic) agents used during the acute phase of a heart attack or stroke can open the affected artery and reestablish blood flow. Patients who receive the treatment in the first and second hours after the onset of heart attack

symptoms experience significant reductions in disability and death when compared to patients who are treated in the third to sixth hours. For strokes, this time has now been extended to six (6) hours. Modern diagnostic tools and assessment techniques now allow District paramedics to notify receiving hospitals in advance of their arrival, allowing the patient to bypass the emergency department and be taken straight to the cardiac catheterization lab or CT scanner.

Traumatic Injuries & the "Golden Hour"

The moment a severe traumatic injury occurs, causing significant bleeding and/or inadequate perfusion, a 60-minute clock begins to counting down. If the patient does not reach a trauma surgeon with 60 minutes, their chances of survival rapidly diminish. This concept, which began during the Vietnam War, remains the benchmark for trauma care worldwide.

Unlike medical emergencies, the victims of severe traumatic injuries must be taken to a Level-1 or Level-2 trauma center. What distinguishes these hospitals from all others is their distinction to provide "comprehensive" care beyond their emergency department. These facilities are equipped with specialized teams and resources, capable of providing emergent, traumatic-related surgery.

Presently, there are two (2) Level-2 trauma centers within seven (7) miles of the District borders: John Muir Medical Center in Walnut Creek and Highland Hospital in Oakland. In addition, Children's Hospital Oakland is a Level-1 pediatric trauma center. Regional burn units are located in Sacramento, San Francisco, and San Jose.

The "Cascade of Events"

In every emergency there is a sequence of critical events that occur. Part of the risk assessment includes the evaluation of the District's ability to respond to emergencies. The following illustrates the events that occur prior to a District fire/ambulance unit arriving to an emergency:

Event Initiation Point:	The moment at which a human being or technologic sentinel (e.g., smoke alarm, infrared heat detector, etc.) becomes aware that conditions exist requiring activation of the emergency response system. These result in activation of the emergency response system. Factors may delay the initiation or call for help by seconds, minutes, hours, or even days before assistance is requested. An example is the patient who ignores chest discomfort for days until it reaches a critical point at which time he/she makes the decision to seek assistance.
Alarm Received and Transmitted:	The moment at which a call is received and answered at the 911 Public Safety Answering Point (PSAP). The basic nature of the emergency is then determined and the location is confirmed. By law, in California, the initial 911 call must be received by a law enforcement agency. Presently, 911 cellular calls are first answered by the CHP regional dispatch centers.
Alarm Answering Time:	The moment the call is transmitted from PSAP to the Fire/EMS Communications Center and answered. The Fire/EMS Communications center is known as a "Secondary PSAP".
Alarm Processing Time:	The time it takes to process the call and transmit to emergency response facilities (ERFs) or to emergency response units (ERUs) in the field. ERUs (fire engines, ambulances, and command vehicles) are tracked by satellite. The computer in the fire dispatch center, known as Computer Aided Dispatch (CAD) tracks these units on a moment-to-moment basis and will look for the closest available resources when an incident is entered into the CAD.
Turnout Time:	The interval between the activation of station and/or company alerting devices and the time when the responding crew is aboard the apparatus and the apparatus is enroute (wheels moving) to the call. This recorded in the CAD via the mobile computer terminal (MDT) or by radio.
Travel Time:	The time from which the responding apparatus clears the fire station or is enroute to the time they arrive at the given location. Occasionally, the given location is incorrect.
On-Scene Time:	The point at which the responding unit arrives on the scene of the emergency. This is typically transmitted by MDT or radio.
Initiation of Action:	The point at which operations to mitigate the event begins. This may include size-up (condition report), investigation, resource deployment, and/or patient contact/intervention.

Total Response Time:	The time from the call being received at the 911 PSAP and the point at which crews arrive and intervention begins.
Termination of Incident:	The point at which all tasks have been completed and are available to respond to another request for service.

The District collects and evaluates response-time data on a monthly basis.

To a great degree, in public discussion about how well a fire district can perform, there is a tendency to believe that when a fire starts we will be there four minutes later. This type of measure is an indicator of the customer's perception of performance of the emergency service system. It reflects a misconception regarding those factors that the fire service has direct control of and ignores those elements that are critical but require extensive public education, code enactment and enforcement. To the degree that this report will be focusing on reducing the point of time from dispatch to arrival; equally, it should be emphasized that an effective fire protection program should also focus on reducing the time between ignition and detection; and preventing fires from occurring in the first place.

Statistics That Relate to Time

For nearly 50 years, most fire service agencies have been using a statistical term "average" response time as a measure of their overall performance. The District has also utilized average response times in its reporting and evaluation. However, this statistic is generally considered as an inadequate statistical reference because a few isolated abnormal response times will skew the average, giving an inaccurate picture of the overall response time.

When the International Association of Fire Chief's (IAFC) Task Force on Accreditation researched this subject, it discovered that averaging was not a true reflection of performance. It is suggested that fractile goals are more relevant in defining an expected response goal for fire and EMS response times instead of using averages. The Standards of Coverage analysis that follows will utilize a percentile relationship in evaluating current coverage, impact of proposed developments, and establishing long-term goals to improve service capabilities.

Community Risk Scenarios

The District has determined that there are three (3) major risk scenarios within the District. In Order of risk, they include: 1) terrorism, 2) major earthquake, 3) wildland interface/intermix fires.

Additionally, residential structure fires, commercial structure fires, and medical emergencies are areas of concern. As previously indicated, these events are typically isolated to single parcels or individual people.

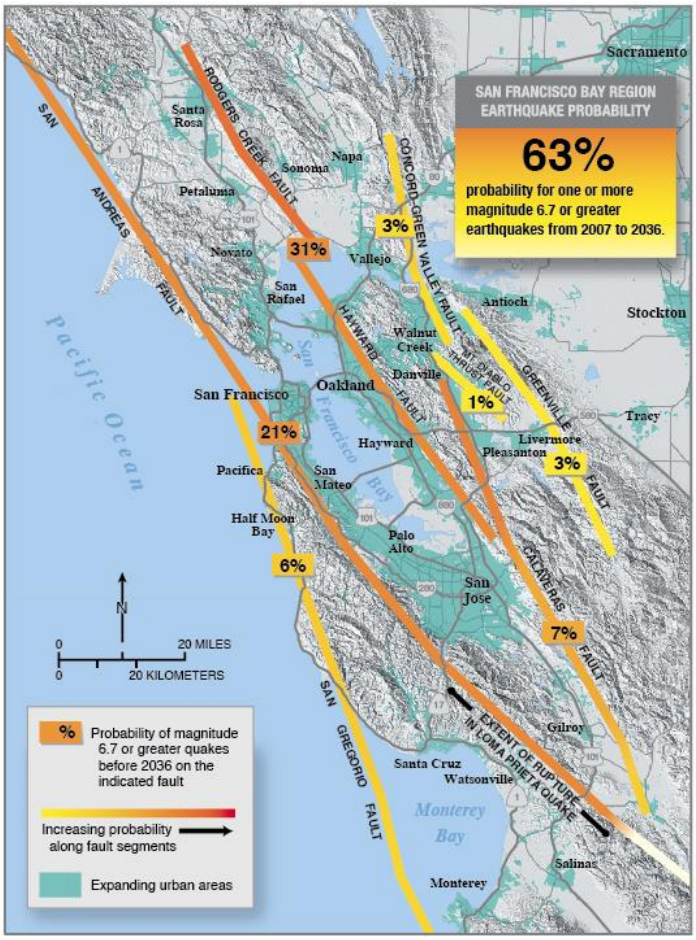
Terrorism

With guidance from the US Department of Homeland Security (DHS) and Federal Emergency Management Agency (FEMA), the District has identified several scenarios during vulnerability assessments. These will not be discussed in detail in this report.

Earthquakes

Earthquakes are considered a major threat to the Bay Area and District due to the proximity of several fault zones, notably the Hayward fault just west of the District. In 2015, the District completed an Applied Research Project (APR) on resource deployment following a major earthquake in or near the District. The purpose of this research project was to identify the appropriate framework for an Incident Action Plan (IAP) during the first 14 days following a major earthquake with the goal of further developing the emergency response framework and implementing an improved plan. Results indicated that MOFD update its plan referencing transition to subsequent operational periods using the *FEMA Incident Action Planning Guide*, the *City and County of San Francisco Emergency Response Plan – Earthquake Annex*, and the *Contra Costa County Earthquake Concept of Operations Plan* as models. Although MOFD's plan can be updated and improved using these references, it was not further recommended that MOFD or other fire service agencies consider building out pre-constructed IAP's for successive operational periods because there are too many variables.

In April 2008, scientists and engineers released a new earthquake forecast for the State of California called the Uniform California Earthquake Rupture Forecast (UCERF). Compiled by the USGS, the Southern California Earthquake Center (SCEC), and the California Geological Survey (CGS), with support from the California Earthquake Authority, it updated the 2002 earthquake forecast made for the greater San Francisco Bay Area. The figure below shows the updated probabilities for earthquakes of magnitude 6.7 or greater in the next 30 years.



As indicated in the figure, the overall probability of a magnitude 6.7 or greater earthquake in the Greater Bay Area was 63%. However, in September of 2016, that statistical probability was increased to 72% when it was discovered that the Hayward and Rodgers faults may be connected. Therefore, the figure will need to be updated.

The earthquake probability is highest for the Hayward-Rodgers Creek Fault system at 31%. The last damaging earthquake on the Hayward Fault was in 1868. The 140 years since 1868 is same length of time as the average interval between the past five (5) large earthquakes on the southern Hayward Fault.

The probability of a large earthquake on the San Andreas Fault in the next 30 years is now about 22%. This fault was responsible for the magnitude 7.8 1906 San Francisco earthquake and the magnitude 6.9 1989 Loma Prieta earthquake.

The Calaveras Fault in the East Bay, and the San Gregorio Fault along the San Francisco Peninsula coast, has probabilities of 7% and 6%, respectively, of producing a magnitude 6.7 or greater earthquake in the next 30 years.

In the East Bay, near the Central Valley, the Greenville Fault, the Mt. Diablo Thrust, and the Concord-Green Valley Fault were assigned probabilities of 3% or less of producing a magnitude 6.7 or greater earthquake in the next 30 years.

A major earthquake along any one of the major faults will cause substantial numbers of casualties, fires, and extensive damage to critical infrastructure. The effects could be aggravated by aftershocks and by secondary effects such as additional fires, landslides and dam failures. Such an event will exceed the response capability of the local communities and possibly even the State.

As an example, the Loma Prieta earthquake caused a total of over 16,000 uninhabitable units throughout the Monterey and San Francisco Bay Areas. Thirteen of the 18 potential Bay Area earthquake scenarios have a far larger impact than the Loma Prieta Earthquake. Many Bay Area faults can generate earthquakes and every Bay Area county is significantly affected by at least two. Several of the larger earthquakes will impact several counties severely.

The Association of Bay Area Governments (ABAG) estimates that a north and south rupture of the Hayward fault will result in an estimated 10,102 uninhabitable housing units in Contra Costa County.

Sewage, drinking, and firefighting water delivery to the plants is provided by a network of pipelines that run through and are maintained by various municipalities. Many of these pipelines cross the Hayward fault. In 1986, earth scientists and engineers cautioned that waste water pipelines from the hillside areas that cross the Hayward fault, “will be sheared and unable to carry sewage. Open trenches may be necessary to carry sewage for short distances. Alternatively, planners will have to provide for emergency housing or temporary sanitation facilities”. A 2007 report concurred on the vulnerability of sewage pipes, noting that, “they are made of the most brittle materials and do not have sealed joints”.

However, replacement and retrofit of aging systems has been sporadic, and this issue remains a problem. Treatment plants will be forced to shut down after a major earthquake if there is a loss of power. The water treatment plant in Orinda uses methane gas from its plant, but that will be unable to support full plant function. It may be necessary for emergency-treated raw sewage to be discharged into the Bay for up to one month following such an event.

The District has specific policies addressing earthquake response.

Wildland Interface/Intermix

The Wildland-Urban-Interface (WUI) area is defined as the geographical area where structures and development meet wildland or hazardous vegetation; where combustible homes meet combustible vegetation. There is a sharp line of demarcation where the vegetation stops and the neighborhoods begin. The Town of Moraga has many neighborhoods that fit this description as well as portions of South Orinda. On September 1, 1988, three (3) homes were destroyed and three (3) others were heavily damaged in south Orinda.

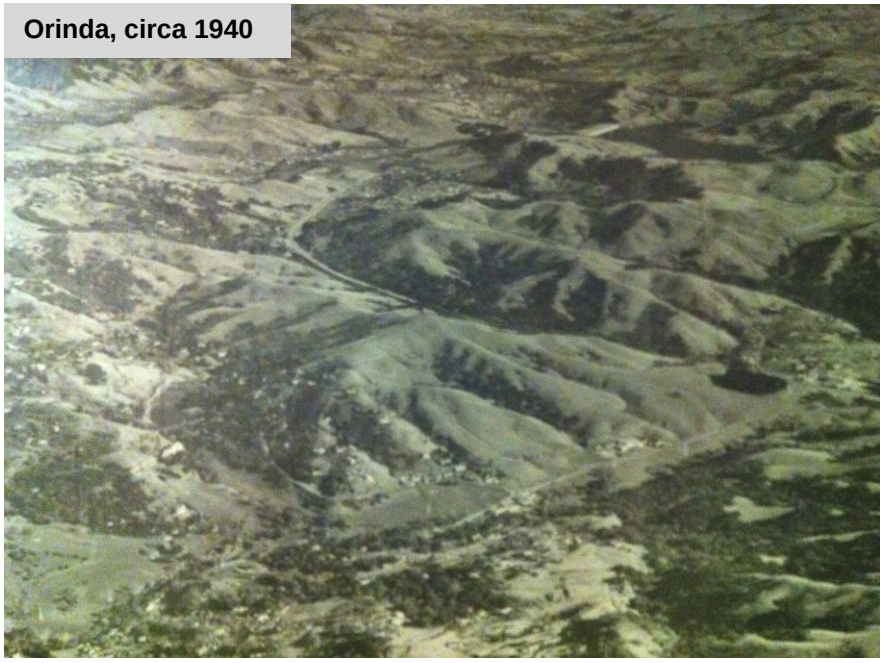
Wildland Intermix, shares some similarities with WUI but with one significant difference: residential structures are built and located mixed within the vegetation. This poses a major risk to citizens as well as firefighters. Within the District, these neighborhoods exist primarily within north Orinda.

Approximately 20% of the land area of City of Orinda is within the Very High Fire Hazard Severity Zone (VHFHSZ). The Town of Moraga has been designated as a Moderate Level of fire risk. (The District is in the process of conducting a re-evaluation of its threat zone areas.) Ever-present in the minds of residents is the largest wildland Interface/Intermix fire in the Bay Area, the 1991 Tunnel Fire (Oakland Hills Fire), resulted in $1.7 billion in losses. This fire killed 25 people, and destroyed more than 3,354 family dwellings and 456 apartments were destroyed. Dry Diablo winds that day produced gusts up to 60 miles per hour, combined with vegetation that was parched from 5 years of drought set the stage for a conflagration. Temperatures were in the 90's, humidity was below 20%, and the wind was from the north east producing hot and dry conditions. During the fire, the fuels that burned were 43% homes, 31% eucalyptus and pine trees, and 26% native trees. In Orinda, the homes are much further apart than in the Oakland hills, so home-to-home ignition will not be a dominating factor. However, the problem of flammable vegetation is present.

Hazardous Fuels and Fuel Reduction Efforts

The East Bay hills represent a prime example of the modification of the fuel environment that occurs to accommodate human activities. Hundreds of years ago, fields of wild grass and oak trees occupied most of the terrain. These indigenous trees were harvested as the population in the area grew and prospered in the late 1800's.

Orinda, circa 1940



In place of the oak trees, local farmers planted thousands of eucalyptus trees because the trees were thought to be fast growing, hardwood, perfect for use as railroad ties and furniture. This turned out not to be the case and as a result, the trees invaded and are now prevalent along the hillsides. Another anticipated use of the eucalyptus trees was to utilize them as wind breaks. Instead, the wind blew the seeds and further spread their growth. In the western portion of the District (and east Oakland) there are an estimated 450,000 eucalyptus trees occupying an area that can only safely contain 60,000.

Flammable, non-native plant species such as cedars, junipers, and Monterey pine are prevalent throughout the District. Chamise, greasewood, manzanita, oak, pine, and oak, also common throughout the District, flourish in areas that receive little or no rainfall, or no rain for the majority of the year. All, except the wild grasses are high in resin content, can ignite readily, and produce airborne ember showers.

The eucalyptus and Monterey pines often have low-hanging limbs that provide a laddering effect, allowing lower lying fuels to ignite the crown of the tree. Once a "crown" fire is established, it can quickly become a conflagration. A significant number of these flammable fuels are in close proximity to homes in the area, creating a vulnerability to a wildland interface/intermix fire.

Presently within the District, approximately 10% of residential roofs are wood shake. Along with wood shake siding, these construction features add to the hazardous fuel load within the District. Efforts to discourage roof replacements with these materials are ongoing.

In Moraga, there are a total of 5,926 acres threatened by wildfire. Of this 5,926 acres threatened by wildfire, 1,854 acres are listed as a "High" threat and 199 acres are listed as "Very High". This land includes residential homes, commercial structures, major infrastructure (roads, highways, and related facilities), open urban land, agriculture, rangeland, and forested land.

Source: Land Use and Infrastructure in Hazard Areas, 2010

There are 46 critical facilities (health care, schools, critical facilities, bridges and interchanges) that are threatened and exposed to wildfire in Moraga. Of those, 38 are moderately exposed and 8 are highly threatened. Total roadways exposed to the threat are 72 miles.

Source: Land Use and Infrastructure in Hazard Area Moraga Critical Facilities Exposure, 2010

In Orinda, there are a total of 8,100 acres threatened by wildfire. There are 144 critical facilities (health care, schools, critical facilities, bridges and interchanges) that are threatened and exposed to wildfire in Orinda. Of those, 101 are moderately threatened, 10 are highly threatened and three (3) are extremely threatened. There is a total of 127 miles of roadway exposed to the threat.

Source: Land Use and Infrastructure in Hazard Area Orinda Critical Facilities Exposure, 2010

In addition to risk-based staffing increases during the wildlfire season, the District has adopted implementation of fuel modification program called *Firewise Communities*. NFPA's Firewise Communities Program encourages local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. Firewise is a key component of Fire Adapted Communities – a collaborative approach that connects all those who play a role in wildfire education, planning and action with comprehensive resources to help reduce risk. The program is co-sponsored by the USDA Forest Service, the US District of the Interior, and the National Association of State Foresters.

The District has identified 18 potential Firewise communities. Of these, one has attained designation, and another is in-progress. These programs target parcels in or near wildland areas with an emphasis on creating a defensible space for structures by reducing combustible materials and vegetation at or near structures.

Additionally, the District has been conducting Hazard Reduction Inspections since 2002 and inspects over 14,000 parcels each year. The District has over 2,500 acres of WUI responsibilities. The District also promotes the NFPA's "Ready, Set, Go" program to give residents tips and home evaluations to help reduce the threat of wildland fires.

SECTION IV – CRITICAL TASK CAPABILITY

Structure Fires

The District's resource deployment strategy is based on sending enough resources to reported structure fires to effectively and safely contain and extinguish the fire as quickly as possible. This is typically between 18 and 23 firefighters.

To apply the risk analysis formula (T + V = R) to structural fires within the District, the following factors are considered:

- Threat: The fire itself, which will damage the structure and produce smoke, which is harmful to civilians and firefighters.
- Vulnerability: These are minimized with adequate staffing, good training, tactics and command. Travel times to some properties represents a vulnerability that cannot be easily remedied.
- Risk: The statistical probability of a structural fire that progresses beyond the incipient phase.

While structure fires are statistically insignificant (about 5 per year), they represent a highly-visible emergency within the District, with the potential to seriously damage personal property and people, as well as spreading to the WUI/Intermix. What's more, the Fire District exists with the overriding responsibility of preventing conflagration, so despite its statistically low number, it is highly relevant to the citizens of the District.

The combination of property and life risk determines the fire ground tasks that must be accomplished to minimize loss and prevent the fire from spreading beyond the room or building or origin. These factors, although interrelated, can be separated into two (2) basic types: 1) fire flow and 2) life safety. Fire flow tasks are related to putting water on the fire; life safety tasks are related to finding trapped people and removing them from the building.

The required fire flow is based on the following:

- Building(s) density
- Building construction material
- Building construction type
- Building contents
- Building size
- Distance from other buildings
- Horizontal and vertical openness (lack of partitions)
- Potential energy (BTUs per pound)

Life-safety tasks are based upon the number of occupants in a fire situation, their location, their status (awake versus asleep), and their ability to take self-preservation action. For example, ambulatory adults need less assistance than non-ambulatory. The elderly and small children always require more assistance. The key to the District's success at a structure fire is coordinated teamwork, regardless of whether the tasks are all fire-flow related or a combination of fire flow rescue and life safety. A fire in an occupied residential structure requires a minimum of eight (8) tasks to be simultaneously conducted in order to prevent the loss of civilian lives, stop further property loss, and minimize the risks to the firefighters. The number and type of tasks needing simultaneous action will

dictate the minimum number of firefighters needed at the scene. The following tables are examples of the tasks, which usually are performed simultaneously in fire responses to a single-family residential structure and three-story residential dormitory. The tasks identified usually occur within the first 5-15 minutes of fire-ground operations. This is an absolute minimum of personnel that should be on scene to operate safely and effectively.

Note: When there are people trapped in a burning building, the first-arriving crew does not have to wait for a back-up crew to enter the building to begin rescue. They may or may not use the protection of a hoseline depending on the color, volume, and turbulence of the smoke.

The following tables represent low, medium, and high-risk occupancies with no known rescue:

Structural Fire – 1st-Alarm Assignment Minimum Tasks: Low Risk Occupancy
(One, two, or three family residence, most apartments, small business)

	Number of Firefighters	
Task	CFAI Standard	MOFD Standard
Attack hoseline	2	2
Back-up hoseline	2	2
Rapid Intervention Crew	2	3
Search and Rescue	2	2
Ventilation	2	2-3
Pump Operator	1	1
Water Supply (hydrant)	1	1
Command Officer	1	2
Safety Officer	1	1
Investigator	1	0*
Utilities/Exposures	1	1
Ambulance	0	2
TOTAL:	16	19-20

Note: * All District Captains investigate fires. Complicated, high-dollar loss or injurious fires are investigated by one of four District Investigators.

Structural Fire – 1st-Alarm Assignment Minimum Tasks: Moderate Risk Occupancy
(Some apartments, offices, mercantile, and industrial occupancies not requiring extensive forces)

Number of Firefighters		
Task	CFAI Standard	MOFD Standard
Attack hoseline	4	4-6
Back-up hoseline	4	4-6
Rapid Intervention Crew	2	3
Search and Rescue	2	2
Ventilation	2	2-6
Pump Operator	1	1-2
Water Supply (hydrant)	1	1-2
Aerial Ladder Operator	1	2-3**
Command Officer	1	4
Safety Officer	1	1-2
Investigator	1	0*
Utilities/Exposures	2	2-6
Ambulance	0	2
TOTAL:	22	28-44

Notes: * All District Captains investigate fires. Complicated, high-dollar loss or injurious fires are investigated by one of four District Investigators; ** Incident dependent. Most fire responses within the District utilize automatic-aid from neighboring agencies due to the proximity of nearby fire stations.

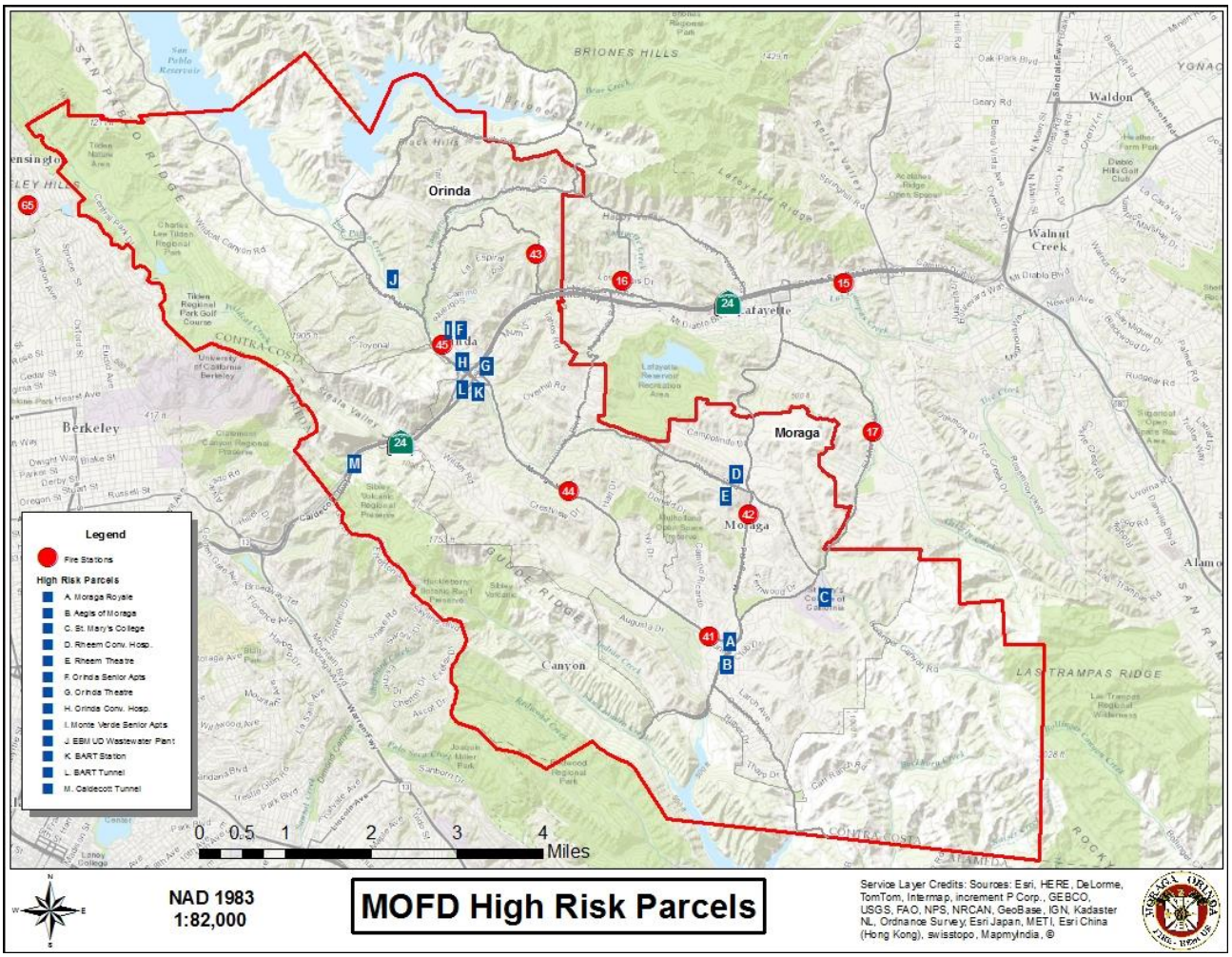
Structural Fire – 1st-Alarm Assignment Minimum Tasks: Special/High Risk Occupancy
(Convalescent hospitals, senior assisted living facilities, BART, mid-rise and other high life-safety potential occupancies).

Number of Firefighters		
Task	CFAI Standard	MOFD Standard
Attack hoseline	2	4-9**
Back-up hoseline	2	4-6**
Rapid Intervention Crew	2	3-6**
Search and Rescue	2	2-9**
Ventilation	4	6**
Pump Operator	1	1-2**
Water Supply (hydrant)	1	1-2**
Aerial Ladder Operator	1	2-3**
Command Officer	1	4
Safety Officer	1	1-2**
Staging Officer	1	0-1**
Lobby Control Officer	1	0-1**
Base Officer	1	0-1**
Stairwell Support	1	0-3**
Investigator	1	0*
Utilities/Exposures	2	2-6**
Ambulance	0	2
TOTAL:	24	32-63

Notes: * All District Captains investigate fires. Complicated, high-dollar loss or injurious fires are investigated by one of four District Investigators; ** Incident dependent. Most fire responses within the District utilize automatic-aid from neighboring agencies due to the proximity of nearby fire stations.

The following map represents the locations of the 13 “High-Risk” parcels within the District:

Map-5: High-Risk Parcels



High-Risk Parcels

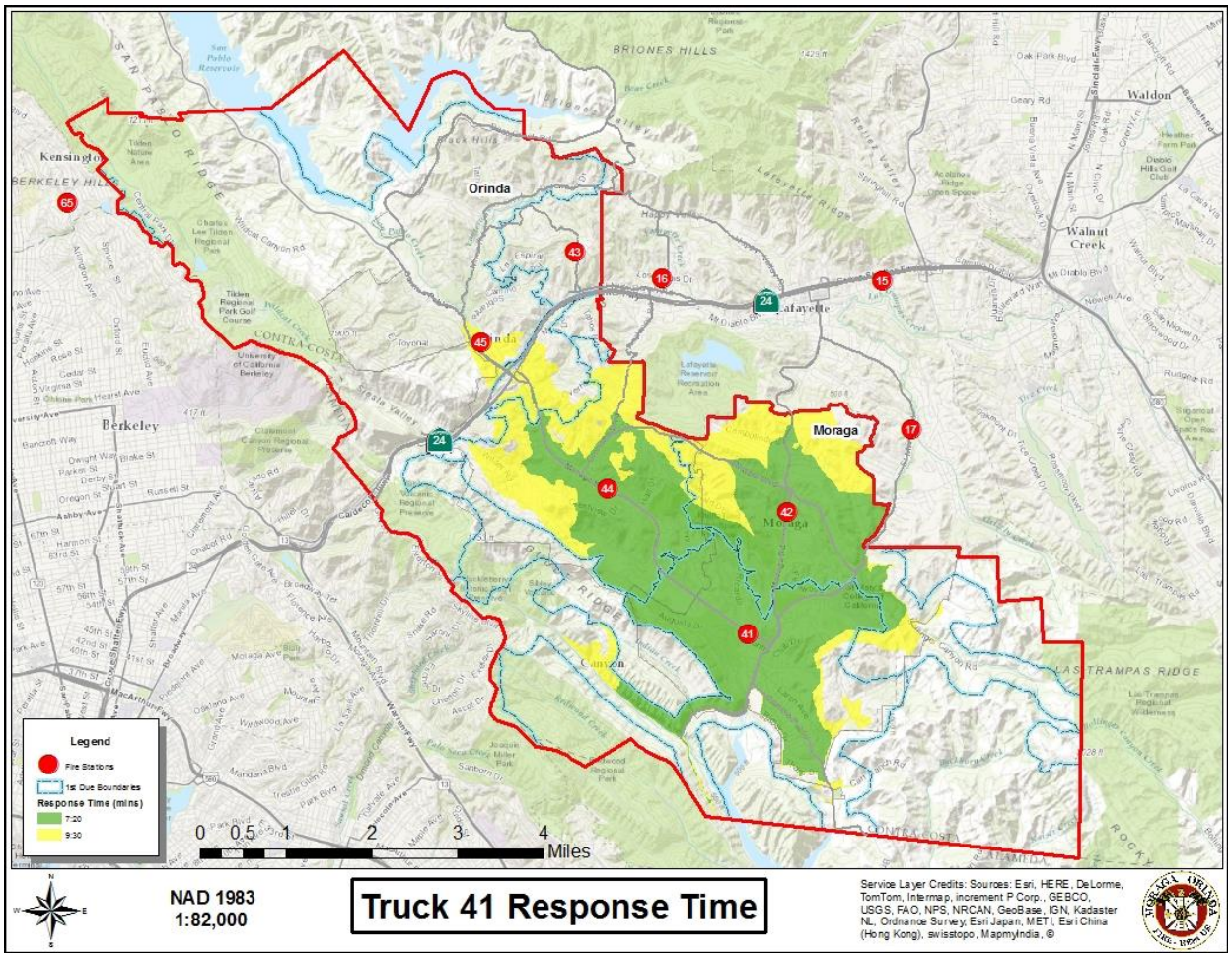
A	Moraga Royale	H	Orinda Conv. Hosp.
B	Aegis of Moraga	I	Monte Verde Senior Apts.
C	St. Mary’s College	J	EBMUD Wastewater Plant
D	Rheen Conv. Hosp.	K	BART Station
E	Rheem Theater	L	BART Tunnels
F	Orinda Senior Apts.	M	Caldecott Tunnel Complex
G	Orinda Theater		

These levels of risk/threat demonstrate the need to set-up the equipment and simultaneously handle the tasks of fire attack, search and rescue, ventilation, backup lines, pump operations, water supply and command. If fewer firefighters and equipment are available or if they have longer distances to travel, then the District may not be able to meet an objective such as confining the fire to the room or floor of fire origin.

Aerial Ladder Truck Placement and Capabilities

The City of Orinda has never had an aerial ladder truck stationed within the community, although seven (7) of the 13 high-risk parcels within the District are within the City; plus Highway-24. Within the District, the use of a ladder truck company has never been fully developed and the resource generally remains underutilized for a variety of reasons. The two primary reasons are: 1) ladder truck has always been located in Moraga in the southern end of the District, resulting in extended response times to Orinda (see Map-6); and 2) the current ladder truck design is not well-suited for the community it serves.

Map-6: Ladder Truck Response Time from Station-41

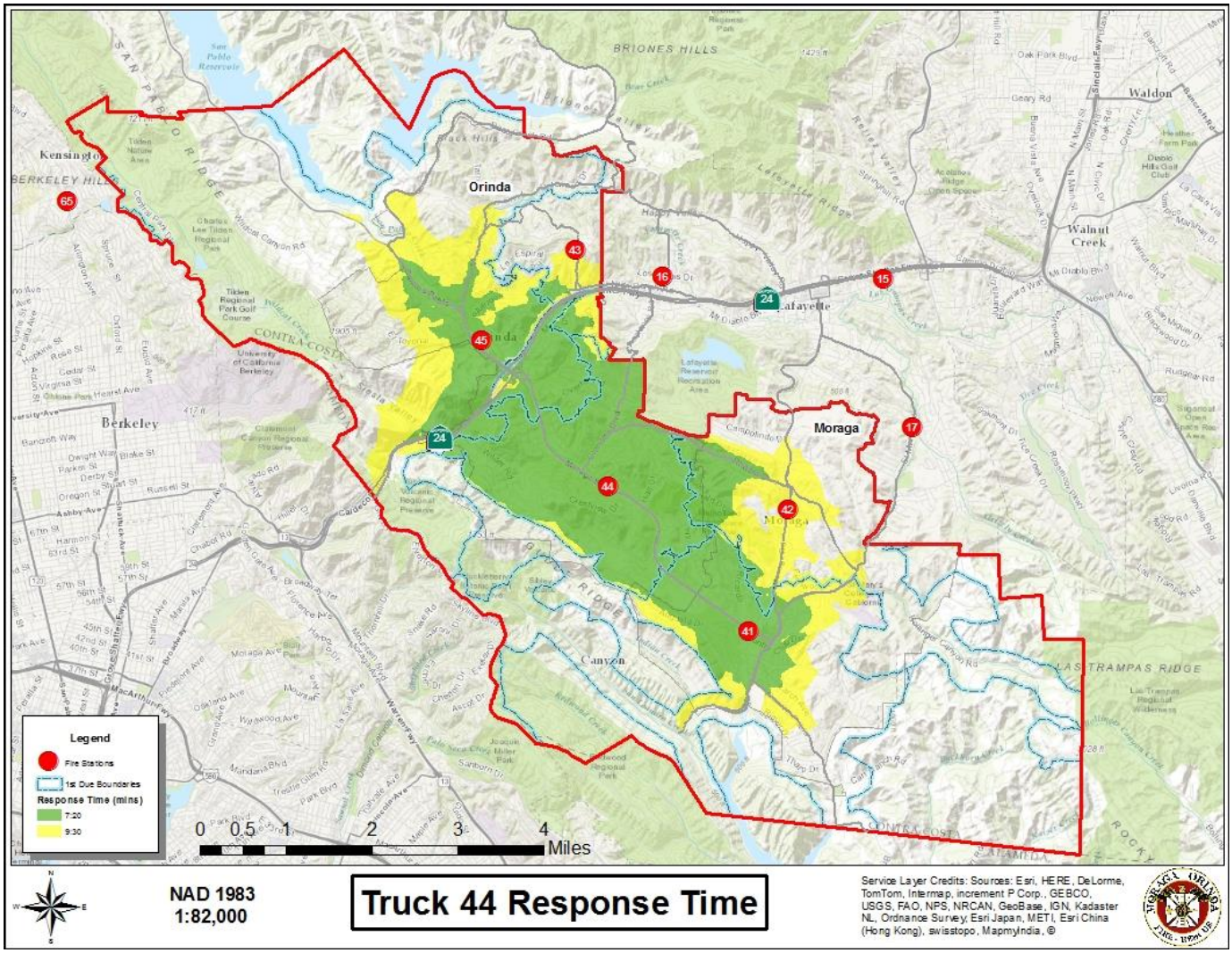


To remedy the issue of ladder truck response time, Goal-3 in the 2006 SOC was to purchase an additional ladder truck (quint type) in FY 2012-13 to be deployed from Station-45 in Orinda. For this reason, in 2012 the District conducted an analysis, which concluded that purchasing an additional truck was unnecessary and that a single ladder truck company would be able to appropriately serve the entire District if centrally located. At that time, the District determined that replacing an aging fire engine at Station-44 with a new ladder truck would also allow the District to do without the purchase of a replacement engine for that station, which is due in 2017.

In 2016, the District determined that from 2014 through 2015, the 2001 ladder truck was out-of-service 109 days due to age and obsolescence and that replacement was necessary. In 2016, the

District also determined that a new ladder truck should be purchased. The District then acquired a used training ladder truck to prepare personnel to operate the new ladder truck type, which is planned to arrive in 2018. At that time, incident concentration analysis also confirmed that Station-44 was the optimal location for a ladder truck due to the low incident volume within Station-44's first-due area, its centralized location, proximity to high-risk hazards, and Highway-24. From Station-44, both communities will be served by one ladder truck company with good response times and in a manner consistent with operational priorities and policies (see Map-7).

Map-7: Ladder Truck Response Time from Station-44



Vegetation Fires Threatening Structures

The District is perhaps best-known for its skill and tenacity extinguishing serious vegetation fires. Most vegetation fires within the District threaten expensive homes, critical infrastructure or watershed. The last incident when a vegetation fire seriously damaged any home within the District was in 1988.

To apply the risk analysis formula (T + V = R) to structural fires within the District, the following factors are considered:

- Threat: The fire itself, which can spread to structures and progress to a conflagration.

- Vulnerability: These are minimized with adequate staffing, good training, tactics and command. Travel times to some properties represents a vulnerability to that not be easily remedied. The weather also produces an uncontrollable vulnerability. Several District community risk-reduction initiatives have reduced the vulnerability such as aggressive vegetation management reduction programs and strict fire code ordinances.

- Risk: The statistical probability of a vegetation fire spreading to structures and becoming a conflagration.

While these events are also statistically insignificant (about 5 1-acre plus fires per year), there have been several multi-acre fires in close proximity to homes that were only mitigated with aggressive fire attack and massive resource allocation. Automatic and mutual-aid agreements between the District and other agencies have made this possible. As with structural fires, vegetation fires are highly visible and have the potential to escalate into a major emergency.

The District's resource deployment strategy for vegetation fires threatening structures is massive. On the initial assignment, over 100 firefighters (from within the region) are dispatched to the scene. Additional alarms can and are sometimes called with assistance from many local agencies.

Life-safety tasks are based upon the location and rate of spread of the fires. Evacuations are only triggered in the event of a major fire, which has not occurred for decades. Unfortunately, the unnatural process of quickly extinguishing all fires, has led to a build-up of fuels, which could someday lead to a conflagration.

2012 Ivy Drive Fire

The following tables represent a typical response configuration for a vegetation fire threatening structures during wildland season:

Vegetation Fire – 1st-Alarm Assignment: Threatening Structures

		Number of Firefighters		
Equipment		MOFD	Local	State
2	Structure Engines	7	--	--
12	Wildland Engines	9	--	32
4	Command Officers	1	1	2
1	Ambulance	2	--	--
2	Air Tankers	--	--	4
3	Helicopters	--	4	8
2	Bulldozers	--	--	2
2	Handcrews	--	--	44
	SUBTOTAL:	19	5	95
	TOTAL:			116

Note: Any significant vegetation fire will typically require additional alarms (2nd or 3rd) from neighboring agencies (local government). 13-20 firefighters will respond with each additional local government alarm. This can quickly bring the total number of firefighters to 156.

The number of firefighters and complexity of significant vegetation fires within the District requires additional command and control officers, planning and logistical support.

When a significant depletion of District resources occurs, other agencies provide station coverage. Inversely, the District provides automatic and mutual-aid, as well as station coverage for other neighboring agencies.

Medical Emergency Responses

During the 2006 Standards of Cover study, the District established the goal of reaching the scene of all medical emergencies with a paramedic within six (6) minutes or less. During a medical emergency, the closest paramedic fire engine and paramedic ambulance respond. If an engine crew is also responsible to cross-staff an ambulance, they will respond in the ambulance and a fire engine from the next-closest station will respond.

The District sends an engine and ambulance to all medical emergencies if available. The District presently has the capacity to deploy three (3) ambulances. To send additional ambulances would compromise the Districts dual-responsibility of fire protection. Fortunately, the District's individual engines and ambulances are available a high percentage of the time. This indicates that the District has excellent capacity to handle more than one incident simultaneously.

Service Level Goals & Methodology

While there are no state or federal mandates for level-of-service, goals are often based upon federal and state legislation, such as 2 In/2 Out, federal and state OSHA requirements, the ISO grading schedule, national standards (such as NFPA), and best practices found in the CFAI agency accreditation process. These service goals are the benchmark of performance in respect to travel times, but do not measure other aspects of performance, such as training, firefighter experience, endurance, or the quality, capability, and reliability of firefighting equipment.

As the size and/or complexity of emergencies range from small to large, the requirements for resources can vary greatly. A high-risk property or area could require a timely deployment of more fire companies. Creating a level of service consists of the analysis made regarding the distribution and concentration of resources needed in relation to the potential demand placed upon them by the level of community risk.

The following service level goals relate to travel times (including call processing time and turn-out time) of the initial response to an emergency. The goals represent the benchmark the District is trying to achieve in each category.

Response-time Goals (Benchmarks) ("Superior" Standard)

	First-Arriving Unit	Balance of First-Alarm Response Force
Fire Suppression	7 minutes, 20 seconds (7:20) Goals: Containment, Rescue	12 minutes, 20 seconds (12:20) Goals: Minimum of 19 Firefighters on scene
EMS	7 minutes (7:00) Goal: Paramedic-engine at Patient's side*	10 minutes (10:00) Goal: Ambulance on scene**
Ambulance	10 minutes (10:00) Goal: 1-2 additional paramedics within minutes of first-arriving paramedic engine.**	N/A

Notes: * 5th edition CFAI standard – Response time = time from "Unit Assigned" (dispatch) to "Arrival" at the scene. 6th edition CFAI standard – Response time = time from "Call Received" to "At patient's side"; ** No CFAI Goal – MOFD Goal.

This change in standard is a reason that the standard should be changed from six (6) minutes to seven (7) minutes (6:00 – 7:00).

The District tracks three performance areas that have been identified in both the CFAI process and NFPA 1710: 1) call-processing time, 2) turnout time, and 3) travel time. "Response time" is the sum of turnout time and travel time.

The CFAI model uses a benchmark/baseline process. This provides for a range of performance within each category from the target benchmark (goal) to a baseline, which is 70 percent of the benchmark. The performance is focused on those calls deemed emergent ("Code 3", lights and siren responses only. This allows an agency to provide a fractile analysis for each area of response related to the benchmark of performance as outlined in the CFAI model. An agency's performance should fall within the ranges provided up to the baseline timeframe. The purpose of the Standards of Cover is to show the benchmark and baseline for those areas of analysis with the objective to eventually meet the benchmark in each of those areas. If in the future the benchmarks change within the CFAI model, the document will be adjusted to reflect the change and begin to measure accordingly.

Effective Response Force

An effective response force is defined as the minimum amount of staffing and equipment that must reach a specific emergency within a specific time. It should be able to mitigate the typical emergency medical incident or fire (that is reported shortly after it starts) and is within the maximum prescribed travel time for the type of medical emergency or risk level of the structure. Considering the fire District cannot hold fire or other risks to zero or successfully resuscitate every patient, its response objective should find a balance among effectiveness efficiency, and reliability, which will keep community risk at a reasonable level. At the same time, the District should yield the maximum life and property savings as well as providing for the safety of the firefighters.

Today, the District employs units for Fire Suppression (structural and vegetation), Technical Rescue's, Water Rescues and Emergency Medical Services. In addition to its own resources, the District also has automatic and mutual-aid agreements in place with neighboring agencies, including Contra Costa Fire Protection District, Berkeley Fire Department, Oakland Fire Department, the El Cerrito-Kensington Fire Department, CAL Fire, and East Bay Regional Park District.

This daily staffing is deployed with a high concentration of personnel assigned to units centrally located within the Town of Moraga and the City of Orinda. Distribution of these units shows overlapping areas where more than 2 units have a travel time within the benchmark of 4 minutes. While this helps with additional incidents within the busier areas of the District, gaps exist in outlying areas of the District due to development after fire station placement, such as Orinda View, Sundown Terrace, Sanders Ranch, Bollinger Canyon, and the community of Canyon where no unit can travel within the benchmark goal of seven minutes and twenty seconds (7:20).

Over the last five years, MOFD has responded to an average of 9.2 emergency incidents per day. The incident-type dictates the number of units and firefighters who are deployed during the initial response. They are assigned as follows:

MOFD Deployment to Typical Emergencies

Types of Calls	Responding Units
Residential Structure Fire	4 Engines, 1 Truck, 1 Ambulance, 2 Battalion Chiefs
Commercial Structure Fire	4 Engines, 2 Trucks, 1 Ambulance, 2 Battalion Chiefs
Vegetation Fire (Suburban)	2 Structure Engines, 3 Wildland Engines, 2 Battalion Chiefs; CAL Fire, EBRP
Vegetation Fire (Rural)	1 Structure Engine, 3 Wildland Engines, 1 Water Tender, 2 Battalion Chiefs; Berkeley Fire*, CAL Fire, EBRP*, El Cerrito Fire*
Medical Emergency	1 Engine, 1 Ambulance
Vehicle/Rescue Accident	1 Engine, 1 Rescue Engine, 1 Ambulance, 1 Battalion Chief
Commercial Fire Alarm	1 Engine, 1 Truck

Notes: * Berkeley Fire, EBRP, and El Cerrito Fire respond to incidents with Tilden Park and some areas of north and west Orinda. These are based on automatic and mutual-aid agreements.

District Performance to Service Level Goals

Response Reliability

Response reliability is defined as the probability that the required amount of staffing and apparatus will be available when a fire or emergency call is received. The response reliability of the District would be 100 percent if every crew were available every time an emergency call was received. In reality, there are times when a call is received but the company is already on another call. This requires a substitute (second-due) company to be assigned from another station.

As the number of emergency calls per day increases, so does the probability that a needed piece of apparatus will already be committed when another call is received. Consequently, as the response reliability decreases, the response time will increase. The size of the area that a station covers, the number of calls, the type of incident, and the population density all affect response reliability. The more densely populated, the more likely a second-due call will occur.

An analysis of current response data can reveal variations in the response reliability among stations. The optimal method of tracking response reliability is to analyze the total call volume for a particular fire management area and then track the number of second and third incidents occurring in that area. Analysis of time-of-day when incidents are occurring is also a relevant data point. The District must have the goal of having a reasonable balance between being over-staffed and under-staffed. Seasonal variations make this more complex and difficult to manage.

Standards of Measurement

Developing the analytics to evaluate performance, the District chose to begin with this edition of the CFAI's Standards of Cover to utilize fractile measurements versus averages. While the median or average can be an important indicator of performance, the use of fractile measurement provides a more precise picture of performance. Also included are the two targets:

- Benchmark The response time *goal* of the District
- Baseline The minimal level of performance as outlined in CFAI (70% of the Benchmark). This helps to clearly identify the areas of improvement needed within the organization.

In 2015, District responded to 3,341 incidents. Focusing on emergency incidents, four (4) types of incidents were chosen to measure its service levels. Structure fires, vegetation fires, and rescue emergencies were chosen because, while they occur at low frequency, the potential for high impact to loss of life and property are great. Medical emergencies were also selected because they are by far, the most frequent type of emergency incident. The incident types and volumes for the preceding year are listed below:

Structure Fires:	9
Vegetation Fires:	10
Rescues:	240
Medical:	2,067
Other:	1,015

These represent 70% of the responses. For each of the above incident types, the District chose to focus on specific criteria, which are listed below along with their benchmark time in Metro/Urban, Suburban and Rural population densities within the District. All the response criteria are travel-time fractile measurements. Because the majority of the population density within the District lies within the "suburban" criteria, it was therefore used as the response-time standard.

Alarm handling or "call processing time" is the time interval form when the alarm is acknowledged at the communication center until the response information begins to be transmitted to the appropriate station. The benchmark time for this fractile measurement is 60 – seconds for 90% of events. This is added to the benchmark of 5 minutes of travel time for Suburban populations and 10 minutes for full force.

Turnout time is the time interval that begins when the station is alerted by either an audible or visual annunciation or both and ends at the beginning of the units travel time. The benchmark time for this fractile measurement is 80 – seconds for fire and special response and 60 – seconds for EMS response, for 90% of events. Again, this time is added to the benchmark of 5 minutes of travel time for suburban populations and 8 minutes for full force.

SECTION V – SERVICE LEVEL OBJECTIVES

Performance Goals and Objectives

The goal of the District is to limit the risks to the community from fire, injury, death, and property damage associated with fire, accidents, illness, explosions, hazardous materials incidents, and other natural or manmade emergencies through prevention and responses. Performance objectives outline the commitment of the District to meet pre-established objectives regarding the timeliness of responses to specific risks. The objectives that follow are the result of a thorough evaluation and categorization of our risks. For each risk we have analyzed our historical responses to that risk, the outcome of those responses and have analyzed the potential for future risk in each defined category. Specific performance measures have been established based on our analysis and mission.

The 2008 5th edition CFAI Standards of Cover and 8th edition Self-Assessment Manual use benchmarks and baselines as the measure of superior and target response performance. Subsequently, the 6th and 9th editions of these documents place less emphasis on these metrics.

The following tables depict "Benchmark", "Baseline" and "Actual Performance". The Benchmark is the highest standard and should be considered as "Superior Service". The "Baseline" is 70% of the Benchmark and should be considered as a minimum "Target".

These time include one minute (1:00) for call processing and one minute (1:00) or one minute and twenty seconds (1:20) for EMS or fire for turnout from the station. Therefore, 2:00 to 2:20 are included in the times below. To calculate the travel-time *only*, subtract 2:00 or 2:20:

Benchmark Standards: CFAI GOALS for "Superior" Service Levels

Benchmark Total Response-Time	**CFAI GOALS "SUPERIOR"**			
	Metro/Urban 2006 Standard	**Suburban 2016 Standard**	Rural	Performance Goal
EMS Paramedic Engine	6:00	**7:00**	12:00	90%
Structure Fire Engine 1st-Arriving	6:20	**7:20**	12:20	90%
Structure Fire Full-Force	10:20	**12:20**	16:20	90%

In summary, the goal is to reach all medical emergencies within the suburban areas (Moraga and Orinda) with seven minutes (7:00) or less and all fires or rescues within seven minutes and twenty seconds (7:20) 90% of the time.

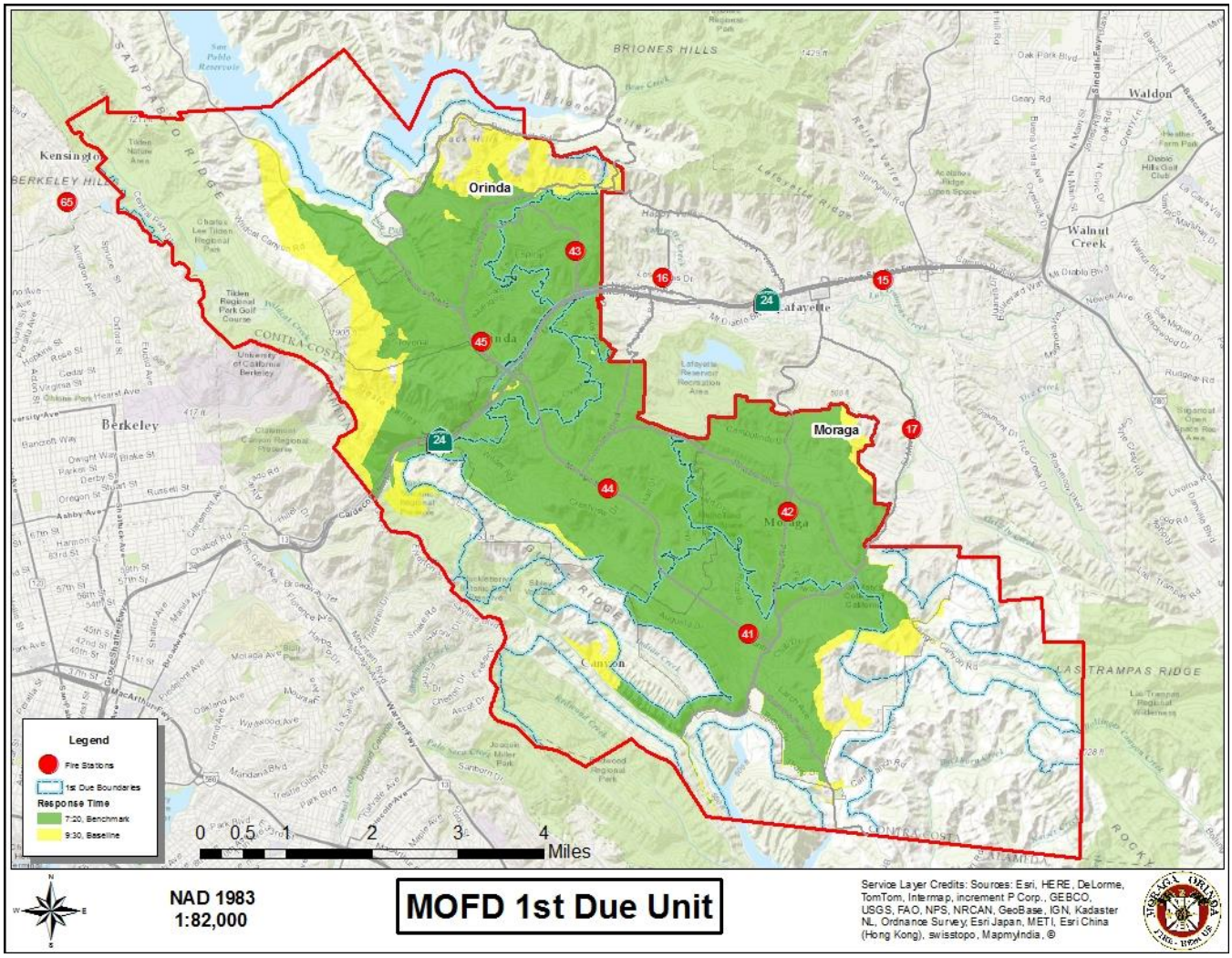
The "Baselines" standard in the following chart represent the current response the minimum "Target" response time goals for the District within each population density. The District has chosen "suburban" as its overall standard. These times include one minute and 30 seconds for call processing and one minute and thirty seconds (1:30) for turnout-time from the station (EMS or fire). Therefore, three minutes is included in the times. To calculate the travel-time *only*, subtract three minutes (3:00).

Baseline Standards (70% of Benchmark): CFAI Goals for "Target" Service Levels

Baseline Total Response-Time	CFAI GOALS "TARGET"			
	Metro/Urban 2006 Standard	**Suburban 2016 Standard**	Rural	Performance Goal
EMS Paramedic Engine	8:12	**9:30**	16:00	90%
Structure Fire Engine 1st-Arriving	8:12	**9:30**	16:00	90%
Structure Fire Full-Force	13:24	**16:00**	21:12	90%

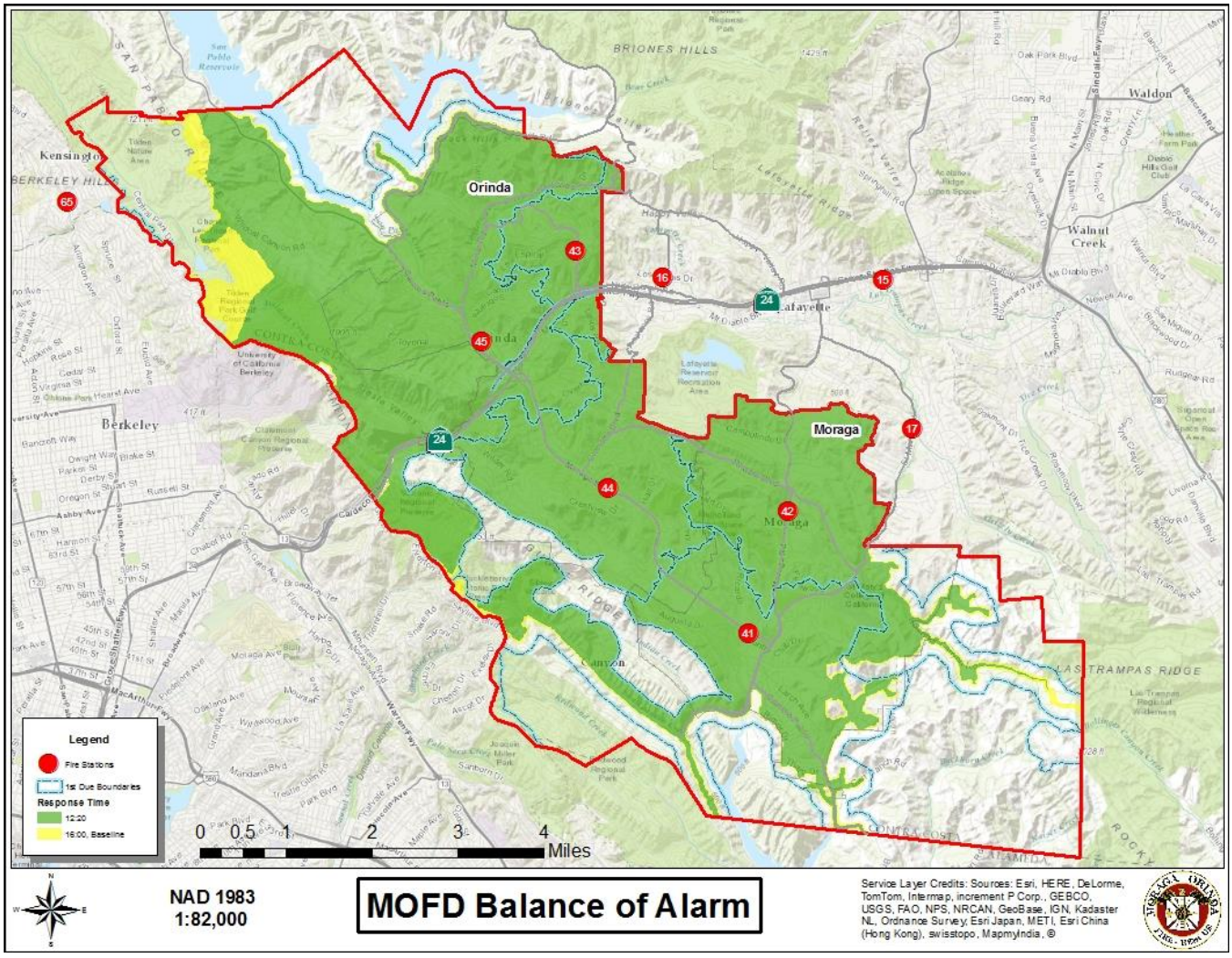
The following map compares the difference between the Benchmark standard of seven minutes and twenty seconds (7:20) and the Baseline of nine minutes and thirty seconds (9:30) for first-arriving engines:

Map-8: First-Arriving Unit Benchmark and Baseline



The following map compares the difference between the Benchmark of twelve minutes and twenty seconds (12:20) and the Baseline of sixteen minutes (16:00) for a full-force response:

Map-9: Balance of Alarm (Full Force) Unit Benchmark and Baseline



Measuring Actual Performance

To evaluate response times, the District uses a software program known a Tableau. This program is provided by the District's IT provider. Within the program, customized tables can be created and filtered according to the desired data. Considerable effort was made in an effort to eliminate skewed data, but not compromise true performance.

Actual Performance Compared with Benchmark (Superior)
Median Response Times and 90th Percentile Times

		EMS	FIRE	
Actual Performance of Benchmark Time Standards (7:00 & 7:20)		**Median Time Suburban**	**Median Time Suburban**	**Performance of 90th Percentile**
EMS Paramedic Engine		4:46	-	8:18
EMS Paramedic Ambulance		5:41	-	10:18
Structure Fire Engine 1st-Arriving		-	7:56	13:27
Structure Fire Full-Force		-	10:02	14:02
Vegetation Fire Engine 1st-Arriving		-	5:02	8:34
Vegetation Fire Full-Force		-	8:23	18:21

Note: These times reflect alarm handling, turnout, and, travel-times measured against the CFAI suburban benchmark standard (superior performance). There is no time standard for ambulance or vegetation fires. The District will retain the ten minute (10:00) goal for ambulance. The District will use the seven minute and twenty second (7:20) goal for first arriving vegetation fire engine and twelve minute and twenty second (12:20) goal for full-force vegetation fires.

SECTION VI – PERFORMANCE OBJECTIVES

Performance Objective Summary

Fires: For all fire incidents, the District's goal is to arrive in a timely manner with sufficient resources to stop the escalation of the fire and keep the fire at the area of origin. Initial response resources will be capable of containing the fire, rescuing potential victims, and perform salvage and overhaul operations while providing for the safety of the responders and public. At a minimum, the first-arriving company with a minimum of three (3) personnel will arrive within seven minutes and twenty seconds (7:20) and an effective response force of 19 firefighters will arrive within 12 minutes and twenty seconds (12:20) and be able to implement command and control operations which include establishing a permanent water supply, a back-up team, search and rescue crew, ventilation, fire attack, and a rapid intervention crew (RIC) for a structure fire OR sufficient resources to protect structures, anchor, contain, and extinguish a vegetation fire.

See Maps-8 and 9

EMS: For all emergency medical service (EMS) incidents, the District will arrive in a timely manner with sufficiently trained and equipped personnel to provide advanced emergency medical services that will stabilize the incident, provide basic and advanced care, support to the victim, and reduce, reverse or eliminate the conditions that have caused the emergency. At a minimum, the first-arriving paramedic (fire) company will arrive with a minimum of three (3) personnel within seven minutes (7:00) and an effective response force of at least two additional firefighter-paramedics (ambulance) will arrive within 10 minutes (10:00) and be able to implement timely transportation of patient to an appropriate medical facility in a safe and effective manner.

See Map-8, 10 and 11

Note: Eleven minutes 59 seconds (11:59) timeframe is the Contra Costa County standard for ambulance response within the MOFD Ambulance Exclusive Operating Area (EOA). The District's goal is well below this standard and compliance with the county standard is presently at 92% of the performance goal.

Glossary of Terms

Acceptable Risk	The level of risk that is acknowledged, understood, and accepted by the authority having jurisdiction (AHJ) based on local needs and circumstances. Usually because the cost or difficulty or implementing an effective countermeasure for the associated vulnerability exceeds the expectation of loss.
Adequate	Providing what is needed to meet a given objective without being in excess.
AED	Automatic External Defibrillator. May be used by untrained members of the public, or first responders, such as police officers.
ALS	Advanced Life-Support. Provided by Paramedics with approximately 1,200 hours of training. Includes advanced assessment skills, ECG interpretation, medication administration, advanced airway maneuvers.
Analysis	Examination of a system, its elements, their relationships, and interaction.
ANSI	A non-profit organization founded in 1908 that is focused on promoting and facilitating voluntary consensus standards and conformity assessment systems.
Availability	Also known as “unit availability”. The percentage of time a fire company is available to respond to an incident.
BART	Bay Area Rapid Transit. The Bay Area’s mass transit electric train system. This system bisects the District and includes two tunnels, which are 3.2 miles in length, known as the “Berkeley Hills Tunnels”.
Baseline	The measurement of actual performance in an organizational context. The minimal level of performance as outlined in CFAI (70% of the Benchmark); measured in time. This helps to clearly identify the areas of improvement needed within the organization.
Benchmark	A quality standard or target. Helps to define superior performance. The response time *goal* of the District; measured in time.
BLS	Basic Life-Support. Provided by both EMT-Basics and Paramedics. Includes basic assessment skills, bleeding control, basic airway management, CPR, and use of AED.
CAD	Computer-aided Dispatch. A software program integrated with satellite location devises on each fire company vehicle. The CAD is programed to look for the closest resources and recommend them to the dispatcher based on the call type.
Call	An emergency or non-emergency incident requiring a response from one or more companies.

Capabilities	The ability to successfully deploy trained personnel and resources to perform the response demand.
Capacity	The maximum amount of resources and/or incidents the District can manage with its resources. Under normal operating conditions, the District has the capacity to handle a 1-Alarm fire or three (3) simultaneous medical emergencies.
CCRFCC	Contra Costa Regional Fire Communications Center. The regional fire dispatch center for Contra Costa County, located in Pleasant Hill. This secondary public safety answering point (PSAP) processes calls for seven (7) of the 11 fire agencies within the county.
CFAI	Commission on Fire Accreditation International. Formed in 1996 by the International Association of Fire Chiefs (IAFC) and International City/County Management Organization (ICMA). It is the internationally recognized organization that provides the best-practices framework and methodology to produce a Standards of Cover (SOC) document.
Community Baseline	The current level of District performance
Community Profile	The overall profile of the community based on the unique mixture of demographics, socioeconomic factors, occupancy risk, fire management areas, and the level of services currently provided.
Community Risk Reduction	The identification and prioritization of risks, followed by the integrated application of resources to improve public safety and well-being, which results in decreased call probability and severity of consequences.
Company	A crew of safety personnel: either 3-4 people on an engine or truck; or 2-3 on an ambulance.
Company Officer	The supervisor of the company. Also known as a “Fire Captain”
Concentration	The spacing of assets (usually fire companies) within a specific geographic area. The spacing of multiple resources arranged so that an initial "effective response force" can arrive on scene within the identified service level objective to mobilize and likely stop the escalation of an emergency.
Consequence	A threat, result, impact or outcome of some significance. Life safety (risk to the occupants from life-threatening situations, including both fire and EMS), economic impact (the losses of property, income, or irreplaceable assets), and responder risk (risk to the emergency responders who are called to handle the incident).
CPSE	Center for Public Safety Excellence. The organization that accredits cities, counties, districts and private companies. They also provide professional credentialing for individuals.

Demographics	Relating to the study of changes that occur in large groups of people over a period of time.
Deployment	The strategic assignment and placement of fire agency resources, such as fire companies, fire stations and specific staffing levels for those companies required to mitigate emergencies.
Distribution	Geographic location of all first-due resources for initial intervention. Generally measured from fixed response points, such as fire stations, and expressed as a measure of time. The station locations and resources (staffing and equipment) needed to assure rapid response deployment to minimize and terminate emergencies. Distribution is measured by the percent of the jurisdiction covered in respect to the adopted service level objectives.
District	Moraga-Orinda Fire Protection District
DOC	District Operations Center: MOFD has a DOC located at Station-45, where volunteers and/or senior command officers can coordinate District operations, assets, and public information. Works in coordination with EOC's.
Effective Response Force	The minimum number of personnel necessary to complete the essential tasks required to bring an emergency under control.
Efficiency	Capacity to produce desired results with a minimum expenditure of time, energy, money or materials. Marked by quality.
Effective	Doing things properly to meet a given objective
Engine	A fire apparatus with 3-4 people, 500 gallons of water, hose, and ladders. Also carries paramedic equipment.
EOA	Exclusive Operating Area. The geographic zone that the District operates its emergency ambulances within.
EOC	Emergency Operations Center: staffed by City, Town, and/or County
FPD	Fire Protection District
Fire Flow	The amount of water required to control a fire emergency, which is based on contents and type of materials involved.
First-due Area	The area surrounding a particular fire station that would typically be served by the company from that station if the crew is available; OR the first-arriving company at an incident.
Full-Force	An alarm assignment consisting of multiple companies
GIS	Geographic Information System

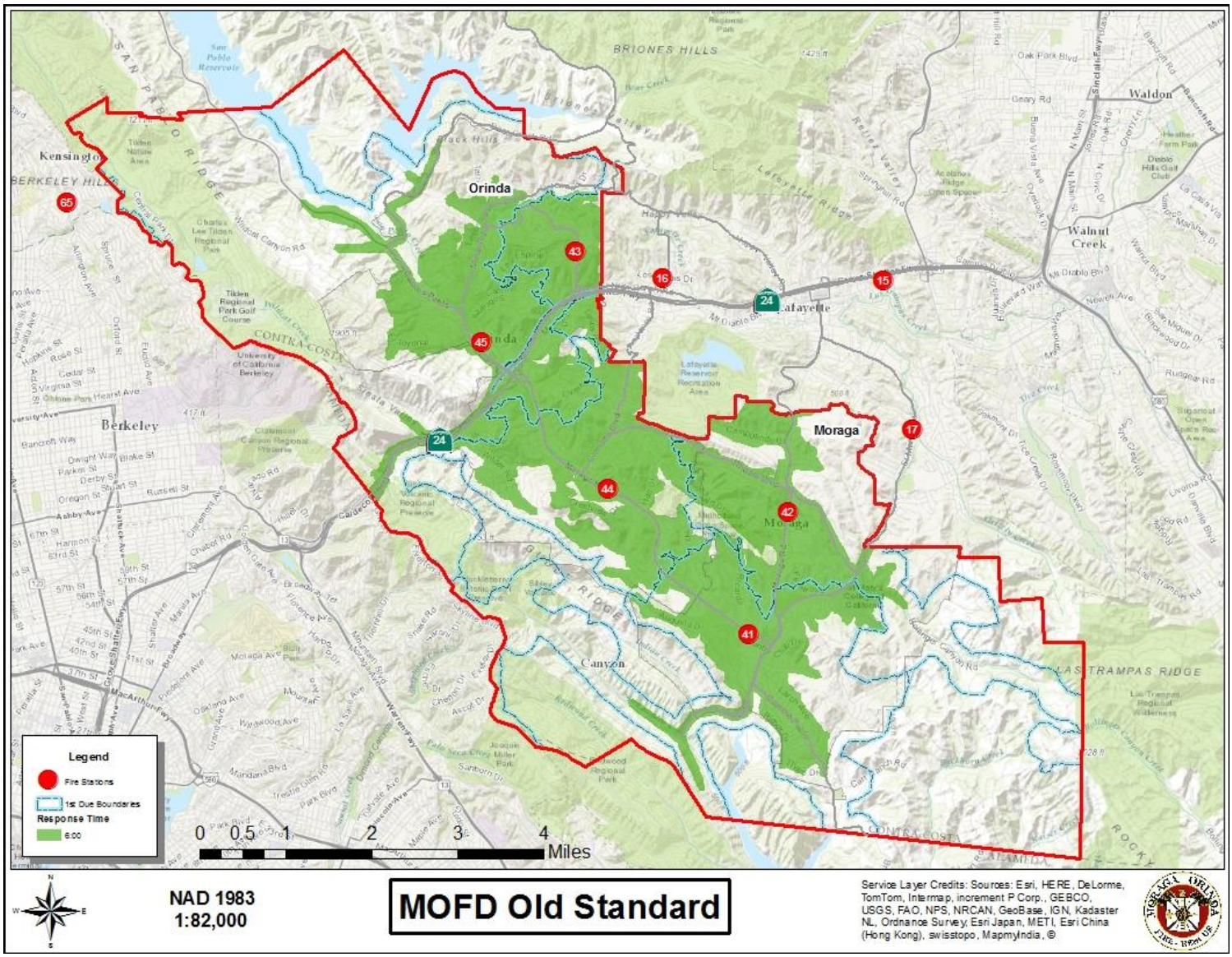
GIS Network	A network of streets (the District) with additional information extracted through added layers to visually represent data such as travel times, response times, etc.
Goal	The term that designates the general end towards which an effort is directed.
Hazard	A condition that presents the potential for harm or damage to people, property or the environment.
IAFC	International Association of Fire Chiefs. Represents the leadership of firefighters and emergency responders worldwide; and are the leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, search and rescue, and public safety policy.
ICMA	International City/County Management Association. Advances professional local government worldwide. The organization's mission is to create excellence in local governance by identifying leading practices to address the needs of local governments and professionals serving communities globally. They provide research, publications, data and information.
Incident Command	A standardized system of command, control, and coordination of emergency response also known as "incident command system" (ICS). The system is now a component of the National Incident Management System (NIMS).
ISO	Insurance Service Organization. ISO is an independent, non-governmental international organization with a membership of 163 national standards bodies. The ISO administers a Public Protection Classification (PPC™) program, which evaluates a community's public fire-protection capability and assigns a protection-class rating from 1 to 10.
Level of Service	The amount and kind of service that the AHJ has determined through an objective, documented, and articulated process appropriate to the needs and circumstances of the community, that takes into account the stakeholders and the ability of the community to adequately fund and deliver the services.
MDT	Mobile Data Terminal. A computer terminal in each District emergency vehicle. Calls can be received on the MDT, which has mapping features and other software platforms.
MOFD	Moraga-Orinda Fire Protection District or "District". An independent Special Fire Protection District, formed in 1997.
NFPA	The National Fire Protection Association. The NFPA is an international, non-profit organization, formed in 1896. It provides standards for a wide variety of fire-related topics. The standards are

	developed by consensus of the 60,000-person membership. Although the standards are not laws, they are referenced as a data source in policy development, best practices, and legal matters.
Occupancy Risk	An assessment of the relative risk to life and property resulting from a fire inherent in a specific occupancy or in a specified occupancy class.
Operator	The person driving the engine or truck. Also known as an "Engineer"
OSHA	The Occupational Safety and Health Administration.
Probability	The likelihood a particular event will occur within a given period of time. An event that occurs daily is highly probable. An event that occurs only once in 30 years is improbable. Probability is an estimate of how often an event will occur.
PSAP	Public Safety Answering Point. "Primary" PSAP's are where all 911 calls in California are directed and must be staffed by a law enforcement agency. If the incident is transferred to a fire agency, they may be a non-PSAP or "Secondary" PSAP.
Quint	A ladder truck that also has a pump and at least 300 gallons of water. Compartment space for rescue equipment and the hose complement may be reduced due to space limitations.
Reliability or Resilience	The organization's ability to quickly recover from an incident or events, or to adjust easily to changing needs or requirements.
Rescue Engine	An engine that also carries vehicle disentanglement equipment (e.g.) Jaws-of-Life and extra rope.
Response Time	The time from the moment the emergency call is received by the dispatch center until the company arrives at the incident or the patient's side (EMS).
Risk	Exposure or chance of injury or loss. The potential for loss as a result of a threat exploiting vulnerability. Therefore, risk is the statistical probability of an event occurring. This cannot be controlled. The sum of Threat + Vulnerability (T + V = R).
Second-due	The second arriving company at an incident
Standards of Cover	Those written policies and procedures that establish the distribution and concentration of fixed and mobile resources of an organization. A document that defines the District's placement of companies (number, type, and location) in relation to the potential demand placed on them by the type of risk and historical need in the community. Uses a specified methodology.
Time-on-Task	The amount of time a company spends unavailable on calls

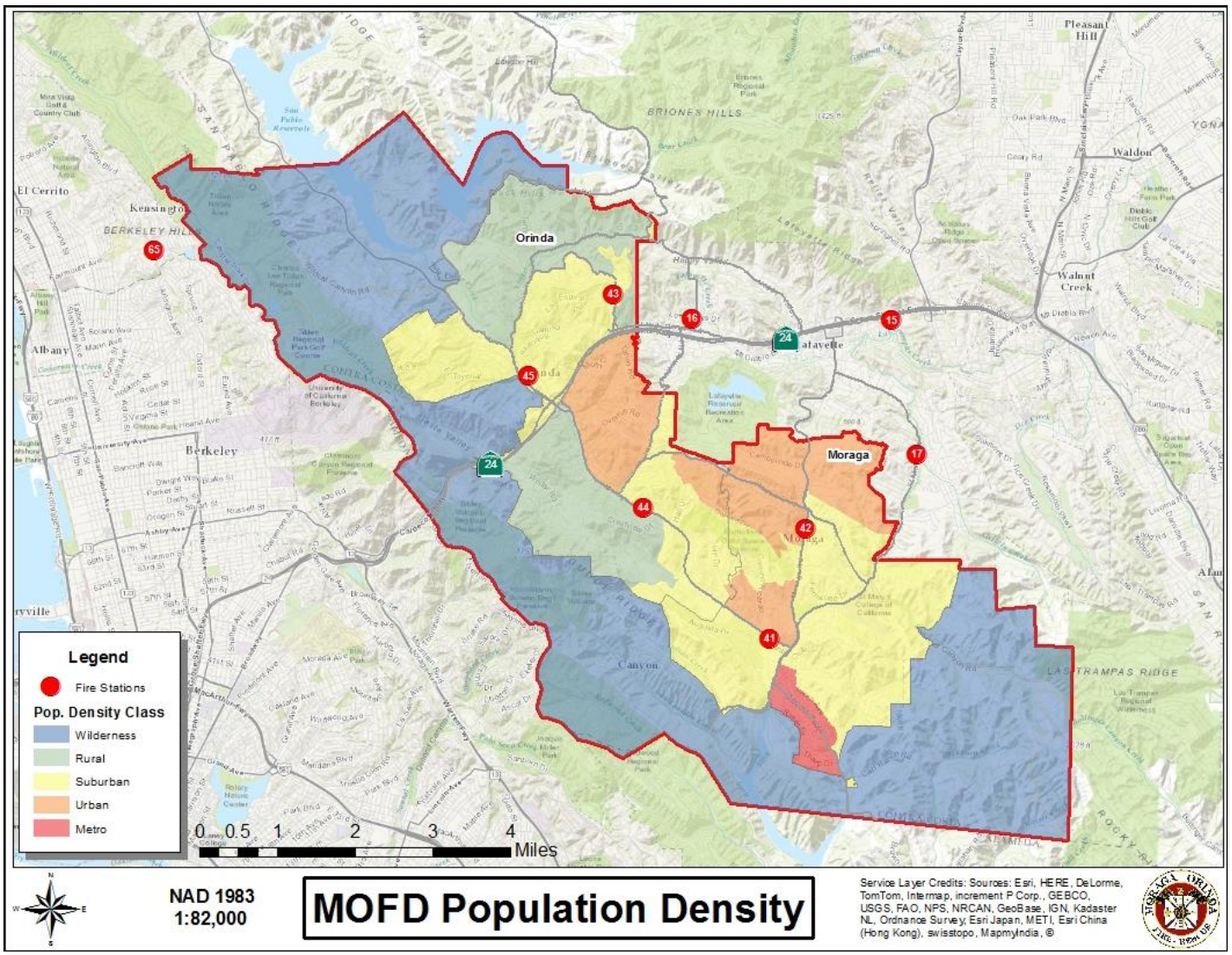
Threat	Anything that can exploit a vulnerability causing damage or destruction. In this case, the physical effects of an earthquake on people, property, and infrastructure.
Total Response Time	The interval from the receipt of the alarm at the agency's PSAP to when the unit arrives on scene (or at the patient's side).
Travel-Time	The time interval that begins when the unit is enroute to the emergency incident and ends when the unit arrives at the scene.
Turnout-Time	The time interval that begins when the crews are notified of the alarm and ends when they have begun their response (wheels moving).
Truck	Also known as a "Ladder Truck". A fire apparatus with 3-4 people, an aerial ladder, additional ground ladders, and rescue equipment.
VHFHSZ	Very High Fire Hazard Severity Zone. State law requires that all local jurisdictions identify VHFHSZ's within their areas of responsibility. Inclusion within these zones is based on vegetation density, slope severity, and other factors that contribute to fire severity. Government Code Sections 51175 – 51182 defines the roles and responsibilities for VHFHSZ adoption. Areas designated by maps are used to identify areas where ignition resistant building standards will be required for new construction, to identify properties requiring defensible space maintenance, and by sellers to disclose natural hazards at the time of property sale.
Vulnerability	A measure of consequence, expressed as the difference between the level of risk and a level of service. A weakness in a system or physical asset. This is the one variable that can be minimized through planning and coordination, hardening of assets, and response capabilities.

MAPS

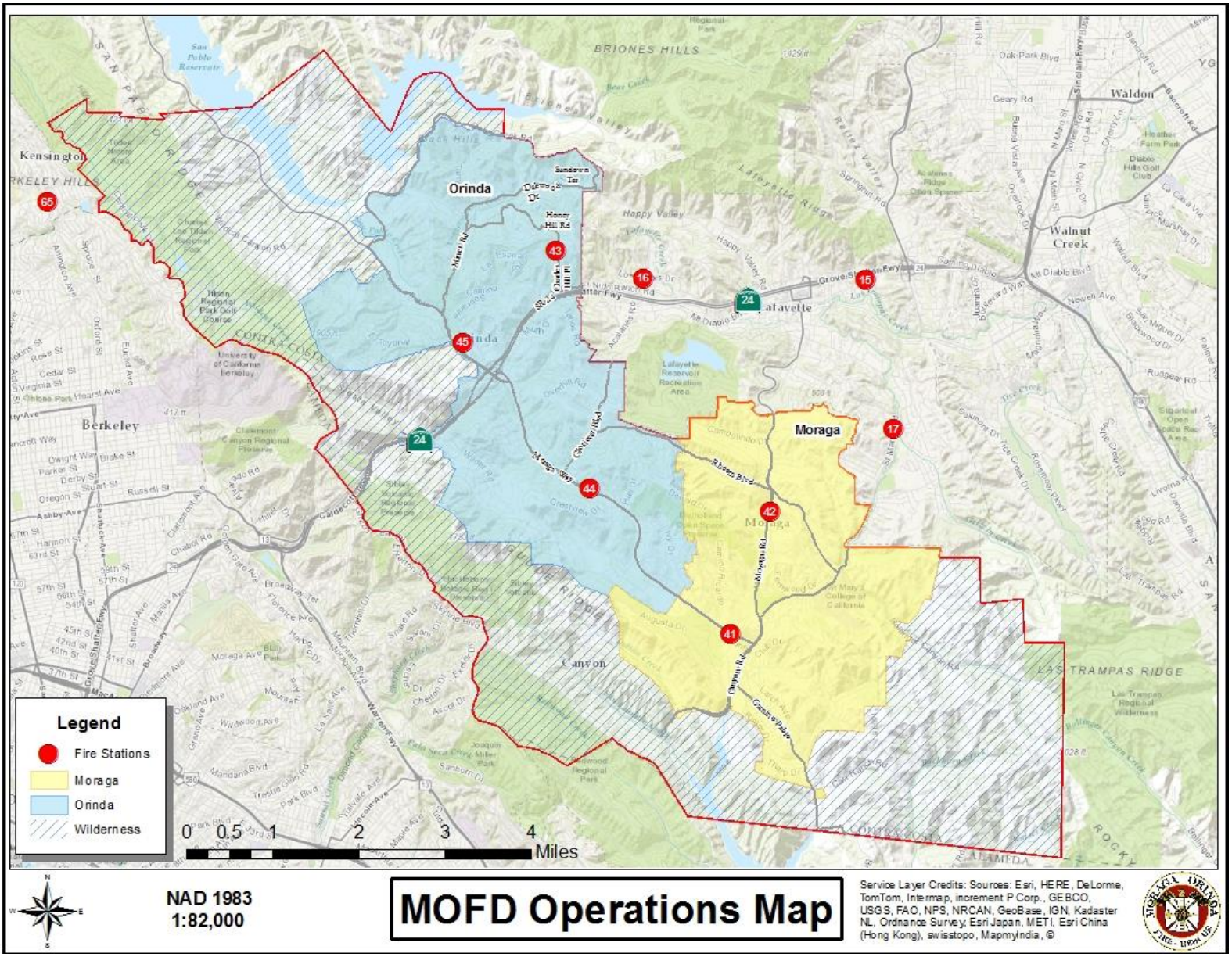
Map-1: 2006 SOC Standard (6:00)



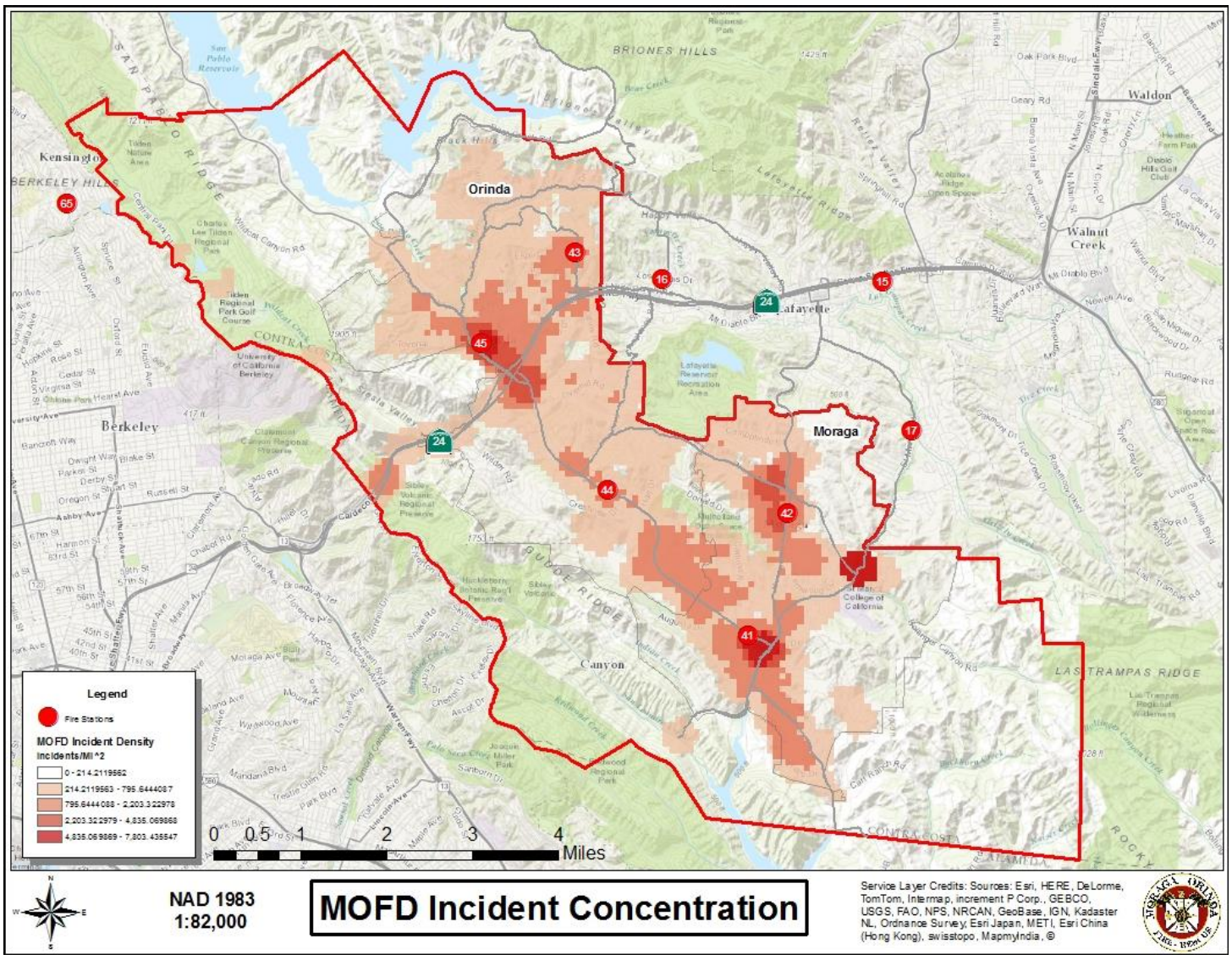
Map-2: Population Density



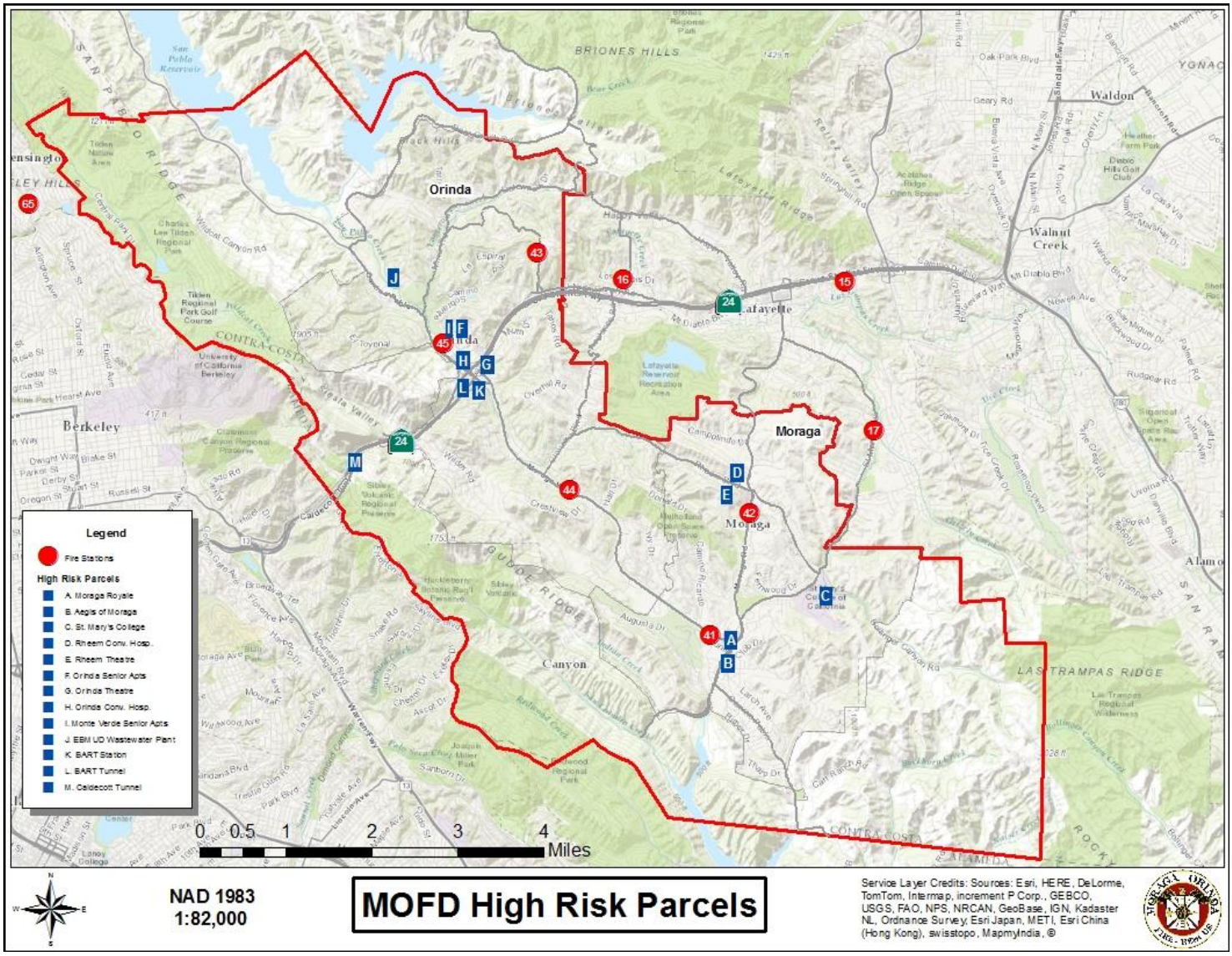
Map-3: Operational Area



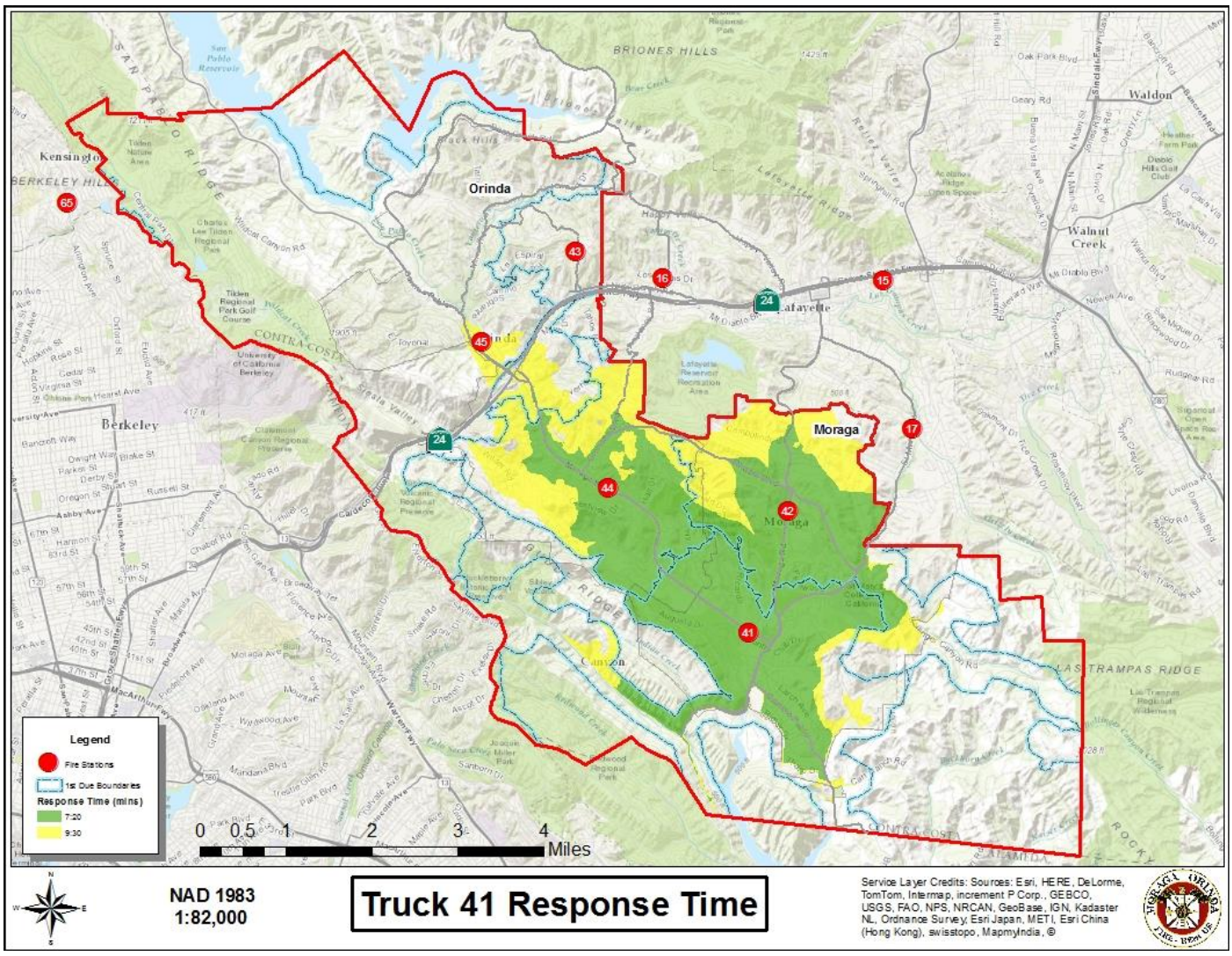
Map-4: Incident Concentrations (2011-15)



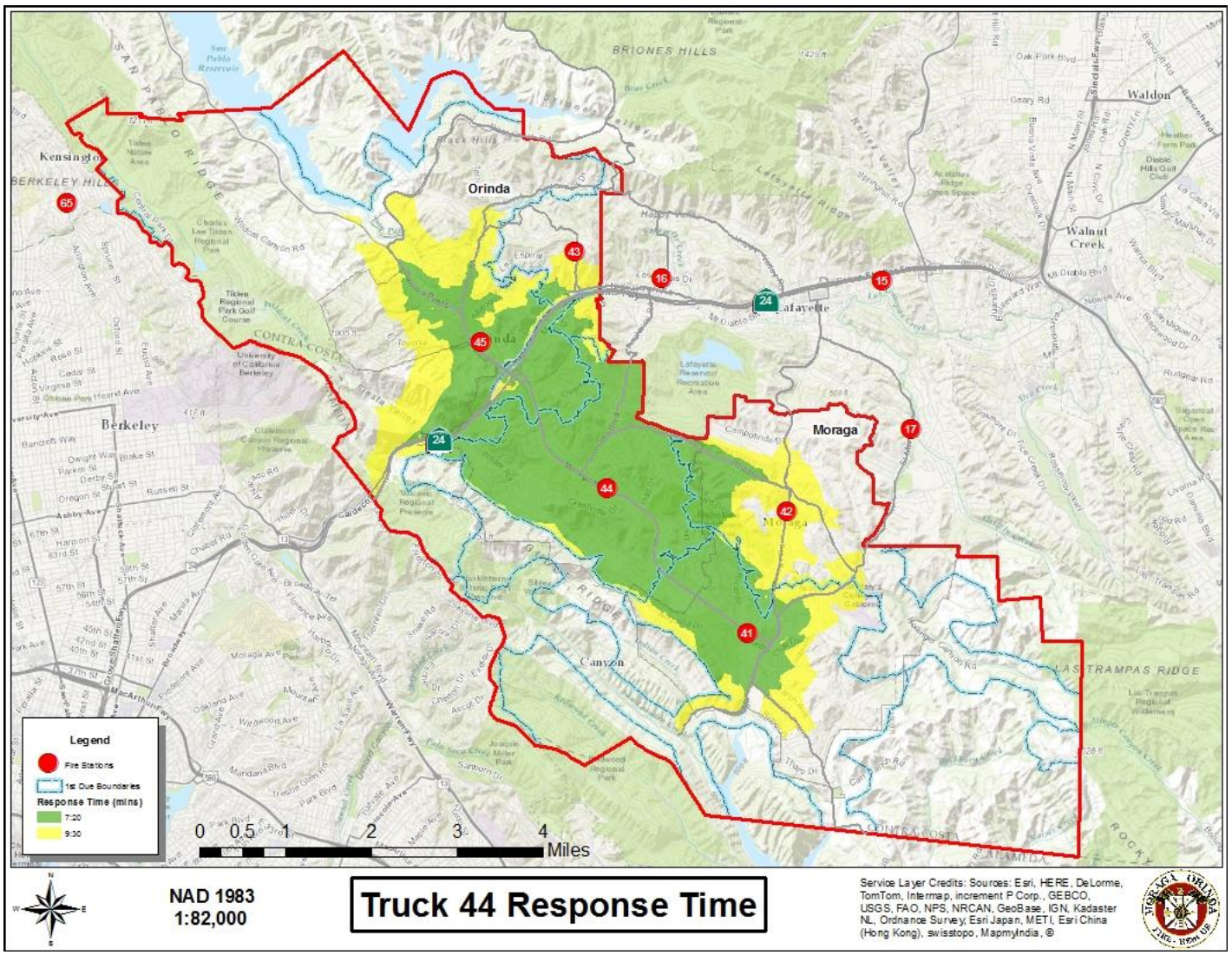
Map-5: High-Risk Parcels



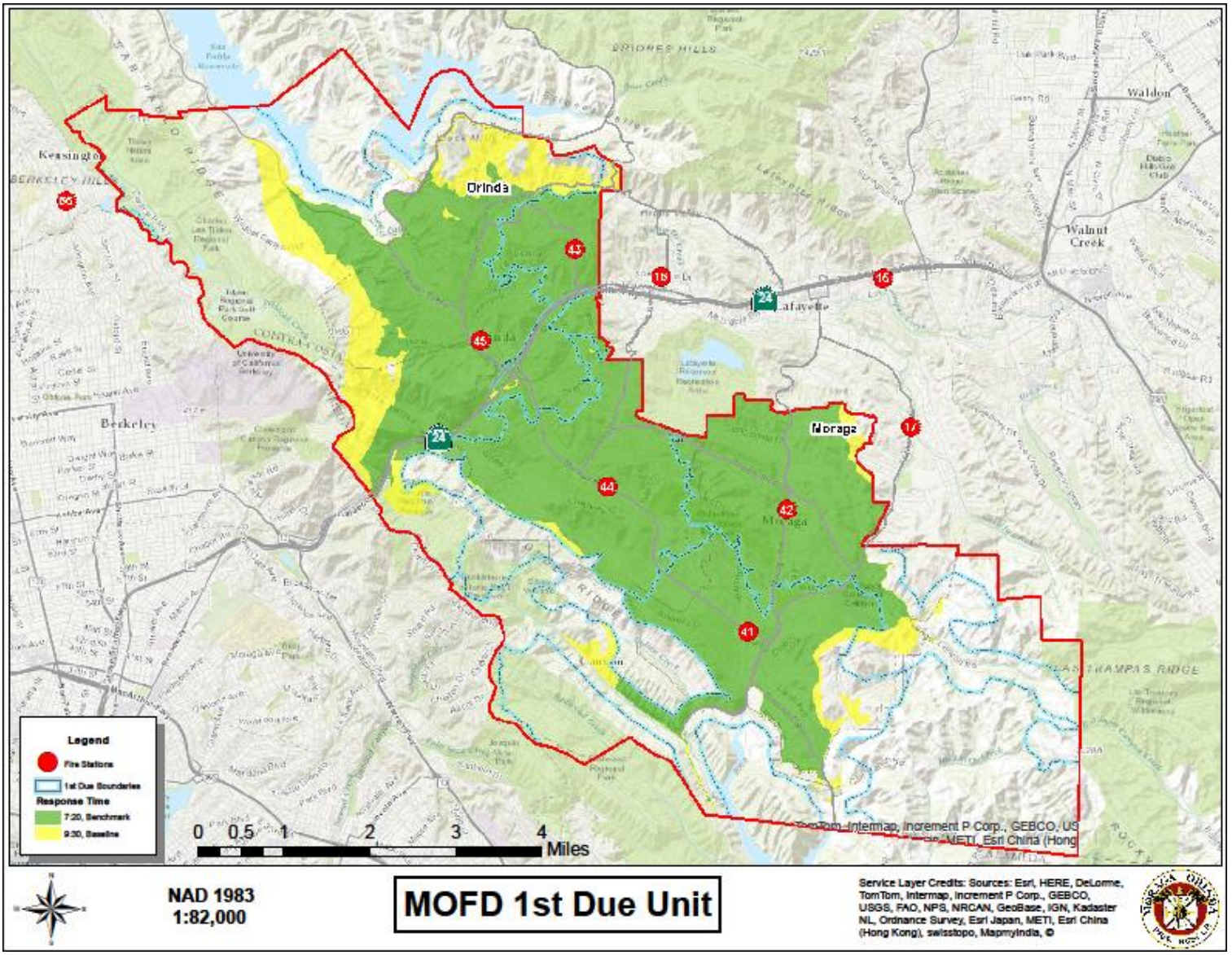
Map-6: Ladder Truck Response Time from Station-41



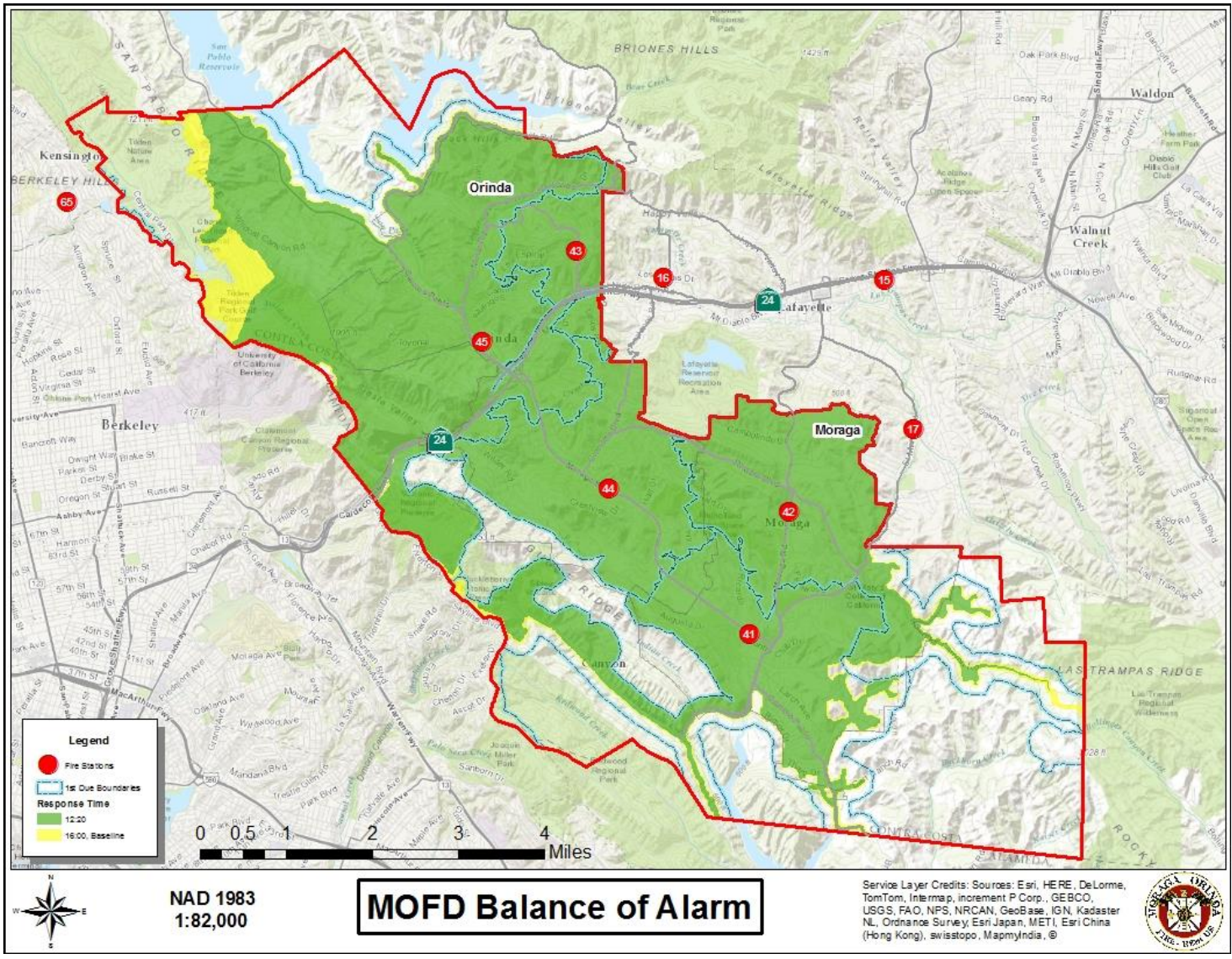
Map-7: Ladder Truck Response Time from Station-44



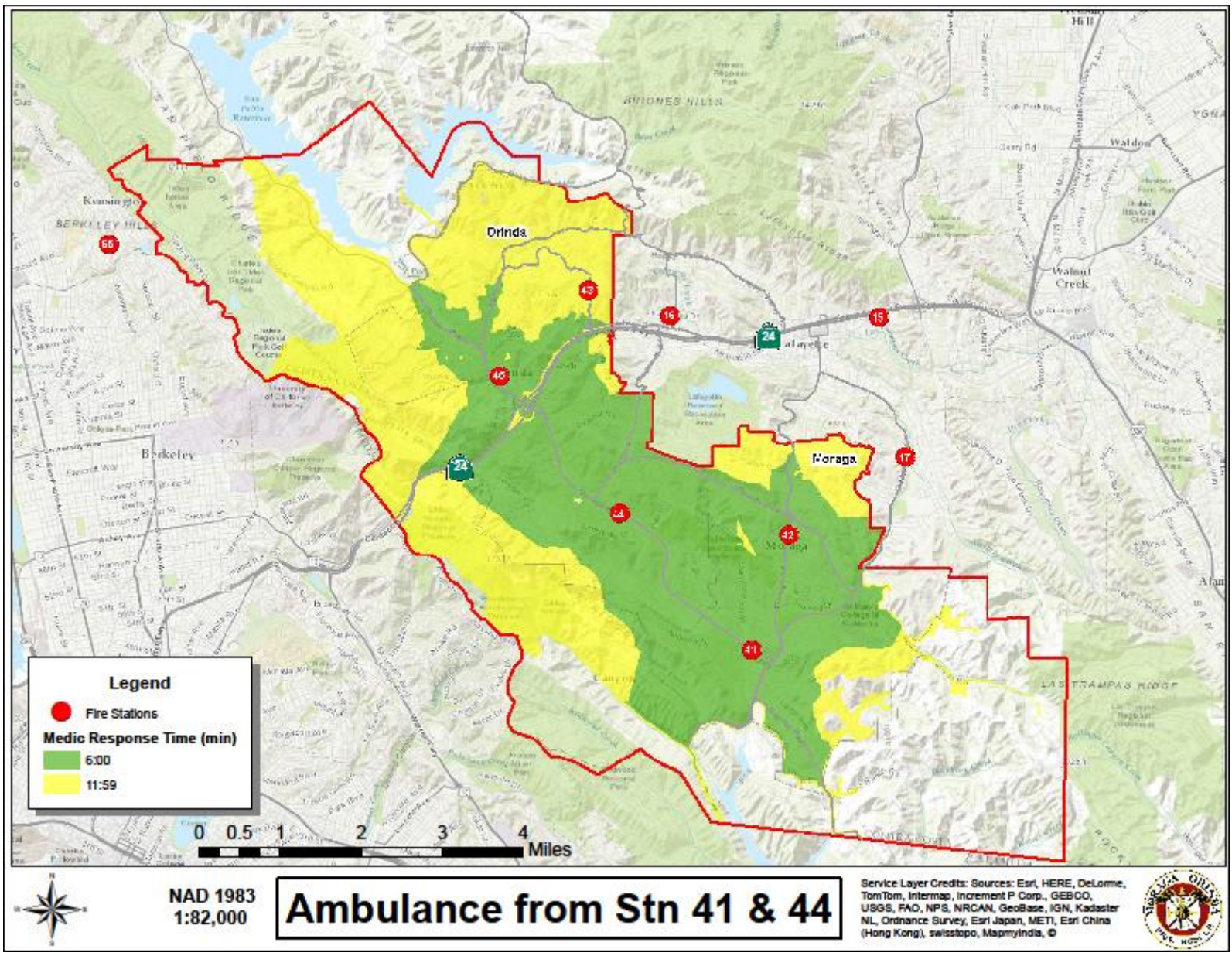
Map-8: First-Arriving Unit Benchmark and Baseline



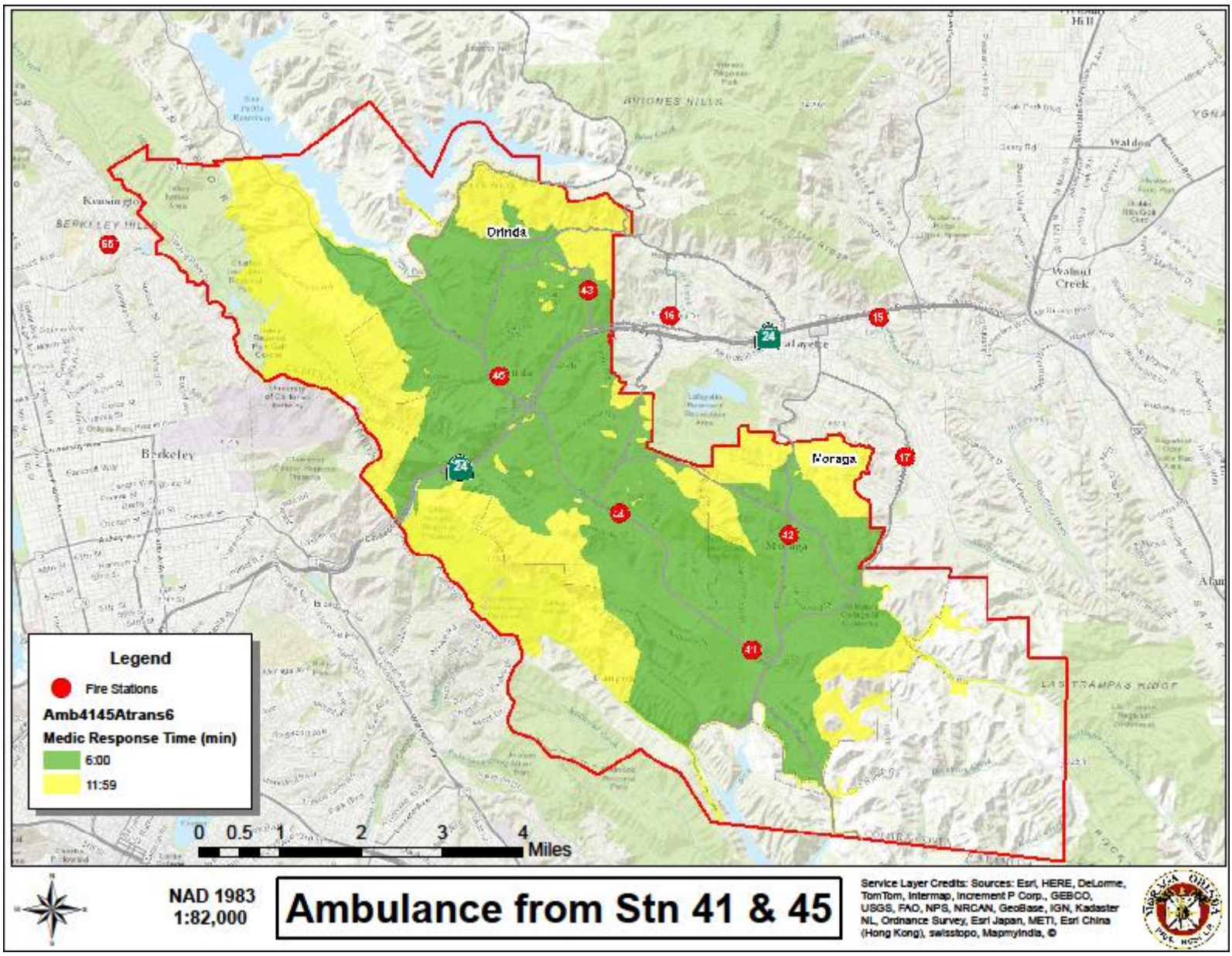
Map-9: Balance of Alarm (Full Force) Unit Benchmark and Baseline



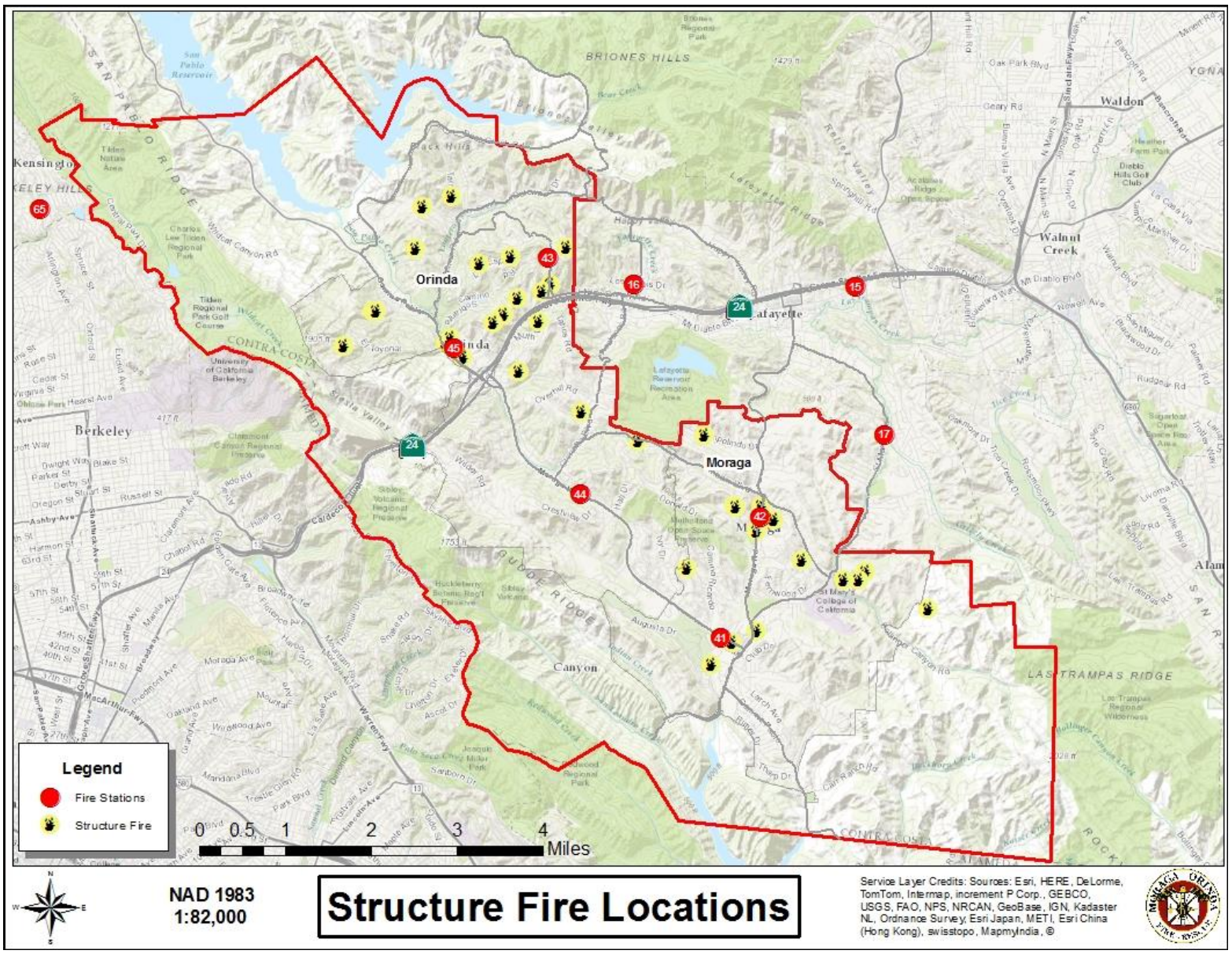
Map-10: Ambulance Response Times from Stations-41 and 44



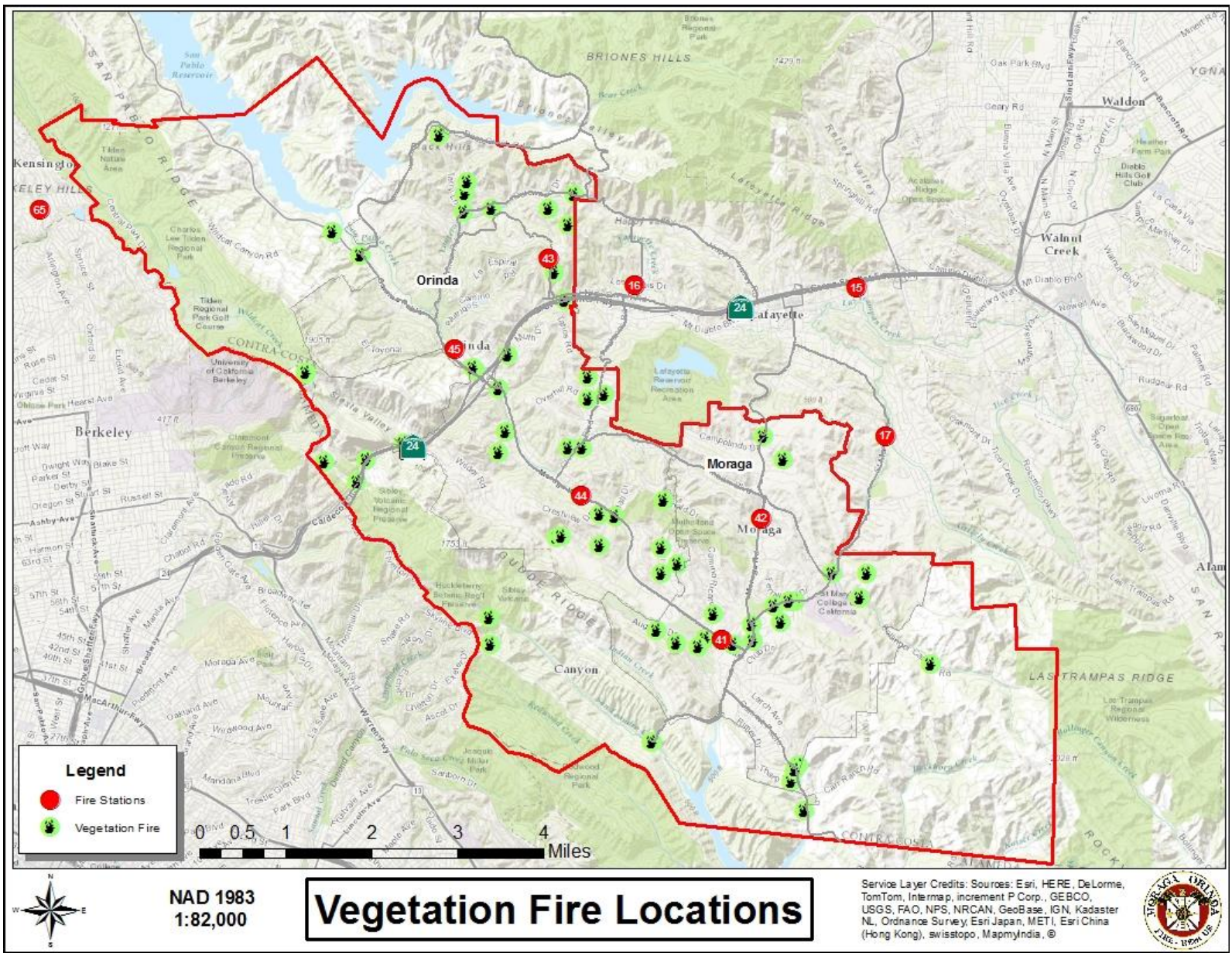
Map-11: Ambulance Response Times from Stations-41 and 45



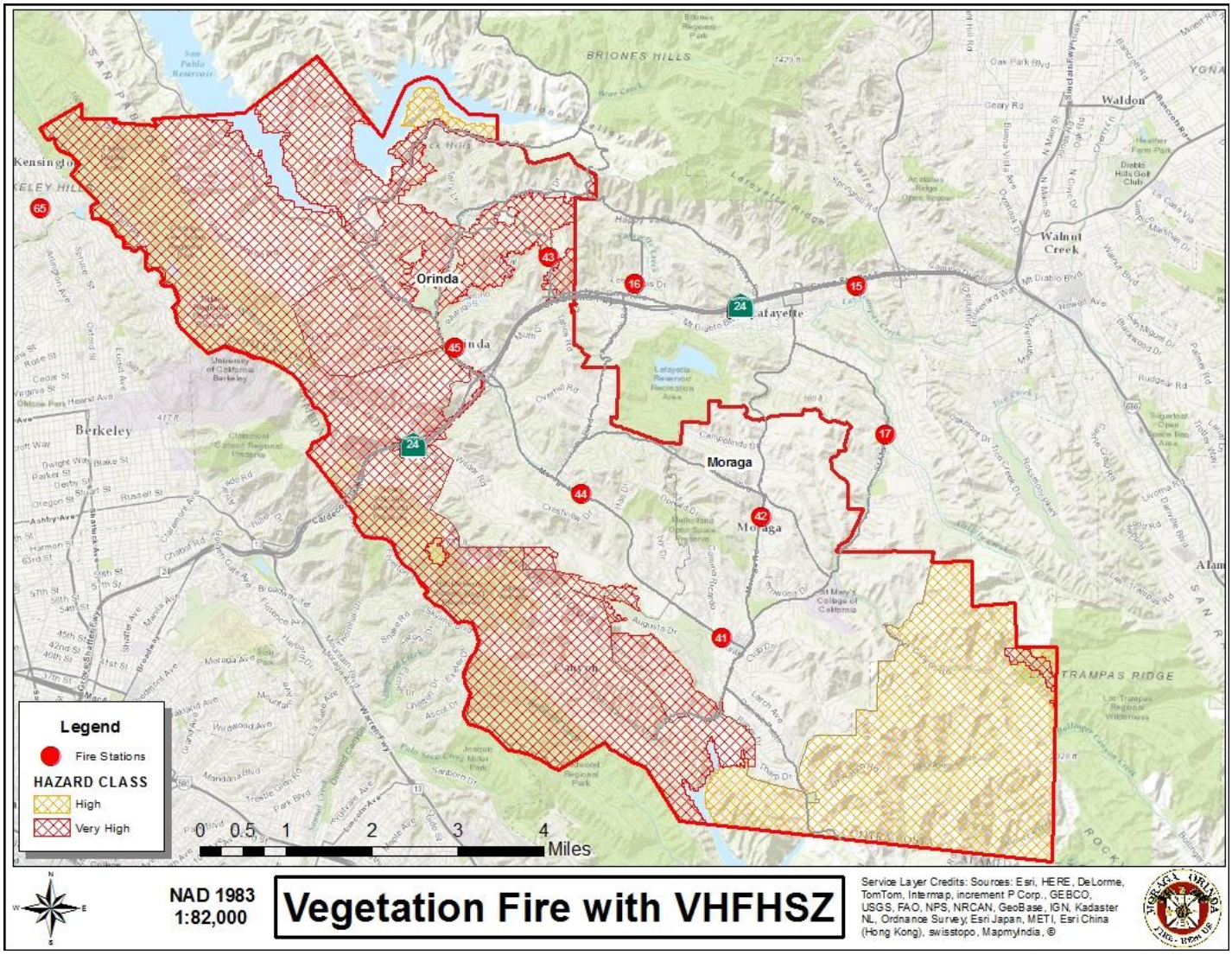
Map-12: Locations of Structure Fires 2011 – 2015



Map-13: Locations of Vegetation Fires 2011 – 2015



Map-14: Location of VHFHSZ within Municipal Boundaries of Moraga & Orinda



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