

SAFETY ELEMENT  
CITY OF HALF MOON BAY GENERAL PLAN

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TABLE OF CONTENTS

I. INTRODUCTION . . . . . 4

    Purpose and Authority. . . . . 5

    Definitions. . . . . 6

    Relationship to Existing General Plan. . . . . 9

    Role of the City . . . . . 10

    Goals and Objectives . . . . . 12

II. INVENTORY OF HAZARDS/EXISTING CONDITIONS . . . . . 13

    Ground Failure/Earthquake. . . . . 14

    Tsunamis and Seiches . . . . . 21

    Inundation from Dam Failure . . . . . 23

    Flood Hazards. . . . . 26

    Soil Stability . . . . . 28

    Fire Hazards . . . . . 32

    Hazardous Materials. . . . . 37

    Airport Safety . . . . . 42

III. GOALS, OBJECTIVES, AND POLICIES. . . . . 44

IV. INFORMATION SOURCES. . . . . 53

Appendix A - Natural Hazards Map  
Appendix B - City Council Resolution C-57-91

LIST OF TABLES

TABLE A	Projected Casualties of an 8.3 Earthquake.	15
TABLE B	Dams in San Mateo County Under State Dam Safety Act	24
TABLE C	Dams in San Mateo County Not Under State Dam Safety Act.	25
TABLE D	Household Substances Classified as Hazardous Materials	38

## I. INTRODUCTION

## PURPOSE AND AUTHORITY

Section 65300 of the California Government Code requires every city and county to adopt a comprehensive, long-term General Plan for the physical development of land under its jurisdiction. The Code requires the General Plan to include several elements, one of which is a Safety Element.

The purpose of the Safety Element is for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence and other geologic hazards known to the legislative body; flooding; and wildland and urban fires. The Safety Element includes mapping of known seismic and other geologic hazards. It also addresses evacuation routes, peakload water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards.

The aim of the Safety Element is to reduce death, injuries, property damage, and the economic and social dislocation resulting from natural hazards including: flooding; mudslides and soil creep; tsunamis and seiches; land subsidence; earthquakes; avalanches; other geologic phenomena; levee or dam failure; certain types of urban and wildland fires; and building collapse.

The Safety Element is the primary vehicle for identifying hazards that the City of Half Moon Bay must consider when making land use decisions. While the Safety Element focuses on identifying fire and geologic hazards, it may also address other locally relevant safety issues such as vehicle accidents, hazardous materials spills, power failure, and storm drainage.

The City of Half Moon Bay has developed the Safety Element in accordance with the California State code in order to sufficiently detail the appropriate policies and programs for the City's planning area. Upon adoption by the City Council, this element will be submitted in accordance with State Code to the California Division of Mines and Geology of the Department of Conservation.

This Safety Element may be amended in accordance with State Law as new, updated, or revised information becomes available.

## DEFINITIONS

The following are definitions of terminology used in this Element:

**ACTIVE FAULT** - A fault that has moved recently and which is likely to move again. For planning purposes, "active fault" is usually defined as one that shows movement within the last 11,000 years.

**AREA OF SPECIAL FLOOD HAZARD** - The land in a flood plain subject to a one percent or greater chance of flooding in any given year; sometimes referred to as the "base flood" or "100-year" flood area.

**COASTAL CLIFF EROSION** - Wearing away of coastal cliffs due to wave action, wind and weathering, and resultant landsliding.

**CRITICAL FACILITY** - Includes facilities housing or serving many people or otherwise posing unusual hazards in case of damage from or malfunction during an earthquake, such as hospitals, fire, police, and emergency service facilities, hotels, restaurants, utility "lifeline" facilities, such as water, electricity, and gas supply, sewage disposal, and communications and transportation facilities.

**DEBRIS FLOW/AVALANCHE** - Landslides involving mixture of rock fragments, gravel, sand, soil, mud, water, and other organic debris such as grass, weeds, and twigs in which flow is the dominant transport mechanism. An extremely high-velocity debris flow landslide is known as a debris avalanche.

**EPICENTER** - A point at the earth's surface that is closest to the subterranean origin of an earthquake.

**EXPANSIVE SOILS** - Soils which tend to expand when wet and shrink when dry due to mineralogical composition.

**FAULT** - A fracture in the earth's crust forming a boundary between rock masses that have shifted.

**FLOODWAY** - The channel of a watercourse plus any adjacent flood plain area that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights.

**GROUND SHAKING** - The temporary acceleration of earth's surface caused by the released earthquake energy which can occur vertically, horizontally or in combination.

**GROUND FAILURE** - A general term for occurrences when seismic activity causes the ground to lose its cohesiveness, as in

liquefaction, subsidence, fault rupture, and earthquake-related landslides.

**HAZARDOUS MATERIAL** - An injurious substance, including pesticides, herbicides, toxic metals and chemicals, liquified natural gas, explosives, volatile chemicals, and nuclear fuels.

**HAZARDOUS BUILDING** - A building that may be hazardous to life in the event of an earthquake because it:

1. Was constructed prior to the adoption and enforcement of local codes requiring earthquake resistant design of buildings;
2. Is constructed of unreinforced masonry; or,
3. Exhibits any one of the following characteristics:
  - Exterior parapets and ornamentation that may fall on passers-by;
  - Exterior walls that are not anchored to the floors, roof, or foundation;
  - Sheeting on roofs or floors incapable of withstanding lateral loads;
  - Large openings in walls that may cause damage from torsional forces; or,
  - Lack of an effective system to resist lateral forces.

**INACTIVE FAULT** - A fault which shows no evidence of movement in recent geologic time and no potential for movement in the relatively near future.

**LANDSLIDE** - A general term denoting downslope movement of slope materials composed of rock, soil, fill or combinations thereof.

**LIQUEFACTION** - The transformation of a saturated granular layer into a fluid state due to intense ground shaking and/or increased pore water pressure.

**LURCHING** - A sudden roll, pitch or sway of the ground resulting directly from the release of seismic energy.

**NON-SEISMIC GEOTECHNICAL HAZARDS** - Geotechnical hazards not triggered by or related to seismic activity, including, but not limited to, landslides, subsidence, expansive soils and coastal shoreline instability.

**POTENTIALLY ACTIVE FAULT** - (1) A fault that last moved within the Quaternary Period before the Holocene Epoch (the last 2,000,000

to 11,000 years); (2) a fault which, because it is judged to be capable of ground rupture or shaking, poses an unacceptable risk for a proposed structure.

**SEICHE** - Oscillating waves in an enclosed or partly enclosed body of water caused by seismic activity or sudden changes in atmospheric conditions.

**SEISMIC ACTIVITY** - Any movement along or in proximity to an active fault that may cause avalanche, ground shaking, ground failure, landslide, liquefaction, lurching, seiche, subsidence, surface rupture, or tsunami.

**SUBSIDENCE** - The gradual, local settling or sinking of the earth's surface with little or no horizontal motion. (Subsidence is usually the result of gas, oil, or water extraction, hydrocompaction, or peat oxidation, and not the result of a landslide or slope failure.)

**SURFACE RUPTURE** - A break in the ground's surface and associated deformation resulting from the movement of a fault.

**TSUNAMI** - A wave, commonly called a tidal wave, caused by an underwater seismic disturbance, such as sudden faulting, landslide, or volcanic activity.

**WILDLAND FIRES** - Fires occurring in a nonurban, natural area which contains uncultivated lands, timber, watershed, brush, or grasslands.

## RELATIONSHIP TO THE EXISTING GENERAL PLAN

Implementation of the Safety Element shall establish goals and policies to further support the land use designations specified in the City of Half Moon Bay General Plan, its Elements, and the Local Coastal Program Land Use Plan and as specified in Coastal Act Sections 30253 (1) and (2) which states that all new development shall:

1. Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
2. Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction or the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

## RELATIONSHIP OF THE SAFETY ELEMENT TO THE MULTI-JURISDICTIONAL LOCAL HAZARD MITIGATION PLAN

The 2021 Multi-jurisdictional Local Hazard Mitigation Plan (MJLHMP), Annex for the City of Half Moon Bay is adopted into the Safety Element by reference, and can be found in its entirety at this link;

<https://www.half-moon-bay.ca.us/153/Long-Range-Planning-General-Plan>

The 2021 MJLHMP, Part B Annex for the City of Half Moon Bay was developed in accordance with the Disaster Mitigation Act of 2000 (DMA 2000) and followed FEMA's Local Hazard Mitigation Plan guidance. The MJLHMP incorporates a process similar to that used for the Safety Element, where hazards are identified and profiled, the people and facilities at risk are analyzed, and mitigation actions are developed to reduce or eliminate hazard risk. The implementation of these mitigation actions, which include both short and long-term strategies, involve planning, policy changes, programs, projects, and other activities.

## ROLE OF THE CITY IN THE ENFORCEMENT OF THE SAFETY ELEMENT

Two primary agencies which respond directly in the event of an emergency are the City Police Department and Half Moon Bay Fire Protection District. The City of Half Moon Bay Police Station is located approximately . mile from City Hall. The nearest Fire Station is located approximately two blocks from City Hall.

In addition to the Half Moon Bay Fire Protection District, the City agencies involved in the development process and the policy implementation as they relate to this Safety Element include the Planning Department, the Public Works Department, the Police Department, and the City Manager's Office. The Planning Department serves as the lead agency in monitoring the implementation of policies at a higher level than the City (i.e. County, State, Federal).

In the event of a natural or technological disaster, the City Police will patrol areas of damage and will instruct citizens of what to do, where aid is available, and specify the appropriate evacuation route. The Police will also notify other services and/or agencies (i.e. fire protection, ambulance, Public Works) as required. The City's Emergency Operation Center, located at the Community Center, will establish communications between local radio stations and Ham operators to inform citizens of the nature and extent of any emergency and advise as to the appropriate actions to be taken.

The following chart indicates the City agencies organization in the event of an emergency:

### COMMAND SECTION

Director of  
Emergency Services  
(City Manager)

Public Information Officer  
(General Services Manager)

### OPERATIONS SECTION

Operations Chief/  
Law Enforcement Branch  
(Police Chief)  
Fire Branch - (Fire Chief)  
Half Moon Bay  
Fire Protection District  
Public Works -  
(Public Works Director)  
Care Shelter -  
(Parks & Recreation  
Director)

### PLANNING SECTION

Situation Analysis (Planner)  
Documentation (City Clerk)  
Damage Assessment Unit  
(Building Inspector)

### LOGISTICS CHIEF

Personnel Unit  
Staff Recreation/  
City Manager's Secretary  
Transportation/  
School Rep  
Care Shelter/  
Recreation Coordinator

### FINANCE SECTION

Financial/Purchasing/Treasurer  
Claims/Public Works Rep

## GOALS AND OBJECTIVES

### Prevention of Serious Injury and Loss of Life

Loss of life and prevention of serious injury is a primary responsibility of local government and should be given highest priority in any public safety program.

### Prevention of Serious Structural Damage to Critical Facilities and Structures Where Large Numbers of People Are Apt To Congregate At One Time

Hospitals, communication facilities, public facilities, and other critical facilities should be designed to function after an earthquake or other natural or technological disaster.

### Insuring the Continuity of Vital Services and Functions

This is one of the most important functions of government simply because there is unlikely to be any other organized source of leadership in a major disaster.

### Education of the Community

This goal is a necessary ingredient to the success of any planning effort. It is a role to be played by school districts, public agencies, business firms, and the Chamber of Commerce.

### Protection of Property

Protection of property and the reduction of adverse economic, environmental, and social conditions resulting from fires and geologic hazards should be anticipated and appropriate actions should be planned.

II. INVENTORY OF HAZARDS/EXISTING  
CONDITIONS

## GROUND FAILURE/EARTHQUAKE

### BACKGROUND

#### Earthquake Potential

A major earthquake (8.3 magnitude) occurring in the City of Half Moon Bay could cause a great many casualties, extensive property damage, fires, flooding, and other ensuing hazards. The effects could be aggravated by aftershocks and by the secondary effects of fire, landslides, and dam failure. The time of day and season of the year would also have a profound effect on the potential number of injuries and the amount of damage sustained. Damage control and disaster relief support would be required from other local governmental and private organizations, and from the state and federal governments.

Extensive search and rescue operations may be required to assist trapped or injured persons. Emergency medical care, food and temporary shelter would be required by injured or displaced persons. Identification and burial of many dead persons would pose difficult problems; public health would be a major concern. Evacuations may be essential to save lives, particularly in dam inundation areas. Many families would be separated, particularly if the earthquake should occur during working hours, and a personal inquiry or locator system would be essential to maintain morale. Emergency operations could be seriously hampered by the loss of communications and damage to transportation routes within, and to and from, the disaster area and by the disruption of public utilities and services.

Extensive federal assistance could be required and could continue for an extended period. These efforts would be required to remove debris and clear roadways, demolish unsafe structures, assist in reestablishing public services and utilities, and provide continuing care and welfare for the affected population, including temporary housing for displaced persons.

The San Andreas Fault, which traverses the San Francisco Peninsula, enters San Mateo County on the Pacific Coast near Daly City and exits the county just southwest of Palo Alto (see Natural Hazards Map). Analysis of earthquake disaster and preparedness in San Mateo County has been based on a 8.3 magnitude earthquake as a reasonable worst-case event within the County. The ground shaking of an 8.3 magnitude earthquake on the northern San Andreas Fault would result in serious damage in San Mateo County.

There is a 23 percent chance of a magnitude 7 earthquake occurring on the Peninsular segment of the San Andreas Fault within the next 30 years, and there is a 67 percent chance for one or more large earthquakes occurring in the San Francisco Bay Area for the same time period. The San Gregorio Fault which is closer to Half Moon Bay, is active and an earthquake on this fault could result in damage similar to that of one on the larger San Andreas Fault.

## Casualties

The following information obtained from the San Mateo Operational Area Office of Emergency Services provides detailed estimates of possible earthquake losses in all of San Mateo County based on an 8.3 magnitude earthquake.

Since studies only predicted the total number of deaths and hospitalized injuries, (exclusive of dam failures) for the entire San Francisco Bay Area, it is assumed that a proportionate number of casualties will be generated in San Mateo County. The total number of casualties projected in the event of an 8.3 magnitude earthquake occurring at 4:30 p.m. (the time when the Bay Area rush hour traffic starts and many people are on the roads) are shown in Table B. San Mateo County has an estimated population of 649,623 (1990 Census). An estimate of total deaths in Half Moon Bay out of the 1990 population of 8,886 is also shown in Table A.

TABLE A  
PROJECTED CAUSALITIES OF AN 8.3 EARTHQUAKE

Schools	DEATHS			HOSPITALIZED INJURIES <sup>1</sup>			
	Hospi- tals	Other Sources	Total	Schools	Hospi- tals	Other Sources	Total
San Mateo Co.							
200	1,450	9,720	11,370	600	4,400	39,340	44,340
Half Moon Bay							
3	0 <sup>2</sup>	133	136	8	02	538	546

Source: San Mateo County

<sup>1</sup> The ratio of non-hospitalized injuries to deaths is 30:1.

<sup>2</sup> There are no hospitals in the City of Half Moon Bay.

### Long-Term Homeless

There could be approximately 9,600 long-term homeless persons.

### Lower Crystal Springs Dam Failure

A failure of the Lower Crystal Springs Dam could result in the following:

	Day	Night
Persons Exposed	67,000	63,000
Maximum Potential Deaths	33,000	34,000
Probable Potential Deaths	22,000	28,000

## Damage to Vital Public Services, Systems and Facilities

### HIGHWAYS

(\*Roads marked with an asterisk would directly affect the City of Half Moon Bay. All other roads listed would have secondary impacts.

#### U.S. 101

U.S. 101 would be closed for a major portion of the distance from Menlo Park to Candlestick Park and would not be opened within 72 hours. South of Candlestick Park to San Bruno, major land slips or movements would be distinctly possible in heavy ground motion, and major stretches of this freeway could be under water or badly damaged due to soil movements. Access to the San Francisco International Airport would be shut off and could be reestablished in approximately 48 hours via Route 82.

#### \* Route 1

The Devil's Slide area and at the San Andreas Fault crossing near the intersection of Skyline Boulevard, would be closed even with moderate groundshaking. Landslides along the coast to the south would close the remainder of the route for at least 72 hours.

#### Route 82 (El Camino Real)

Open with many major detours and delays to avoid collapsed buildings and bridges. Most of the post-earthquake traffic would be on El Camino Real. Damaged and/or destroyed culverts crossing underneath the roadbed may necessitate local traffic diversions.

#### \* Route 92

Closed from Half Moon Bay to Route 280 due to slides and faulting and would not be opened within 72 hours.

#### Route 35

Closed and would not be opened within 72 hours. The northerly portion crosses the San Andreas Fault near King Drive (Daly City); landslide potential south of Route 84. Extensive damage due to fault rupture will occur throughout the northern portion of this route.

#### Interstate 280

Closed for less than 36 hours. Closed at Route 92 by a bridge collapse. A detour can be made around this area in eight hours. Significant landslide hazard. Although this route will be unaffected by fault rupture, its proximity to the fault may subject it to other effects that are not predictable.

#### Interstate 380

Closed at U.S. 101; but open from Route 280 to Route 82. Low liquefaction potential. Detours can be made available around the affected interchanges.

#### Interstate 380/U.S. 101 Interchange

It will not be possible to clear the damage within 72 hours.

In the event of a major earthquake, Highway 1 and Highway 92, which are the only direct roads into the City of Half Moon Bay, may both be inaccessible. Emergency services would have to be brought in by helicopter or boat. If Highway 1 is accessible to the south of the City of Half Moon Bay, it may be possible to take Highway 84 which connects with other major roadways.

### AIRPORTS

#### San Francisco International Airport (SFO)

Closed for over 72 hours; perhaps several weeks. Practical land access will not exist due to freeway and highway damage which will effectively isolate the airport and nearby facilities.

#### Half Moon Bay Airport

No significant damage is anticipated that would effect operations at the Half Moon Bay Airport.

### RAILROADS

The Southern Pacific Railroad crossing between Fremont and Redwood City will be closed. Commuter line will be closed.

### MARINE FACILITIES

No significant damage is expected at the Pillar Point Harbor.

Marine facilities at Redwood Creek will be closed.

### COMMUNICATIONS

#### Telephone Systems

Telephone communications will be adversely affected due to overloading resulting from post-earthquake calls within the area and from the outside, and many instruments will be off their hooks. This situation will be further complicated by physical damage to equipment due to ground shaking, loss of service due to loss of electrical power, and subsequent failure of some auxiliary power sources.

Countywide key system facilities are located near the San Andreas Fault within the County areas projected to experience intense ground shaking. It is likely that the telephone systems in and to the south of San Francisco will have systemic failures not readily bypassed by

alternative traffic routing. It is also probable that the recovery effort will be delayed because many telephone company employees will have difficulty getting access to damaged areas to accomplish repairs.

### Radio Systems

Radio systems will generally operate at 40 percent effectiveness for the first 12 hours after the earthquake, increase to 50 percent for the second 12 hours, then begin a slow decline to approximately 40 percent within 36 hours. The long-term implications are that individual systems gradually will become less useful to the overall recovery effort when supplanted by systems relocated from outside the disaster area. It is unlikely that public safety radio systems would become saturated with noncritical communications from mobile units. Radio traffic densities on redundant (nonemergency designated) channels would increase, particularly when remote base station and repeater failures would tend to limit the number of redundant channels available. After 12 hours, at which time the number of operable units will have declined (because of exhaustion of emergency power fuel) and because recovery efforts will have restored some order, the radio traffic density problems will ease.

### Commercial Broadcasters

All radio and television facilities are anticipated to be out of operation in San Mateo County for 24 hours due to in-house problems and/or power supply problems, and/or transmission line problems. Elsewhere in the San Francisco Bay Area, 1/3 of the facilities are also expected to be out of service for 24 hours. After 24 hours, 50 percent of the entire San Francisco Bay Area facilities are expected to be in operation.

### WATER SUPPLY AND WASTE DISPOSAL

Several of the major aqueducts will sustain damage, causing temporary interruptions in water supply. The numerous major reservoirs in the area provide ample storage to meet demands during the time required for repairs. Damage to water transmission lines, local storage reservoirs, and pumping plants, as well as local distribution system, will affect water availability and pressure. The absence of electrical power for the extended periods will, in some areas, preclude water deliveries where pumping is necessary. Many areas could be dependent on tanker truck to provide their basic needs.

Sewage collection systems will sustain widespread damage. Many sewage treatment facilities also located in structurally poor ground adjacent to the San Francisco Bay will be damaged and will experience electrical power losses, resulting in discharge of raw sewage into the San Francisco Bay.

### San Andreas Water Treatment Plant

Inoperable for more than 72 hours. This plant is vulnerable because of its proximity to the surface rupture and its total dependence on

commercial electric power. The plant can be bypassed without significant impact to the water supply system.

### ELECTRIC POWER

Damage to power plants and their ancillary facilities in affected areas can be expected to reduce generating capacity. The potential impact of this reduction in local output is lessened by the availability of power from other sources outside the affected area and by the obvious significant reduction in consumer demand that will occur. Immediate concerns will focus on repairs necessary to restore power to areas of greatest need.

During some portion of the first 72-hour period following a major earthquake, most areas would experience some temporary loss of power. All critical facilities will require standby generating equipment and emergency fuel supplies.

### NATURAL GAS

Damage to natural gas facilities will consist primarily of (a) some isolated breaks in the major transmission lines and (b) innumerable breaks in mains and individual service connections within the distribution systems, particularly in the areas of intense ground shaking and/or poor ground nearer the San Francisco Bay. These many leaks in the distribution system will affect a major portion of the urban areas on the San Francisco Peninsula, resulting in a loss of service for extended periods. Sporadically distributed fires should be expected at the sites of a small percentage of ruptures both in the transmission lines and the distribution system.

Transmission pipelines serving the San Francisco Peninsula are most vulnerable to damage.

### San Andreas Fault

Rupture of pipelines will occur due to ground failure along the San Andreas Fault zone between San Andreas Lake and Route 1. Pipeline rupture will also occur near Upper Crystal Springs Reservoir (between San Mateo Creek and four kilometers southeast of the junction of Interstate 280 and Route 92) due to landslides.

### POLICIES

1. Continue to adopt updated editions of the Uniform Building Code, published by the International Congress of Building Officials.
2. Continue enforcement of Ordinance No. 13-89 establishing a seismic hazard identification program for unreinforced masonry buildings.

3. Continue ensuring that other appropriate State regulations regarding the identification and mitigation of seismic hazards are implemented.
4. Continue to require that adequate soils, geologic, and structural evaluation reports are prepared when deemed appropriate by the Building Official. All reports submitted to the City for review shall be prepared by registered soils engineers, engineering geologists, and/or structural engineers.
5. Require that measures identified in any soils, geologic geotechnic, and/or any structural reports to adequately mitigate liquefaction be imposed as conditions of project approval.
6. Promote and encourage additional seismic investigations within the City by Federal, State, and local agencies and organizations.
7. The City Grading Ordinance should specifically address identified areas with seismic hazards.
8. Geologic reports, building plans, and environmental impact reports prepared for major construction projects (i.e., all critical facilities or uses with large human occupancies in recognized or suspected hazard areas) shall be prepared by registered engineering geologists and structural engineers and review by the City Engineer.
9. Land use designations should be appropriate in areas that are subject to and/or have the potential to be subject to seismic hazards and shall be consistent with Title 18 of the Half Moon Bay Municipal Code (Zoning Ordinance).
10. In the event of a major earthquake the City shall be prepared to implement procedures in accordance with the Half Moon Bay Multi-Hazard Functional Plan and in accordance with procedures established by the San Mateo Operational Area Office of Emergency Services.
11. The City of Half Moon Bay should actively promote an educational program regarding seismic safety.

## TSUNAMIS AND SEICHES

### BACKGROUND

The phenomenon called "tsunami" is a series of traveling ocean waves of extremely long length, generated by undersea earthquakes, volcanic eruptions, or massive landslides into adjacent bodies of water. As a tsunami crosses the deep ocean its length from crest to crest may be a hundred miles or more and its height from trough to crest only a few feet. In deep water, tsunamis may reach forward speeds of 600 miles per hour. As the tsunami enters shallow waters, such as along the coast, its speed decreases but the wave height increases. It is in these shallow waters that tsunamis become a threat to life and property. Following the arrival of the first wave subsequent waves may increase in height and arrive minutes to hours later.

Although there are no known recorded deaths from tsunami action in San Mateo County, it is probable that there was wave impact in 1946, 1960, and again in 1964. In 1946 an earthquake in the Aleutian Islands generated a tsunami that caused one death in Santa Cruz County. The resultant tsunami from the Alaskan earthquake of 1964 caused eleven deaths in Crescent City, just south of the Oregon border. The United States Geological Survey (USGS) has produced a map delineating areas subject to tsunami inundation based on a 20 foot runup along coastal areas and also at the Golden Gate Bridge. Such a runup is estimated to occur an average of once every 200 years. The areas of the County which would be most heavily damaged by a tsunami are those along the Pacific Coast: Point Ano Nuevo, Pescadero Creek and San Gregorio Creek estuaries, and portions of Half Moon Bay, Miramar, and El Granada. Within the City of Pacifica, affected areas would include: San Pedro Valley, Rockaway Beach, Linda Mar and Laguna Salada. The degree of damage experienced by these areas would depend on the local sea bottom and coastal topographic characteristics as well as the incoming direction of the tsunami. (See Natural Hazards Map)

Seiches are oscillating waves in an enclosed or partly-enclosed body of water caused by earthquakes or landslides which displace part of the water body. Four water bodies in San Mateo County are believed to be large enough to pose significant seiche potential: Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, San Andreas Lake, Pilarcitos Lake, and San Francisco Bay. If an earthquake similar in magnitude to the 1906 earthquake were to occur at a time when these water bodies were at the high water mark, seiches could overtop the spillways of these water bodies by several feet causing large scale inundation downstream.

## POLICIES

1. Encourage the San Mateo Area Office of Emergency Services to develop and maintain a Tsunami Warning Plan to alert affected governmental agencies and beachside residents and businesses. This plan should be coordinated with local television and radio media.
2. New critical facilities should not be located in areas with the potential to be adversely affected by tsunamis and/or seiches. If a critical facility must be located in a tsunami hazard zone, "tsunami-proof" design and construction principles should be incorporated so that it can resist tsunami damage and facilitate evacuation on short notice.

## INUNDATION FROM DAM FAILURE

### BACKGROUND

Dam failures can result from a number of natural or manmade causes such as earthquakes (ground rupture or severe groundshaking), erosion of the face or foundation, landsliding which displaces a large volume of water, rapidly rising flood waters, and structural/design flaws.

There are three general types of dams: earth and rockfill, concrete arch or hydraulic fill, and concrete gravity. Each of these types of dams has different failure characteristics. The earth-rockfill dam will fail gradually due to erosion of the breach; a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete arch or hydraulic fill dam will fail almost instantaneously; thus a very rapid build-up to a peak wave and then a gradual decline. A concrete gravity dam will fail somewhere in between instantaneous and gradual, with corresponding build-up of flood wave.

In addition to the above mentioned characteristics, warning ability is generally determined by the frequency of inspections for structural integrity, the flood wave arrival time (the time it takes for the flood wave to reach its maximum distance of inundation), or the ability to notify persons downstream and their ability to evacuate. The existence and frequency of updating and exercising an evacuation plan that is site-specific assists in warning and evacuation functions.

A dam failure will cause loss of life, damage to property, and other ensuing hazards, as well as the displacement of persons residing in the inundation path. Damage to electric generating facilities and transmission lines could also impact life support systems in communities outside the immediate hazard areas.

A catastrophic dam failure, depending on size of dam and population downstream, could exceed the response capability of local communities. Damage control and disaster relief support would be required from other local governmental and private organizations and from the state and federal governments.

Mass evacuation of the inundation areas would be essential to save lives, if warning time should permit. Extensive search and rescue operations may be required to assist trapped or injured persons. Emergency medical care, food, and temporary shelter would be required for injured or displaced persons. Identification and burial of many dead persons would pose difficult problems; public health would be a major concern. Many families would be separated, particularly if the failure should occur during working hours, and a person inquiry or locator system would be essential. These and other emergency operations could be seriously hampered by the loss of communications, damage

to transportation routes, and the disruption of public utilities and other essential services. Governmental assistance could be required and may continue for an extended period. These efforts would be required to remove debris and clear roadways, demolish unsafe structures, assist in reestablishing public services and utilities, and provide continuing care and welfare for the affected population including, as required, temporary housing for displaced persons.

There are thirteen dams in all of San Mateo County that are large enough to endanger lives and property in the event of a failure. Eleven of these dams are large enough and in locations such that a failure would endanger a sizeable population. The flood plain that would result from catastrophic failure of each of these eleven dams has been mapped by the owner of each dam (the maps are on file with the San Mateo Operational Area Office of Emergency Services).

TABLE B  
DAMS IN SAN MATEO COUNTY UNDER STATE DAM SAFETY ACT

DAM AFFECTED	OWNER	HEIGHT (FEET)	CAPACITY (ACRE- FEET)	POPULATION
Bear Gulch	California Water Service	61	672	1,000
Burlingame	Town of Hillsborough	87	91	2,800
Crocker	Town of Hillsborough	45	34	2,800
Crystal Springs	San Francisco Water Dpt.	140	54,000	70,000
Emerald Lake	Emerald Lake Country Club	57	87	7,500
Felt Lake	Stanford University	67	900	8,000
Johnston*	Half Moon Bay Properties	27	30	100
Laurel	City of San Mateo	40	55	750
Notre Dame	College of Notre Dame	51	120	500
Pilarcitos*	San Francisco Water Dpt	103	3,100	300
Pickney/West	Allen & Co. et al	64	47	100
San Andreas	San Francisco Water Dpt	107	18,500	70,000
Searsville	Stanford University	68	952	14,000

Source: San Mateo Area Office of Emergency Services

\*The dams marked above with an asterisk would be of prime concern to the City of Half Moon Bay. (See Natural Hazards Map)

Six smaller dams in San Mateo County have been exempted from the inundation mapping and dam failure planning requirements of the state Dam Safety Act. None of the smaller dams would have a direct effect on the City of Half Moon Bay.

TABLE C

## DAMS IN SAN MATEO COUNTY NOT UNDER STATE DAM SAFETY ACT

DAM	OWNER	HEIGHT (FEET)	CAPACITY (ACRE FEET)
Bean Hollow 2-3	Emma Denardo Muzzi	40	1,361
Canada Road	CalTrans	52	78
Coastways	Mary DeFremery Atkins	46	100
Green Oak No. 1	Capitola Berry Farms	39	287
Lake Lucerne	Emma Denardo Muzzi	21	455
Pomponio Ranch	Carver Ranch	63	256

Source: San Mateo Area Office of Emergency Services

## POLICIES

1. Encourage the San Mateo Area Office of Emergency Services to develop and maintain a dam inundation warning plan to alert affected governmental agencies, residents, and businesses located in the potential hazard areas. This dam inundation plan should be coordinated with local television and radio media.
2. Land use considered to be appropriate in areas that are subject to dam inundation hazards shall be consistent with Title 18 of the Half Moon Bay Municipal Code (Zoning Ordinance).

## FLOOD HAZARDS

### BACKGROUND

Floods are generally classed as either slow-rise or flash floods. Slow-rise floods may be preceded by a warning time lasting hours, days, or possibly weeks. Evacuation and sandbagging for a slow-rise flood may lessen flood-related damage. Conversely, flash floods are the most difficult to prepare for, due to the extremely short warning time, if any is given at all. Flash flood warnings usually require evacuation within the hour. Once flooding begins personnel will be needed to assist in rescuing persons trapped by flood water, securing utilities, cordoning off flooded areas and controlling traffic. These actions may overtax local agencies and additional personnel and resources may be required. It is anticipated that existing mutual aid resources would be used as necessary to augment local resources.

Watersheds in San Mateo County are relatively small and the run to the Pacific Ocean or to the Bay is relatively short. The typical long, slow-rising floods experienced in the Central Valley and along the great rivers of northern California do not occur here. Watersheds flowing through the City of Half Moon Bay limits to the ocean are as follows: Arroyo Canada Verde, Frenchmans Creek, Pilarcitos Creek, Arroyo Leon Creek, an unnamed creek north of Roosevelt Road crossing Balboa Boulevard, an unnamed creek south of Kehoe Avenue tributary to Pilarcitos Creek, and an unnamed creek at the southern portion of the City extending from north of Fairway Drive.

In more densely populated urban areas, the risks to life and property from flood hazards are increased. As more development occurs within floodplain areas, it often becomes necessary to finance expensive engineering solutions to the flooding problems.

Urban areas can also be victimized by the problem of debris blockage of creek channels. In many areas, residential neighborhoods border directly on creek channels. These areas could easily be spot flooded if the channels are not clear. Decaying flood-deposited garbage or other organic material could create health hazards in the aftermath of a flood.

A map prepared by the United States Geological Survey in 1971 indicated that the Pilarcitos Creek and Arroyo Leon Creek drainages were potential flood hazard areas. These areas were not included in revisions to that map prepared by the USGS in 1973. The Federal Emergency Management Agency (FEMA) prepared the Flood Insurance Study for the City of Half Moon Bay in 1986. The map prepared as a part of this Study indicates that potential flooding is likely to occur only in a small area to the west of Alameda Avenue and north of Guerrero Avenue in the Miramar area. This map was used to delineate areas of potential flooding on the Natural Hazards Map.

## POLICIES

1. Continue enforcement of Chapter 14.34 Flood Damage Prevention of the City of Half Moon Bay Municipal Code.
2. When reviewing development proposals, use the Natural Hazards map to determine the general location of flooding hazard areas.
3. When the Natural Hazards map does not clearly illustrate the presence or extent of flooding hazards and a development site is within a reasonable proximity to a natural hazard, use more detailed maps and information, including but not limited to, the Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA) for San Mateo County and the Dam Failure Inundation maps prepared for the San Mateo Operational Area Office of Emergency Services.
4. Support measures for disclosure of the presence of flooding hazards during transactions of property located within areas of special flood hazard.
5. Support measures for the abatement of flooding hazards, including but not limited to: (1) removal or relocation of development from flood hazard areas; (2) construction of impoundments or channel diversions provided that adequate mitigation of environmental impacts can be demonstrated; and (3) debris clearance and silt removal programs conducted in a manner so as not to disrupt existing riparian communities.
6. Adequate mitigation measures should be incorporated into all development proposals in the vicinity of flood hazard areas.
7. Discourage the location of new critical facilities in flood hazard areas.
8. Wherever possible, retain natural floodplains and guide development to areas outside of areas of special flood hazard.
9. When development is proposed in areas of special flood hazards, require habitable areas of a structure to be safely elevated above the base flood elevation and not contribute to the flooding hazard to surrounding structures.
10. Promote subdivision design to avoid areas of special flood hazard when possible, and identify these areas on the approved subdivision map.
11. Require all proposed new development to provide for development of onsite and downstream off-site mitigation of potential flood hazards and drainage problems and require development fees to fund the required improvements when necessary.

## SOIL STABILITY

### BACKGROUND

#### Unstable Slopes

##### Soil Creep

Soil creep is the slow downslope movement of soil and weathered bedrock. The moving layer can range from a few centimeters to several feet in thickness. Rates of movement also vary ranging from less than a centimeter per year to 10 centimeters or more per week. The rate of soil creep depends on several factors including slope, slope materials, and climate. The rate of creep can be increased or decreased by human activities, especially when the load on creeping slopes is increased with buildings or artificial fill. Correct placement of artificial fill can decrease soil creep.

Although it is too slow to be perceptible, the cumulative effects of creep are easily recognized: cracked sidewalks, pavement and walls, leaning or bent trees and fences, and shifts in the alignment of linear features such as railroad tracks, streets, and fences.

##### Landslides

Landslides include all movements of soil, rock, or debris as a result of falling, sliding, or flowing. Most landslides are a combination of two or more types of motion and/or material. Landslides are categorized according to the types of motion and material involved. They can be directly caused by earthquakes or be completely independent of them.

Falls describe the sudden movement of material from vertical or near-vertical slopes, and are generally labeled by the type of material displaced.

Slides refer to movements in which the material moves more or less as a unit along recognizable shear surfaces. If the shear surface is concave, the slide movement will be rotational and is denoted by the term "slump." If the shear surface is planar, translation movement occurs and the term "slide" is used alone. Both slides and slumps are further classified according to the type of material involved (e.g., earth slump, rockslide, debris slide, where "debris" refers to combinations of soil, fill, weathered bedrock, and/or organic material).

Flows describes the movement of material in which an innumerable number of small-scale movements rather than massive sliding is the dominant mechanism of transport. This category is further broken down by the type of material

involved and the rate at which it moves (e.g., debris flow, mudflow). The modifier "avalanche" is used to describe exceptionally fast flows. The occurrence of landslides is determined by both natural and human factors. Natural factors include the cohesive strength and shrink-swell characteristics of the affected minerals, the orientation of joints and plains of weakness between slide material and bedrock, the steepness of slopes, the degree of saturation of ground materials (highly affected by rainfall), and the density of vegetation. Human factors include the oversteepening and overloading of slopes, the removal of natural vegetation, the addition of water to the soil by watering of lawns and septic system drain fields, and onsite ponding of storm runoff.

### Cliff Erosion

Wave action removes materials from the base of coastal cliffs along the western edge of the County, causing varying degrees of landsliding and cliff erosion. This rate of erosion is dependent upon several factors, including the steepness of coastal slopes, lithology, the degree of consolidation of cliff materials, the response to precipitation and the incoming intensity and direction of waves. Most of the coastal cliff area of Half Moon Bay is classified as having moderate stability. The southern area has high stability and the northern area has low stability characteristics as classified by San Mateo County. (See Natural Hazards Map)

### Land Subsidence

#### Non-Seismic Land Subsidence and Differential Settlement

Subsidence and differential settlement (the uneven lowering of the ground surface) constitute minor natural hazards in the City of Half Moon Bay. Differential settlement is a more common hazard often occurring when buildings and bridges are built on poor foundation materials. Pilings are often used to anchor structures to firmer deposits below the surface in these situations. Surface footings tend to be used to support less important structures. If surface footings are used to support one part of a structure and pilings for another, differential settlement will occur, with the area supported by surface footings setting faster than the piling supported section. Differential settlement generally occurs slowly enough that its effects are not serious.

#### Shrink/Swell Soils

Shrink/swell soils are those which can expand or contract depending on moisture content and soil mineralogy. Expansive soils are associated with the presence of certain types of clay minerals which expand considerably when wet and shrink when dry.

Peat and other organic soils may pose a subsidence hazard. These soils generally found in existing or former marshy areas, are highly compressible when dry. Upon drainage, the organic material (often partially decomposed plant matter) undergoes oxidation and results in a decrease in soil volume. Organic soils have not been extensively mapped in the City and subsidence from their oxidation is likely to affect only a small portion of the County.

### Seismically-Induced Subsidence

Subsidence, defined as the sinking or lowering of a part of the earth's surface, can occur as a result of or independent of earthquakes. Seismically-induced subsidence can be either a direct or an indirect result of an earthquake. Direct tectonic displacement of bedrock can result from strong earthquakes causing either subsidence or uplift of up to several feet over relatively large areas of ground surface. Indirect subsidence resulting from compaction of gradual soil layers caused by ground shaking is more common. Such shaking causes subsidence by compressing the soil deposit so that pore space formerly filled by groundwater or air is eliminated. There must be an outlet for evacuation of these pore spaces in order for subsidence to occur.

### POLICIES

1. Ensure that all appropriate City and State regulations regarding the identification and mitigation of geologic hazards are implemented.
2. Continue to require that adequate soils, geologic, and structural evaluation reports are prepared when deemed appropriate by the Building Official. All such reports submitted to the City for review shall be prepared by registered soils engineers, engineering geologists and/or structural engineers.
3. Require that measures identified in any soils, geologic, geotechnic, and/or any structural reports to adequately mitigate hazards to be imposed as conditions of project approval, to the extent feasible.
4. Promote and encourage additional geologic investigations within the City by Federal, State and local agencies and organizations.
5. The City Grading Ordinance should specifically address activities within or in close proximity to identified areas with geologic hazards.
6. Geologic reports, building plans, and environmental impact reports prepared for major construction projects (i.e., all critical facilities or uses with large human occupancies in recognized or suspected hazard areas) shall be prepared by

registered engineering geologists and structural engineers and reviewed by the City Engineer.

7. Soils and geologic reports for hillside construction shall be prepared for all new development in areas exceeding 20 percent slope and reviewed for adequacy by appropriate City staff or consultants selected by the City at the applicant's expense.
8. Whenever there is a substantial landslide or significant damage to a foundation or structure occurs as a result of a seismic event, the City should require a detailed study of the geologic materials, foundations, or structures involved to be prepared for any future event.
9. New critical facilities, structures involving high occupancies, and public facilities should not be sited in areas of high damage susceptibility. Where such location is deemed essential to the public welfare, these structures will be sited, designed and constructed with due consideration of the potential for damage due to ground deformation, seismically triggered subsidence, and landslide.

## FIRE HAZARDS

### BACKGROUND

Because of the mix of urban, rural, and wildland areas in California, fire protection is a difficult problem and fire protection systems are complex. Large tracts of sparsely populated land must be protected from wildland fires in hot, dry summers at the same time that adequate protection must be provided to densely populated urban centers. Fire protection in urban areas must also be designed and equipped to cope with industrial fires with any associated hazardous materials concerns, structures of varying height, density, and occupancy, and transportation accidents involving hazardous materials. There are twenty cities within San Mateo County. Each city is responsible for its fire protection either by utilizing its own resources or contracting with the California Department of Forestry, a fire district, or adjacent municipal service. Brisbane, Burlingame, Daly City, Foster City, Hillsborough, Millbrae, Pacifica, Redwood City, San Bruno, San Mateo, and South San Francisco have their own fire departments. Other cities are protected by the Colma, Half Moon Bay, Menlo Park, Point Montara, and Woodside Fire Protection Districts. The South County Fire Authority is responsible for fire protection in Belmont and San Carlos. Unincorporated areas are the primary responsibility of the California Department of Forestry, along with some fire protection districts, and volunteer fire companies. Fires in both urbanized and forested settings can rapidly extend to the point that local resources are inadequate. All fire agencies in San Mateo County have signed the California Master Mutual Aid Agreement and participate in mutual aid operations as required.

### Classifications

#### Fuel Loading

In San Mateo County almost the entire unincorporated rural area is covered with woodland, brush, or grassland except for the cultivated lands in the Coastal Zone. In recent years, extensive study has been undertaken at the State level to classify the fire hazard severity of different regions of the State. One of the key components in measuring severity is the type and quantity of flammable vegetation within a given unit of land area. This factor, also known as "fuel loading characteristics," can then be combined with weather and slope to obtain a measure of relative hazard.

Three basic fuel loading characteristics have been identified by the State. "Heavy" fuel loading vegetation is assigned to woodland and brushwood areas. This characteristic is generally assigned to vegetation that is six feet or more in height and which has a crown density of 20 percent or more of the ground

area. The heavy fuel loading vegetation types include conifers and mixed evergreen timberlands and chaparral which are found in abundance in the rural area of the County.

"Medium" fuel loading vegetation generally includes scrub vegetation that is less than six feet in height but with similar crown density characteristics. This category includes California sagebrush, coyote brush, manzanita, and other chaparral species common to the County.

"Light" fuel loading vegetative types are various types of grasslands, herbaceous rangelands and irrigated pasture lands. These areas are almost completely treeless and, although highly flammable during dry seasons, do not have significant fuel content to sustain any fire that might be started.

### Weather Conditions

The second major natural characteristics to consider in fire hazard measurement are local weather conditions. In Northern California, very little rain normally falls between mid-April and the beginning of November. By September, many portions of the State are tinder dry from months of aridity. It is not unusual for strong, drying winds to blow in from the north and east.

The State has established three "critical fire weather frequency" classes to measure the weather-related fire hazard severity. These classes basically measure the annual number of days in which a critical "fire load index" is exceeded over a 10-year period, with Class I the lowest and Class III the highest level of danger.

A fire weather frequency class rating has been provided for all of the USGS quadrangles in California. Due to the high rainfall experienced by the portion of San Mateo County west of Skyline Boulevard, as well as the cooling influence of the summer coastal fog, no portion of San Mateo County is given the most severe weather rating.

### Slope

The third major characteristic of fire hazard measurement is the degree of slope present in a localized area. The rugged terrain and steep slopes that characterize much of the County's rural area can create extreme access problems for fighting fires once they have started. Generally, vegetation is more abundant in steep canyon areas due to less severe sun and wind exposure and greater capture of rain runoff. Fires that start in the bottom of canyons will burn 16 times faster upslope than if they begin at the top of ridges and burn downslope.

The State has divided slope categories into three different classes of fire severity. Class I includes slopes from 0 to 40 percent. This category assumes that direct attack on the fire is

possible with all-wheel drive fire trucks, bulldozers, and crews and aircraft. Class II includes slopes between 41 and 60 percent. This class assumes direct attack is not possible with fire trucks, but still possible in most cases with bulldozers, hand crews, and aircraft. Class III includes slopes greater than 61 percent. This class includes areas mostly beyond the capability of bulldozers which can only be directly attacked by hand crews and aircraft.

#### Level of Service

Since 1962, the County has contracted with the California Department of Forestry (CDF) for structural fire protection and general rescue services in unincorporated areas of the County not served by other fire districts or departments. Officially, this service is provided by CDF under the title of the County Fire Department. In some counties, CDF only has wildland fire protection (for forest, brush, and grassland fires) in what are known as "State Responsibility Areas." The general goal of the CDF/County Fire system is to provide a response time of five minutes or less to any fire occurring in the rural area 90 percent of the time.

The Half Moon Fire Protection District serves the unincorporated areas of El Granada, Miramar, Princeton, all of the incorporated area of the City of Half Moon Bay, and canyons east and south of Half Moon Bay. The first backup call to the Half Moon Bay Fire Protection District for the northern portions of the City and the unincorporated area would be the Point Montara Fire Department (half paid/half volunteer staff) with the second backup being the City of Pacifica Fire Department. To the south and east the first backup call would be the CDF which has stations in Belmont and Pescadero. For major calls San Mateo County has a "Central Strike" force which would include the cities of San Mateo, Foster City, Burlingame, Hillsborough, and Millbrae Departments.

The Half Moon Bay Fire Protection District can provide a minimum response time of two minutes and a maximum response time of eight minutes to all portions of the City. There is a maximum response time of approximately 18 minutes to outer service areas in the unincorporated areas of the County. The Fire District currently has 21 suppression employees, one Fire Marshall, one Fire Prevention Officer, one Administrative Officer, one Assistant Fire Chief, one Fire Chief, and 22 Volunteer Firefighters. The Fire District maintains two fire stations. Fire Station 40 is located at 635 Main Street, Half Moon Bay, and Fire Station 41 located at 531 Obispo Road, El Granada. Each has a manned engine company 24 hours per day. The District currently has one rescue/squad vehicle, one cliff rescue vehicle, four engines, and a combination engine/ladder.

The District currently requires sprinklers in all commercial and industrial buildings 2,500 square feet or greater. There are currently no sprinkler requirements for residential development.

Any residential development outside of areas served by the water service district is required to maintain a 5,000 gallon minimum water supply to be used for fire suppression. All new development is required to provide steamer hydrants every 300 feet in residential districts and every 300 feet in commercial/industrial districts, commencing at the street corners, or as otherwise required by the Fire Chief. All new streets are required to be a minimum of 36 feet wide with a 60 foot turning radius (curb face to curb face) on all cul-de-sacs, unless otherwise approved as a part of an overall development plan, and the streets are clearly posted as Fire Lanes with no parking at any time.

The Fire District is responsible for the review of all proposed development, street names, and house/building numbering.

### POLICIES

1. The City shall continue to require new development to pay a fee and/or participate in an Assessment District for Fire District equipment, facility expansions, additional man power, and other capital improvements when the need arises to accommodate the increased service demand of new development and/or provide for needed capital improvements through future Capital Improvement Programs.
2. All applications for new subdivisions, development plans, conditional use permits, environmental impact reports, and business license applications, shall continue to be made available for review and comment by the Fire District to ensure compliance with fire safety regulations.
3. Fire prevention programs should include consideration of a Fire Retardant Roofing Ordinance and a Residential Sprinkler Ordinance.
4. The Fire District should continue with its weed abatement program and enforcement of Uniform Fire Code Requirements as part of its fire prevention programs.
5. The Fire District should review all applications for new development in hillside/canyon areas and all new commercial development in the City to assess potential impacts to existing fire protection services and the need for additional and expanded services.
6. The City and Fire District should explore the feasibility of automatic sprinklers in structures used for human occupancy in hillside and canyon areas.
7. New subdivisions in hillside or canyon areas of the City should be designed to facilitate brush clearance around structures.

8. The City shall work with the Fire District and Coastside County Water District to establish a priority list for upgrading fire flow capabilities in neighborhoods that may have inadequate fire flows.
9. Land uses in rural or fire hazard areas shall only be permitted if clustered near major roads, have adequate access for fire protection vehicles, and have demonstrated that adequate water system and fire plans are available.
10. In urban and rural areas, consider land uses to be appropriate if development can be served by the Fire District, adequate access for fire protection vehicles is available, and sufficient water supply and fire flow can be guaranteed.
11. Require that the length of cul-de-sacs be limited to a maximum of 250 feet unless otherwise approved by the Fire District as a part of an overall development plan.
12. Support efforts to identify all roads, streets, and major public buildings in a manner so that they are clearly visible to fire protection and other emergency vehicles.
13. Provide adequate access to and fire breaks with a minimum clearance of 30 feet adjoining open space areas subject to fire hazard as part of new developments.

## HAZARDOUS MATERIALS

### BACKGROUND

The release of a hazardous material to the environment could cause a multitude of problems that can be discussed in a general manner. The significance of the problem to the environment, property, or human health is dependent on the type, location, and quantity of the material released. Although hazardous material incidents can happen almost anywhere, certain areas of the state are at higher risk. Jurisdictions near roadways such as Routes 1 and 92 that are frequently used for transporting hazardous materials and jurisdictions with industrial facilities that use, store, or dispose of such materials all have increased potential for major mishaps, as do jurisdictions crossed by certain railways, waterways, airways, and pipelines.

Releases of explosive and highly flammable materials have caused fatalities and injuries, necessitated large scale evacuations, and destroyed millions of dollars worth of property. Toxic chemicals in gaseous form has caused injuries and fatalities among emergency response teams and passersby. When toxic materials have entered either surface or ground water supplies, serious health effects have resulted. Releases of hazardous chemicals have been especially damaging when they have occurred in highly population areas or along heavily traveled transportation routes.

San Mateo County has a population of over 603,000 in an area of 448 square miles. The bayside portions of the county from Brisbane to Menlo Park contain a number of facilities closely associated with hazardous materials. These industries include semi-conductor and related devices; paints, varnishes, lacquers, enamels, and allied products; chemicals; and biological research activities. The coastside sections of the county are primarily rural and most of this area is forested or agricultural. There are concentrations of pesticides and related substances in these areas.

Hazardous materials are also commonly found in residential and rural areas of the County. Typical residential substances include pesticides, cleaning fluids and household solvents, which require special storage and disposal practices. Table E identifies common household substances classified as hazardous materials. In rural areas of the County, pesticide and herbicide application is used in conjunction with agriculture and forestry operations. San Mateo County ranks 36th out of the 58 counties in Statewide use of restricted pesticides, including both urban and rural application.

TABLE D  
HOUSEHOLD SUBSTANCES CLASSIFIED AS  
HAZARDOUS MATERIALS

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Hazardous in any Quantity:

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Pesticides (e.g., insecticides, herbicides, fungicides and rodenticides)

Waste Oil (e.g., crankcase oil)

Flammable:

Solvents (e.g., turpentine)  
Paint Thinners (e.g., naphtha)  
Fuel Wastes (e.g., kerosene, charcoal starter)

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Hazardous in Large Quantities:

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Chemical Cleaners (e.g., driveway cleaners)

Anti-Freeze

Acids (e.g., battery acids, swimming pool acids)

Alkaline Caustics (e.g., some fertilizers and industrial chemicals)

Liquid Cement (e.g., contact cement)

Cleaning Compounds (e.g., ammonia, organic solvents)

Bleaches

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Source: San Mateo County Solid Waste Management Plan 1984;  
VIII-11

There are four major highways in the county: State Route 1 which runs north to south along the western edge; Interstate 280 which runs north to south through the center of the county along the San Andreas Fault; U.S. 101 which runs north to south along the eastern edge of the county; and State Route 92 which bisects the other three roads as it runs east to west at mid-county. Half

Moon Bay is directly affected by traffic on State Route 1 and State Route 92.

Incidents of toxic material spill and accidental discharge within the County are occurring with increasing regularity. Although statistics are lower than the majority of Bay Area counties, there are an estimated 250 major hazardous material spill incidents annually Countywide. The majority of recorded spills occur within the urban developed area, particularly along the Bayfront, with a group of spill sites clustered near Highway 101. The Highway 92 crossing at Crystal Springs Reservoir is used for transport of gasoline and agricultural chemicals to the coastline and has been identified as a potential hazardous material spill location which could seriously affect a major water supply.

Approximately 90 percent of the hazardous material spills in San Mateo County occur on-site, while the balance occur during truck transit. The vast majority of local spills are contained and cleaned up by company personnel without being reported to local officials. Generally, 10 percent of the spills occurring onsite are considered significant and reported to fire departments, of which approximately half require response by outside agencies and one-tenth result in injury requiring immediate medical attention. Fatalities associated with hazardous material releases have occurred in the County, primarily resulting from fire and explosion. Petroleum products constitute the largest category of spill substances (57 percent regionally), with corrosives, acids, pesticides, PCB and other chemicals making up the balance.

Transportation of hazardous waste is limited under the State law to registered haulers. A monitoring system, known as the "manifest system," is used to track all hazardous wastes transported offsite to storage, treatment, or disposal facilities. The manifest accompanies the shipment, with copies sent to the State from both generator and receiving facility to ensure that the designated waste is received by an appropriate facility. There are ten State licensed hazardous waste haulers based in San Mateo County.

Illegal disposal of hazardous waste into sewer systems, at landfill sites, and directly into streams, or dumping along roadways is a growing problem and accounts for a substantial fraction of emergency responses by the County Hazardous Materials Response Team. This type of incident is expected to increase as operating costs (and therefore use fees) for authorized disposal sites rise. Industry generally is aware of hazardous materials regulations and appropriate disposal procedures and acts responsibly. Small generators (small business and households) are largely unaware of the hazardous waste problem and tend to view current regulations as not pertaining to them. Small generators are also less able to incur the costs of proper disposal and may attempt to cut operating costs by illegal dumping. There is a lack of incentives, both positive and

negative, to encourage proper disposal, recycling, or reduction in waste generation.

San Mateo County Environmental Health Department maintains an inventory of hazardous materials. The list is passed on to the local fire marshall to survey locally. The main problems are agriculturally related with the storage of pesticides and insecticides. The Fire District is responsible for annual inspections of all businesses and the review of all occupancy permits for storage of hazardous materials.

Approximately six to eight spills per year occur on State Route 1. State Route 1 is one of the main transportation corridors for military transport from Monterey to the Bay Area. The military is exempt from reporting the cargo identity.

## POLICIES

1. Do not encourage industries which rely extensively on use of hazardous materials.
2. Ensure that development proposals involving hazardous waste facilities are consistent with the San Mateo County Hazardous Waste Management Plan.
3. Continue implementation and enforcement of State chemical disclosure laws and regulations.
4. Provide information and assistance to residents, businesses, and industry that request information regarding the proper use, storage, transportation, handling, and disposal of hazardous substances.
5. Conduct and/or support the operation of household hazardous waste collection programs to be conducted to benefit the City. The City should also provide educational programs regarding the proper use and disposal of hazardous substances.
6. Encourage the Fire District to continue annual inspections of hazardous material users and hazardous waste generators of comply with State and local regulations.
7. Consider adopting an amendment to the City's Zoning Ordinance that would prohibit assembly-type uses (i.e., theaters, day care centers, churches, etc.) from being located in multi-tenant buildings that are located in industrial zones and are designed to accommodate hazardous substance users.
8. Continue to coordinate with the San Mateo County Environmental Health Department regarding the City responsibilities and appropriate actions to be taken in the event of a hazardous material release incident.

9. Coordinate with other agencies that have emergency response responsibilities in the event of a hazardous material release (i.e., California Highway Patrol and County Sheriff and Fire Departments).
10. Conduct periodic reviews and updates of the City's hazardous materials incident response plan. This review should be conducted in conjunction with a simultaneous review of the hazardous materials users list compiled and maintained by the Fire District in compliance with chemical disclosure laws.
11. That the Half Moon Bay Police Department and the Half Moon Bay Fire Protection District shall conduct an annual test of the City's Hazardous Incident Response Plan to ensure its on-going efficacy.
12. Require an applicant for new development on property containing abandoned gas well sites, as a condition of approval, to relocate the abandoned well, or otherwise mitigate any potential adverse impacts from the existence of the abandoned well site on the property proposed for development.
13. Any development project or structure proposed to be located over or in the proximity of an abandoned oil and gas well site must be approved by the State Division of Oil and Gas. Reabandonment may be required. If construction over an abandoned oil and gas well is unavoidable, any gas venting system over the well recommended by the State Division of Oil and Gas must be installed and approved to the satisfaction of the State Division of Oil and Gas.

## AIRPORT SAFETY

### BACKGROUND

General airport safety, especially near airport runways is recognized as a hazard concern.

Located approximately four miles north of the City of Half Moon Bay on Route 1, the Half Moon Bay Airport accommodates approximately 70,000 aircraft operations each year. This figure is project to exceed 100,000 by 1995. The 60 CNEL contour (1978) is mostly within the present airport boundaries, while the projected 1995 contour includes approximately 16 acres of residentially zoned property north of the Airport in the unincorporated area of the County outside of the City of Half Moon Bay. Aircraft noise is evident due to low ambient noise levels and the high percentage of low altitude training flights.

Areas of high accident potential usually occur at the ends of runways, in aircraft approach and departure zones, where forced landings are most likely to occur. The Airport Land Use Commission (ALUC) has designated these high risk areas as "approach zones" at the Half Moon Bay Airport. The Federal Aviation Administration (FAA) has similarly designated "clear zones" at each of the County's three airports. The approach zone is rectangular in shape, covering 2,000,000 square feet (1,000' x 2,000'), located 200 feet off each end of the runway. The clear zone is trapezoidal in shape, 1,000 feet long, with area varying according to runway and aircraft size, also located 200 feet off each end of the runway.

ALUC and FAA policy is to keep approach and clear zones free of structures. Nonstructural uses, motor vehicle parking, and open storage may be permitted in approach zones provided certain maximum density requirements are not exceeded. The FAA defines structural development in a clear zone as an "obstruction to air navigation" and, pending required study, could result in modification of airport operation to ensure safety.

All of the clear zone and a majority of the approach zone land of the Half Moon Bay Airport is publicly owned, outside of the City limits, and absent of structural development. On remaining privately owned land in the approach zone, several buildings exist along the periphery, where they are least apt to pose a hazard risk.

Building height beyond the approach and clear zone is also a safety concern, as tall structures can be hazardous to flight operations. Accordingly, the FAA and ALUC have defined height limits for buildings near airports. The specific height limit is based upon an imaginary flat plane, sloping upward and outward from the runway (representative of flight paths), known as an

"approach surface." The slope of an approach surface varies with aircraft requirements. The typical general aviation approach surface maintains a 34:1 slope, while large commercial approach surfaces involve slopes between 40:1 and 50:1. Approach surfaces and resultant height restrictions are based primarily on FAA standards. Currently, there are no structures encroaching into designated approach surfaces at the Half Moon Bay Airport. Although the FAA sets obstruction criteria in terms of maximum height, actual legal authority to control height rests with the ALUC and the local government where the structure is situated. If a structure or object exceeds the defined height, the FAA would require preparation of an aeronautical study to determine the effect on navigable airspace and whether a hazard to air navigation is present. As with clear zones, the FAA can modify airport operations to ensure safety.

#### POLICIES

1. Work with adjoining jurisdictions and the Half Moon Bay Airport to coordinate and implement a disaster response plan.
2. Through land use controls, regulate the type and intensity of development in areas with potential air operational hazards, although currently there are no such areas within the corporate limits of the City of Half Moon Bay.

### III. GOALS, OBJECTIVES, AND POLICIES

## GOALS, OBJECTIVES, AND POLICIES

### GOALS AND OBJECTIVES

#### Prevention of Serious Injury and Loss of Life

Loss of life and prevention of serious injury is a primary responsibility of local government and should be given highest priority in any public safety program.

#### Prevention of Serious Structural Damage to Critical Facilities and Structures Where Large Numbers of People Are Apt To Congregate At One Time

Hospitals, communication facilities, public facilities, and other critical facilities should be designed to function after an earthquake or other natural or technological disasters.

#### Insuring the Continuity of Vital Services and Functions

This is one of the most important functions of government simply because there is unlikely to be any other organized source of leadership in a major disaster.

#### Education of the Community

This goal is a necessary ingredient to the success of any planning effort. It is a role to be played by school districts, public agencies, business firms, and the Chamber of Commerce.

#### Protection of Property

Protection of property and the reduction of adverse economic, environmental, and social conditions resulting from fires and geologic hazards should be anticipated and appropriate actions should be planned.

### POLICIES

#### Ground Failure/Earthquake

1. Continue to adopt updated editions of the Uniform Building Code, published by the International Congress of Building Officials.
2. Continue enforcement of Ordinance No. 13-89 establishing a seismic hazard identification program for unreinforced masonry buildings.

3. Continue ensuring that other appropriate State regulations regarding the identification and mitigation of seismic hazards are implemented.
4. Continue to require that adequate soils, geologic, and structural evaluation reports are prepared when deemed appropriate by the Building Official. All reports submitted to the City for review shall be prepared by registered soils engineers, engineering geologists, and/or structural engineers.
5. Require that measures identified in any soils, geologic geotechnic, and/or any structural reports to adequately mitigate liquefaction be imposed as conditions of project approval.
6. Promote and encourage additional seismic investigations within the City by Federal, State, and local agencies and organizations.
7. The City Grading Ordinance should specifically address identified areas with seismic hazards.
8. Geologic reports, building plans, and environmental impact reports prepared for major construction projects (i.e., all critical facilities or uses with large human occupancies in recognized or suspected hazard areas) shall be prepared by registered engineering geologists and structural engineers and review by the City Engineer.
9. Land use designations should be appropriate in areas that are subject to and/or have the potential to be subject to seismic hazards and shall be consistent with Title 18 of the Half Moon Bay Municipal Code (Zoning Ordinance).
10. In the event of a major earthquake the City shall be prepared to implement procedures in accordance with the Half Moon Bay Multi-Hazard Functional Plan and in accordance with procedures established by the San Mateo Area Office of Emergency Services.
11. The City of Half Moon Bay should actively promote an educational program regarding seismic safety.

#### Tsunamis and Seiches

1. Encourage the San Mateo Area Office of Emergency Services to develop and maintain a Tsunami Warning Plan to alert affected governmental agencies and beachside residents and businesses. This plan should be coordinated with local television and radio media.

2. New critical facilities should not be located in areas with the potential to be adversely affected by tsunamis and/or seiches. If a critical facility must be located in a tsunami hazard zone, "tsunami-proof" design and construction principles should be incorporated so that it can resist tsunami damage and facilitate evacuation on short notice.

#### Inundation from Dam Failure

1. Encourage the San Mateo Area Office of Emergency Services to develop and maintain a dam inundation warning plan to alert affected governmental agencies, residents, and businesses located in the potential hazard areas. This dam inundation plan should be coordinated with local television and radio media.
2. Land use considered to be appropriate in areas that are subject to dam inundation hazards shall be consistent with Title 18 of the Half Moon Bay Municipal Code (Zoning Ordinance).

#### Flood Hazard

1. Continue enforcement of Chapter 14.34 Floor Damage Prevention of the City of Half Moon Bay Municipal Code.
2. When reviewing development proposals, use the Natural Hazards map to determine the general location of flooding hazard areas.
3. When the Natural Hazards map does not clearly illustrate the presence or extent of flooding hazards and a development site is within a reasonable proximity to a natural hazard, use more detailed maps and information, including but not limited to, the Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA) for San Mateo County and the Dam Failure Inundation maps prepared for the San Mateo County Office of Emergency Services.
4. Support measures for disclosure of the presence of flooding hazards during transactions of property located within areas of special flood hazard.
5. Support measures for the abatement of flooding hazards, including but not limited to: (1) removal or relocation of development from flood hazard areas; (2) construction of impoundments or channel diversions provided that adequate mitigation of environmental impacts can be demonstrated; and (3) debris clearance and silt removal programs conducted in a manner so as not to disrupt existing riparian communities.
6. Adequate mitigation measure should be incorporated into all development proposals in the vicinity of flood hazard areas.

7. Discourage the location of new critical facilities in flood hazard areas.
8. Wherever possible, retain natural floodplains and guide development to areas outside of areas of special flood hazard.
9. When development is proposed in areas of special flood hazards, require habitable areas of a structure to be safely elevated above the base flood elevation and not contribute to the flooding hazard to surrounding structures.
10. Promote subdivision design to avoid areas of special flood hazard when possible, and identify these areas on the approved subdivision map.
11. Require all proposed new development to provide for development of onsite and downstream off-site mitigation of potential flood hazards and drainage problems and require development fees to fund the required improvements when necessary.

#### Soil Stability

1. Ensure that all appropriate City and State regulations regarding the identification and mitigation of geologic hazards are implemented.
2. Continue to require that adequate soils, geologic, and structural evaluation reports are prepared when deemed appropriate by the Building Official. All such reports submitted to the City for review shall be prepared by registered soils engineers, engineering geologists and/or structural engineers.
3. Require that measures identified in any soils, geologic, geotechnic, and/or any structural reports to adequately mitigate hazards to be imposed as conditions of project approval, to the extent feasible.
4. Promote and encourage additional geologic investigations within the City by Federal, State and local agencies and organizations.
5. The City Grading Ordinance should specifically address activities within or in close proximity to identified areas with geologic hazards.
6. Geologic reports, building plans, and environmental impact reports prepared for major construction projects (i.e., all critical facilities or uses with large human occupancies in recognized or suspected hazard areas) shall be prepared by registered engineering geologists and structural engineers and reviewed by the City Engineer.

7. Soils and geologic reports for hillside construction shall be prepared for all new development in areas exceeding 20 percent slope and reviewed for adequacy by appropriate City staff or consultants selected by the City at the applicant's expense.
8. Whenever there is a substantial landslide or significant damage to a foundation or structure occurs as a result of a seismic event, the City should require a detailed study of the geologic materials, foundations, or structures involved to be prepared for any future event.
9. New critical facilities, structures involving high occupancies, and public facilities should not be sited in areas of high damage susceptibility. Where such location is deemed essential to the public welfare, these structures will be sited, designed and constructed with due consideration of the potential for damage due to ground deformation, seismically triggered subsidence, and landslide.

#### Fire Hazards

1. The City shall continue to require new development to pay a fee and/or participate in an Assessment District for Fire District equipment, facility expansions, additional man power, and other capital improvements when the need arises to accommodate the increased service demand of new development and/or provide for needed capital improvements through future Capital Improvement Programs.
2. All applications for new subdivisions, development plans, conditional use permits, environmental impact reports, and business license applications, should be made available for review and comment by the Fire District to ensure compliance with fire safety regulations.
3. Fire prevention programs should include consideration of a Fire Retardant Roofing Ordinance and a Residential Sprinkler Ordinance.
4. The Fire District should continue with its weed abatement program and enforcement of Uniform Fire Code Requirements as part of its fire prevention programs.
5. The Fire District should review all applications for new development in hillside/canyon areas and all new commercial development in the City to assess potential impacts to existing fire protection services and the need for additional and expanded services.

6. The City and Fire Department should explore the feasibility of an automatic sprinkler ordinance for structures used for human occupancy in hillside and canyon areas.
7. New subdivisions in hillside or canyon areas of the City should be designed to facilitate brush clearance around structures.
8. The City shall work with the Fire District and Coastside County Water District to establish a priority list for upgrading fire flow capabilities in neighborhoods that may have inadequate fire flows.
9. Land uses in rural or fire hazard areas shall only be permitted if clustered near major roads, have adequate access for fire protection vehicles, and have demonstrated that adequate water system and fire plans are available.
10. In urban and rural areas, consider land uses to be appropriate if development can be served by the Fire District, adequate access for fire protection vehicles is available, and sufficient water supply and fire flow can be guaranteed.
11. Require that the length of cul-de-sacs be limited to a maximum of 250 feet unless otherwise approved by the Fire District as a part of an overall development plan.
12. Support efforts to identify all roads, streets, and major public buildings in a manner so that they are clearly visible to fire protection and other emergency vehicles.
13. Provide adequate access to and fire breaks with a minimum clearance of 30 feet adjoining open space areas subject to fire hazard as part of new developments.

#### Hazardous Materials

1. Do not encourage industries which rely extensively on use of hazardous materials.
2. Ensure that development proposals involving hazardous waste facilities are consistent with the San Mateo County Hazardous Waste Management Plan.
3. Continue implementation and enforcement of State chemical disclosure laws and regulations.
4. Provide information and assistance to residents, businesses, and industry that request information regarding the proper use, storage, transportation, handling, and disposal of hazardous substances.

5. Conduct and/or support the operation of household hazardous waste collection programs to be conducted to benefit the City. The City should also provide educational programs regarding the proper use and disposal of hazardous substances.
6. Encourage the Fire District to continue annual inspections of hazardous material users and hazardous waste generators to comply with State and local regulations.
7. Consider adopting an amendment to the City's Zoning Ordinance that would prohibit assembly-type uses (i.e., theaters, day care centers, churches, etc.) from being located in multi-tenant buildings that are located in industrial zones and are designed to accommodate hazardous substance users.
8. Continue to coordinate with the San Mateo County Environmental Health Department regarding the City responsibilities and appropriate actions to be taken in the event of a hazardous material release incident.
9. Coordinate with other agencies that have emergency response responsibilities in the event of a hazardous material release (i.e., California Highway Patrol and County Sheriff and Fire Departments).
10. Conduct periodic reviews and updates of the City's hazardous materials incident response plan. This review should be conducted in conjunction with a simultaneous review of the hazardous materials users list compiled and maintained by the Fire District in compliance with chemical disclosure laws.
11. That the Half Moon Bay Police Department and the Half Moon Bay Fire Protection District shall conduct an annual test of the City's Hazardous Incident Response Plan to ensure its on-going efficacy.
12. Require an applicant for new development on property containing abandoned gas well sites, as a condition of approval, to relocate the abandoned well, or otherwise mitigate any potential adverse impacts from the existence of the abandoned well site on the property proposed for development.
13. Any development project or structure proposed to be located over or in the proximity of an abandoned oil and gas well site must be approved by the State Division of Oil and Gas. Reabandonment may be required. If construction over an abandoned oil and gas well is unavoidable, any gas venting system over the well recommended by the State Division of Oil and Gas must be installed and approved to the satisfaction of the State Division of Oil and Gas.

Airport Safety

1. Work with adjoining jurisdictions and the Half Moon Bay Airport to coordinate and implement a disaster response plan.
2. Through land use controls, regulate the type and intensity of development in areas with potential air operational hazards, although currently there are no such areas within the corporate limits of the City of Half Moon Bay.

#### IV. INFORMATION SOURCES

## INFORMATION SOURCES

## DOCUMENTS

Federal Emergency Management Agency:	Flood Insurance Rate Map City of Half Moon Bay Community Panel Number 060319 0005A. June 3, 1986
California State Department of Health Services:	Hazardous Waste Control Law Health and Safety Code
California State Division of Mines and Geology:	Elementary Seismology
San Mateo County General Plan:	Solid Waste Element Natural Hazards Element Man Made Hazards Element
City of Half Moon Bay:	Managing Emergency Operations Hazard Specific Situations

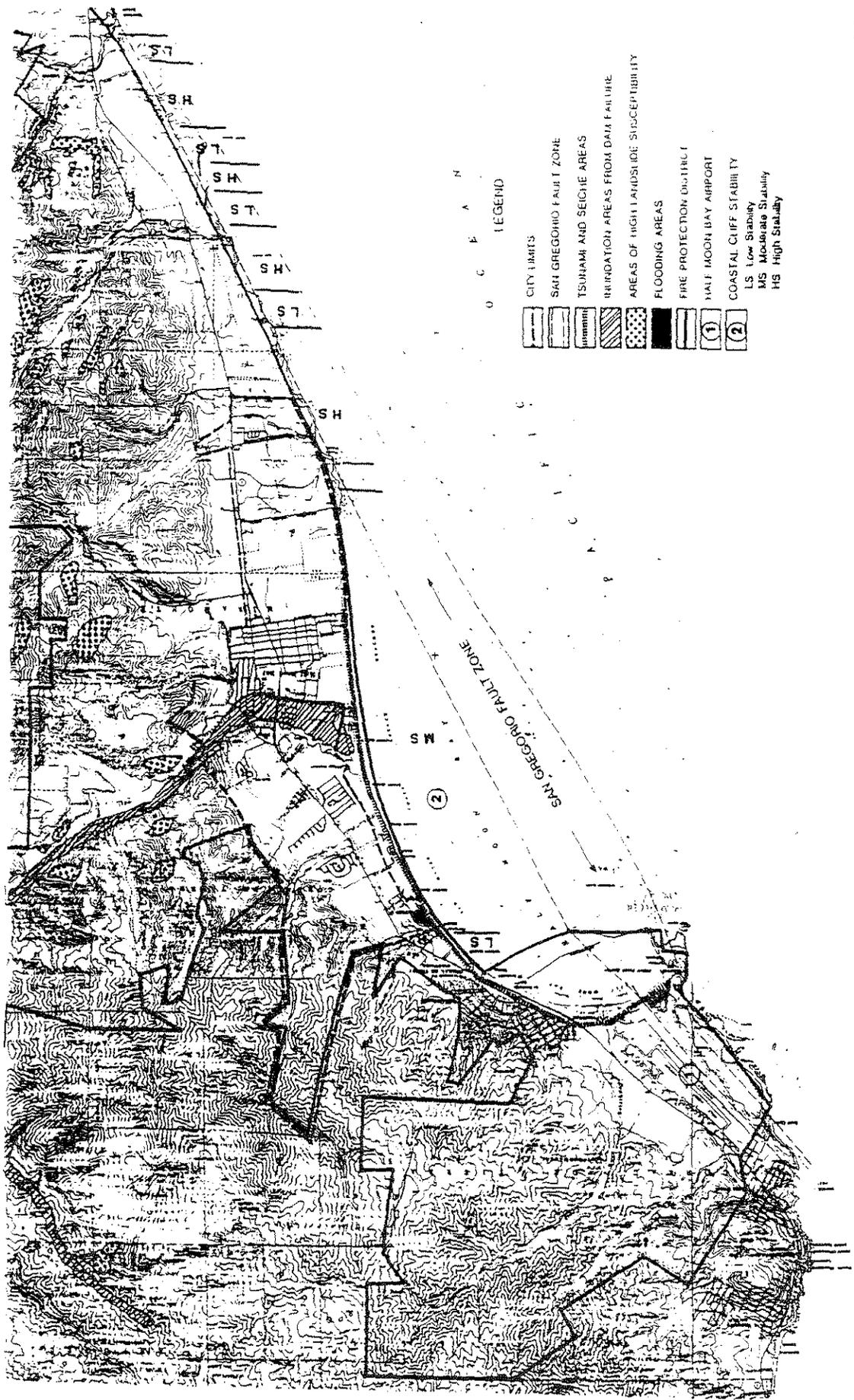
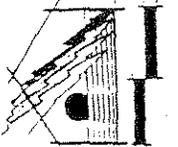
## PERSONS AND ORGANIZATIONS CONTACTED

City of Half Moon Bay

Fire Protection District:	Gil Bustichi, Fire Chief Norm Giacotto, Fire Marshall George Bettencourt, Assistant Fire Chief
Planning Department:	Chris Gustin, Planning Director Amy French, Associate Planner
Police Department:	Dennis Wick, Police Chief
Public Works Department:	William G. "Mike" Smith, Director

San Mateo County

Office of Emergency Services:	Harvey Smith Mel Toomer
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- LEGEND
- CITY LIMITS
  - SAN GREGORIO FAULT ZONE
  - TSUNAMI AND SEICHE AREAS
  - WINDRAGON AREAS FROM DATA FAILURE
  - AREAS OF HIGH LANDSLIDE SUSCEPTIBILITY
  - FLOODING AREAS
  - FIRE PROTECTION DISTRICT
  - HALF MOON BAY AIRPORT
  - COASTAL CLIFF STABILITY
    - LS Low Stability
    - MS Moderate Stability
    - HS High Stability

# ATURAL HAZARDS MAP GENERAL PLAN

CITY OF MOON BAY