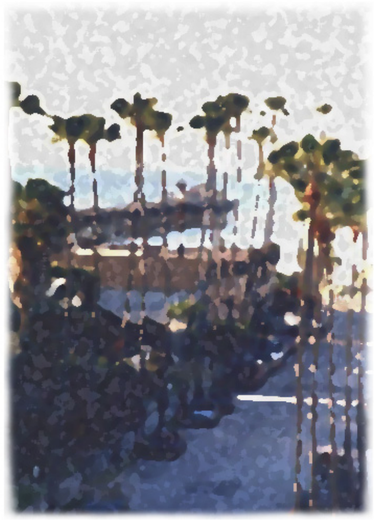
City of Seal Beach



Safety Element

Contents

List of Figures

Introduction

Purpose and Background

The Seismic Safety - Safety Element was originally adopted on July 14, 1975. As the result of subsequent changes in the requirements regarding General Plan Elements, the City decided on August 11, 1997 to rename this Element (i.e., "Safety Element") and to expand its scope to cover storm drainage, shoreline protection, and the use, transport, and disposal of hazardous materials.

The Safety Element is organized into six topics and an implementation chapter. Following the introduction, Topics 1 through 6 discuss separate safety issues as they relate to the City of Seal Beach. Following the discussion in each topic are policies to deal with the identified issues. The Implementation section of the Element indicates which City Department has primary responsibility for implementing each policy, how it will be funded, and the scheduled timing for implementation.

The major topics discussed in the Safety Element are:

- Emergency Planning/Response
- Hazardous Materials
- Geologic Hazards
- Fire Hazards
- Flood Hazards
- Shoreline Protection
- Implementation

Statutory Requirements

In 1971, the California State Legislature required that all cities and counties adopt Seismic and Safety Elements as part of their General Plans. The basic objective of the Safety Element is to reduce loss of life, injury, damage to property, and economic and social dislocation resulting from future natural and man-made hazards. To achieve this objective, the Safety Element is utilized as the major tool for identifying hazards that should be considered before making land use decisions. Mapping is required of known seismic and other geologic hazards (such as landslide areas), and issues such as emergency evacuation routes and water supply for fire fighting must be addressed.

Government Code §65302(g) requires a Safety Element that is developed 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, liquefaction, and other seismic hazards; flooding and wildland and urban fires. A Safety Element shall also address evacuation routes, peak load water supply requirements, and minimum road widths and clearances required around structures, as those items relate to identified fire and geologic hazards.

Topic 1: Emergency Planning/Response

The potential for a major calamity increases with the continuing urbanization of previously unpopulated areas and with the advent of industrial processes that utilize hazardous materials. The impacts of earthquake, fire, and flood are magnified as more and more high-risk land is urbanized. Because of their unknown or unexpected nature, many emergencies require quick and decisive action. Because disasters are dynamic and we continually learn through experience, emergency response and planning should also be dynamic and continually maintained and updated. Several disasters in Seal Beach and in other communities in California have taught us a great deal about disaster response.

The City of Seal Beach adopted an Emergency Operations Plan in June 1996. This Plan details the City's specific responsibilities before, during, and after any emergency. This Plan is consistent with the State Emergency Services Plan, which describes the response of all levels of government and certain private sector organizations to natural, man-made, or war-caused emergencies that threaten life, property, and the resources of California. Section 8568 of the California Emergency Services Act provides a basis for the City's emergency management programs by requiring cities to carry out the provisions of the State Emergency Services Plan. The City's Plan is an extension of the state plan.

The City's plan describes how the City will respond in the event of, but not limited to, a state of war or act of terrorism emergency, natural emergency situations (earthquakes, fires, floods, storms and tsunamis), and man-made emergency situations (pollution spills, civil disturbances, aircraft accidents, industrial accidents, explosions and radiological incidents). Emergencies that are preceded by a recognized buildup period allow for advance warning to those impacted areas and population groups. Timely warning and information broadcasts are important to citizens' ability to help themselves, and for their evacuation. Emergencies generally occur without advance warning, and therefore require prompt mobilization and commitment of the emergency organization after the onset of the emergency.

During or following local emergencies, the City is the first agency involved. If the emergency is so large that the City's resources are inadequate or exhausted, assistance will be requested of, and provided by, nearby jurisdictions through mutual aid agreements. Neighborhood groups can assist to the City by conducting first aid and search and rescue operations in times of large disasters. When mutual aid systems are not sufficient for the disaster task, the County requests assistance from the state. The Governor's Office of Emergency Services (OES) coordinates regional emergency response and disaster assistance. The state may also request aid from the federal government in the form of a Presidential Disaster Declaration. The Federal Emergency Management Agency (FEMA) then provides disaster assistance, temporary housing assistance, and recovery funds after a Presidential Disaster Declaration.

The City's Emergency Services Plan lists three temporary seats of government in the event City Hall is not available. These locations are the Seal Beach Police Department, the Seal Beach Public Works Department, and Fire Station #48 on Beverly Manor Road. Due to the close proximity of all of these alternate locations, none of these facilities are likely to be available in a major catastrophe such as an earthquake. The locations of alternate seats of government and emergency facilities have not been evaluated as to their effectiveness in terms of location and response capabilities.

Mobility of the community to accomplish evacuation and the deployment of emergency personnel during any disaster is essential. A variety of emergency response challenges exist within the City of Seal Beach. The City is located in an area subject to strong earthquake impacts and flooding impacts. In addition, the Los Alamitos Joint Forces Training Base is located to the north of the City boundary, and flight operations from the Training Base generally take off over the City of Seal Beach, resulting in a potential for aircraft emergency responses, particularly in the case of an aircraft accident (refer to Figure S-1). The large majority of flight operations at the Training Base are helicopter operations, which do not result in a major exposure to the general public in the event of an accident.

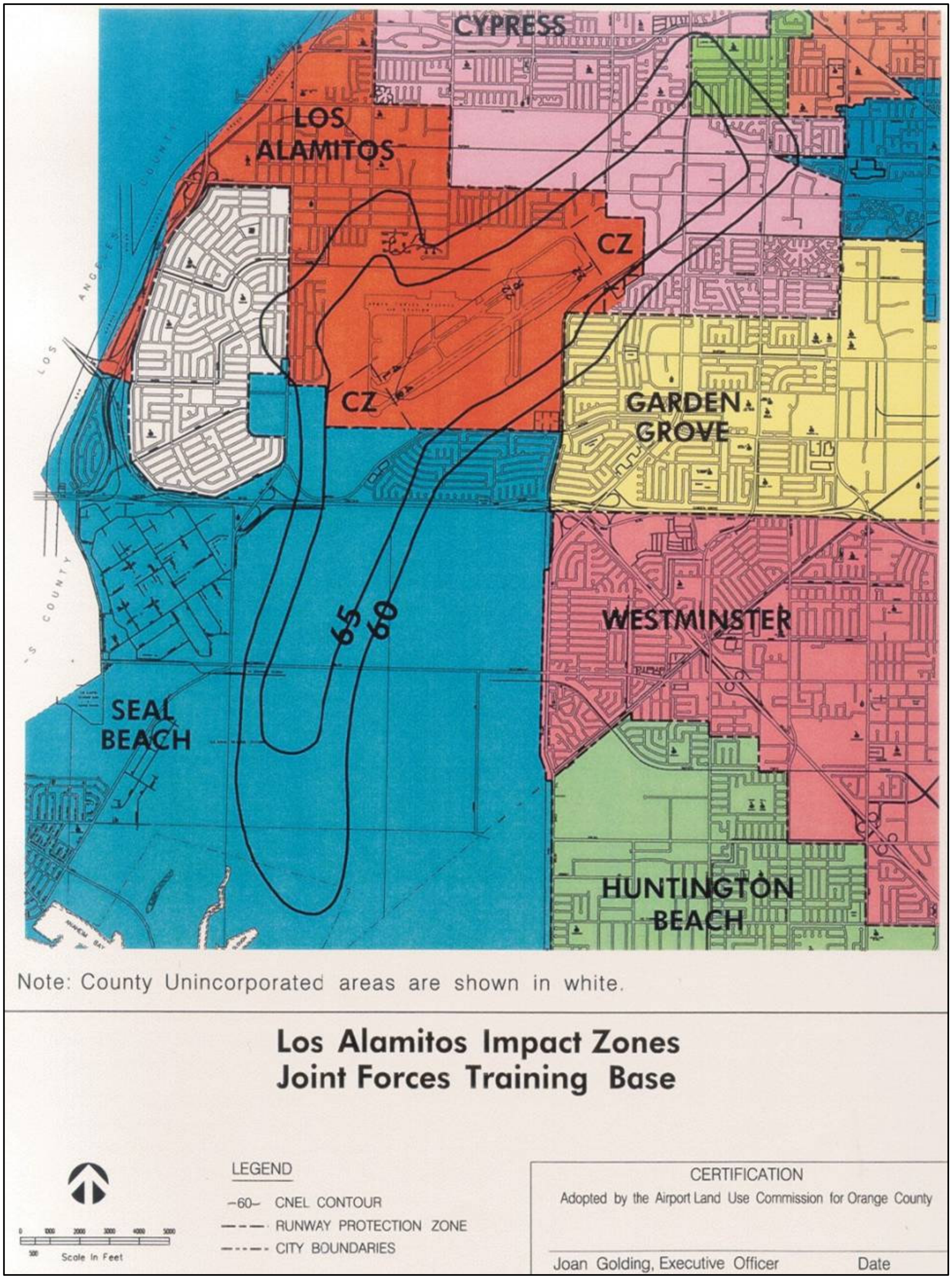


Figure S-1 - Los Alamitos Impact Zones, Joint Forces Training Base

Structures within the City should not exceed the elevations defined in the Federal Aviation Regulations (FAR), Part 77 – "Objects Affecting Navigable Air Space," as applicable to the Los Alamitos Joint Forces Training Base. These regulations are the guidelines that describe the ultimate heights of structures under the "imaginary surfaces" and would be used for determining if a proposed structure is an "obstruction" (refer to Figure S-2-AELUP Height Restriction Zone for JFTB).

All developments within the City will be subject to the FAR Part 77 Notice Requirements. The sponsor of any project that requires the filing of notification with the Federal Aviation Administration shall provide copies of the completed FAA form 7460-1 or 7480-1 to the Director of Development Services and to the Executive Director of the Airport Land Use Commission. The City will incorporate the findings of the Airport Land Use Commission and the FAA into its decision-making process as it pertains to individual projects.

It is the City's responsibility to develop evacuation plans that readily and effectively remove residents from hazardous areas to locations of greater safety. The mandate of the City to protect public health, safety, and welfare requires the City to ensure that disaster planning within each neighborhood meets both the City's and neighborhood's interpretation of acceptable risk. In issues of overriding safety concerns, the City's mandate requires affirmative action to maximize public safety.

A discussion of emergency response and evacuation must focus on three levels of preparedness: the household, the neighborhood, and the community at large. Specific policy decisions and public actions must be taken at each of these levels to assure an acceptable level of risk for the City's residents.

Household Emergency Planning

Household emergency planning refers to actions that are taken by private citizens to increase their own level of disaster preparedness. Emergency response at this level generally requires the dispatch of specific vehicles to serve specialized functions.

The highest probability of an evacuation occurs from individual households. Isolated occurrences arise due to structural fires or localized flooding, as experienced in the 1983 storms and again in January 1995. Evacuation at the household level generally does not require public agency assistance, except to deal with the cause of the evacuation and medical care. Problems associated with response to individual households are generally related to street closures due to some impact directly related to the disaster incident itself.

Families need to increase their general preparedness for the most likely natural disasters that could occur in their particular location. Many specific steps can be taken on the part of a homeowner to gain some autonomy and safety in the case of a natural disaster. Adequate supplies, training, and education about the effects of likely disasters and available support systems help in this regard. The City can support these individual household efforts with various services, such as the periodic distribution of emergency planning packets that provide up-to-date emergency planning information and response guidelines.

Neighborhood Emergency Planning

Neighborhood emergency planning requires the neighborhood and the community to determine an acceptable level of risk and the resulting public actions to elevate disaster preparedness to that level. Evacuation planning refers to the removal of people from areas of extreme hazards to areas of public safety.

As a result of historic development patterns and constraints imposed by local topography, the City is divided into geographic neighborhoods. These neighborhoods are an integral component of emergency response planning. Emergency planning should incorporate the resources of the individuals within these neighborhoods and recognize the constraints each neighborhood embodies.

A citizen response model could be incorporated into the City's Emergency Operations Plan that utilizes a neighborhood coordinate system of planning and response. This plan could also incorporate a communication component for information coordination and emergency resources allocation. It might be possible to designate individual neighborhood communication sites and establish emergency local radio broadcasts. Neighborhood planning could build upon the Neighborhood Watch program. This program has been a victim of funding priorities, but as a response to the requirement of the Emergency Plan to promote neighborhood autonomy, it could be re-invigorated and supported by City staff. For instance, a periodic newsletter could be established to help keep the neighborhoods informed of the most recent advances in emergency response and coordination.

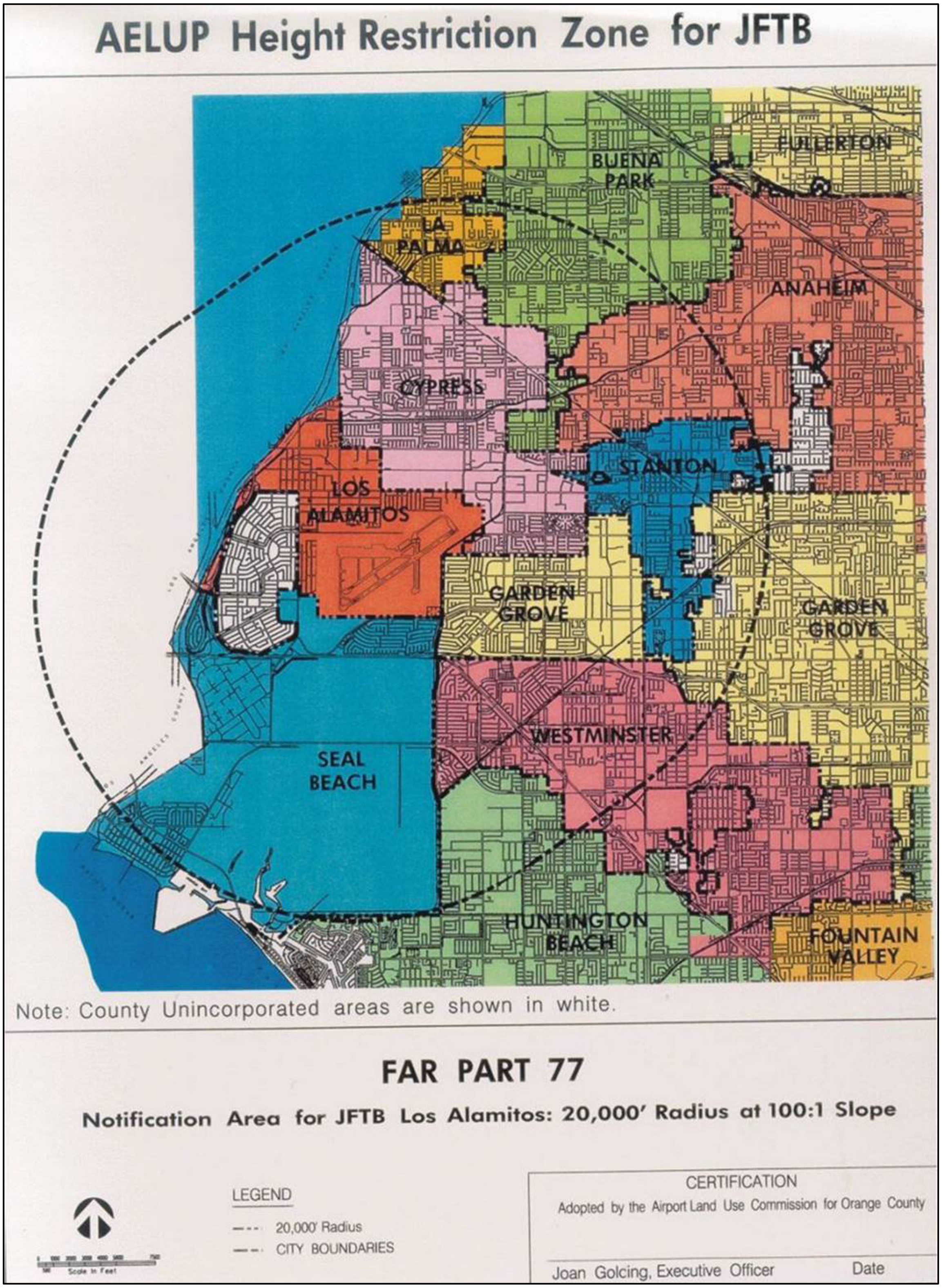


Figure S-2 - AELUP Height Restriction Zone for JFTB

Community Emergency Planning

Community level emergency planning includes the development of an emergency plan to be initiated in the event of a citywide evacuation. The Emergency Operations Plan anticipates this type of concern, and includes provisions for emergency housing, transportation, clothing, food, and medical aid. As neighborhood evacuation planning addresses evacuation routes from various neighborhoods, comprehensive citywide emergency planning includes the development of a supportive infrastructure responsive to the emergency needs of the community.

As part of a community-wide response to evacuation planning, the City's Emergency Operations Plan identifies the roles and relationships of all governmental, quasi-governmental, and private service agencies existing within the City and could be updated to inventory facilities within the community available for emergency response needs. This plan becomes operational in the event of a local emergency and should be periodically updated.

In the event of a community-wide disaster, more than one evacuation center could need to be established within the City. The scale of such a disaster would preclude individual evacuation attempts from the community in favor of the efficiency of mass evacuation. It is doubtful that any roadway could accommodate vehicular evacuation on a community-wide scale.

Citizens relocated to evacuation centers within the community would need to remain in those locations rather than add to the expected confusion on congested roadways. It is not anticipated that any new roadways serving the community would be needed for evacuation. In the case of a community-wide disaster, the City would need to have coordinated plans with local military organizations for the airlift of supplies and for evacuation of residents requiring medical care beyond the capability of the community's resources.

The City of Seal Beach is fortunate to have the Seal Beach Naval Weapons Station within its corporate boundaries. The Naval Weapons Station can provide personnel and equipment for emergency response activities, and can also serve as an evacuation center in the case of a major earthquake in the City. The Los Alamitos Joint Forces Training Base is located immediately adjacent to the College Park East neighborhood, and is designated as a regional disaster relief center by the State of California. During a major emergency response in southern California, the Joint Forces Training Base would be activated for emergency medical purposes and for evacuation center purposes. The City's Emergency Operations Plan should be updated to reflect this needed coordination with the Naval Weapons Station and the Joint Forces Training Base.

An Emergency Operations Center (EOC) has been established at the Seal Beach Police Department to manage community-wide or neighborhood emergencies. City staff, along with other emergency response providers, would be utilized for staffing the EOC and have, at minimum, annual training events to adequately support its operation. A public information officer is designated in the Emergency Operations Plan, with procedures for obtaining and disseminating accurate information set forth in the Plan.

In the event of an emergency, whether a natural disaster or a situation involving homeland security, the EOC will coordinate response activities with the County of Orange via the Loma Ridge Emergency Operations Center located in the foothills just off the Eastern Transportation corridor (SR 241) near Irvine Lake. During non-emergency situations, the EOC will liaison with the Orange County sheriff's Emergency Management Group for disaster coordination and the Terrorism Early Warning Group for Homeland Security Coordination.

Another asset available to the City in the event of an emergency is the large number of ham radio operators who reside in Seal Beach. These ham operators are a part of a larger group of ham operators known as Radio Amateur Civil Emergency Services (RACES) who can be relied on for assistance during an emergency.

As with all emergency planning, there must be ongoing maintenance and training. This involves the allocation on the part of City government of the necessary funding support for an ongoing emergency management coordinator.

Access Issues

In Seal Beach, the College Park West community is accessed by only one entry point, which creates potentially undesirable access in the event of a disaster. The College Park East, Leisure World, and Surfside communities have only two access points, adjacent respectively to Lampson Avenue, Seal Beach Boulevard, and Pacific Coast Highway, which could result in access difficulties in a major earthquake or flooding situation (refer to Figure S-3 - Impaired Road Access Map).

In addition to these neighborhoods, many of the City's major roadways are susceptible to circulation restrictions and geologic or hydrologic hazards that could result in their closure during critical periods. The number of access routes to any neighborhood is less significant than their circulation capacities (e.g., parking, travel-way width) and their susceptibility to closure by hazards (e.g., bridge damage, flooding).

Some of the neighborhoods, such as College Park East, College Park West, and Leisure World, are not subject to major environmental constraints like an identified fault or floodway. Roadways that provide access to these neighborhoods cannot always remain open, because under even minor adverse conditions such as a downed tree or electrical line, these areas may become inaccessible.

The City could undertake a comprehensive emergency access evaluation and upgrade program in which each public and private road/trail is evaluated in terms of providing emergency vehicle access and identifying access problems. The goal of this evaluation and upgrade program would be to upgrade the access-deficient areas by retrofitting the substandard roads/routes in an appropriate manner, based on the results of this evaluation. In addition, an emergency circulation system could be designated for evacuation and response.

The emergency circulation road/route system could be maintained at high priority levels of policy and financial consideration. For instance, the public utility companies could be consulted and encouraged to prioritize the undergrounding of their utility lines along these routes. Tree maintenance could be emphasized on public right-of way and private property along these routes. City maintenance of these roads or emergency routes could receive funding priority.

As discussed above, the most severely access-restricted neighborhoods are College Park West, College Park East, Leisure World, and Surfside. These neighborhoods are single-access or dual-access neighborhoods and are subject to environmental constraints that could restrict access.

College Park West

College Park West is recognized as an area subject to multiple hazards. The major hazard that could minimize access is bridge collapse due to an earthquake. The neighborhood's isolation, proximity to open space areas, topographic conditions, and wind patterns make it susceptible to a wildfire during a Santa Ana wind condition. As a result of these identified hazards, College Park Drive could become impassable. In that event, emergency vehicles would be unable to obtain ingress, and vehicular egress of the residents would not be possible.

The fire hazard potential exists in College Park West due to the threat of structural fire spread during a Santa Ana wind condition. This type of fire can trigger an evacuation response, particularly during a Santa Ana wind condition.

It is imperative to residents' safety that alternative routes of evacuation be established in the College Park West area. Any route located too close to the existing roadway could quickly succumb to the same hazard that forced closure of the existing roadway. The location of College Park West adjacent to the San Gabriel River and the I-405/I-605/Seventh Street interchange make the construction of an evacuation route in this area appear to be aesthetically and economically unsound.

The City needs to continue to investigate and implement an emergency access route that will meet the safety needs of this neighborhood and will be consistent with community economic and environmental goals. An emergency access connection should be investigated utilizing the San Gabriel River levees.

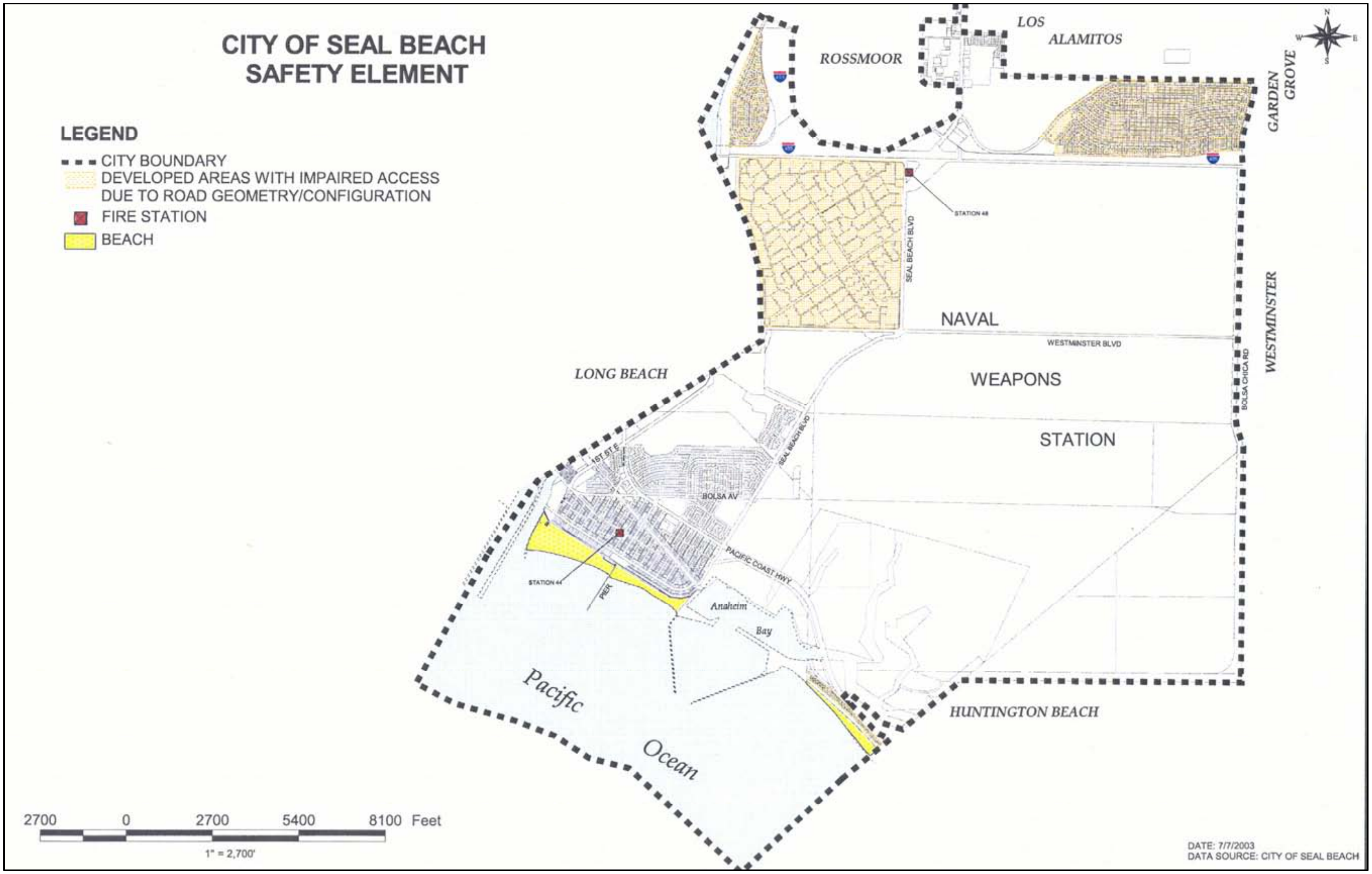


Figure S-3 - Impaired Road Access Map

College Park East, Leisure World, and Surfside

These communities, although not as restricted by access issues, face similar concerns to College Park West. These communities are subject to similar fire hazard exposures as exist in College Park West due to the threat of structural fire spread during a Santa Ana wind condition, with Surfside having the greatest exposure due to the building standards in that community. A wind-driven fire can trigger an evacuation response, particularly during a Santa Ana wind condition. In recognition of the greater fire hazard potential in Surfside, the City has required for some time that all new construction in Surfside provide residential fire sprinklers approved by the Orange County Fire Authority.

It is imperative to residents' safety that alternative routes of evacuation be established in these communities. Any route located too close to the existing roadway could quickly succumb to the same hazard that forced its closure. College Park East is served by Lampson Avenue, with two access points, one to Seal Beach Boulevard, and the other to Valley View Street in the City of Garden Grove. Leisure World has two major access points, both from Seal Beach Boulevard. The southerly access point is located adjacent to Leisure World Center, which provides an additional access point to Westminster Avenue. Surfside has two access points, both of which ultimately access Pacific Coast Highway. The primary access point is at Phillips Street, with direct access only to Pacific Coast Highway. The secondary access point, at Anderson Street, provides access to Pacific Coast Highway at Anderson Street or alternate access points to Pacific Coast Highway by way of Pacific Avenue in Sunset Beach. The location of these neighborhoods, adjacent to freeways, drainage channels, the San Gabriel River, and the Pacific Ocean make the construction of evacuation routes in these areas appear to be aesthetically and economically unsound.

The City needs to continue to investigate and implement an alternate emergency access route system that will meet the safety needs of these neighborhoods and will be consistent with community economic and environmental goals. The provision of pedestrian walkways for the Leisure World and Surfside communities could be established relatively easily to facilitate evacuations by foot. Vehicular access, however, would involve significant construction due to existing site conditions at each of these neighborhoods.

Underground Conversion of Overhead Utilities

Overhead utility lines are known hazards that can be mitigated by relocating them underground. Downed power lines can restrict and delay emergency response vehicles and evacuation. Heavy winds can cause tree branches to knock down power lines, creating a safety hazard, and power poles and utility boxes are hazards in road rights-of way.

Surfside has recently completed a comprehensive utility underground conversion program, and there are no overhead utility services present in Surfside at this time. This program was completed through a resident-approved assessment district.

Policies

1A. Periodically review and update the Emergency Operations Plan to ensure effective implementation of the Plan during an emergency. Incorporate into the Plan as appropriate:

(a) a citizen response model using a neighborhood coordinate system, such as a Neighborhood Watch program;

(b) a comprehensive communications component that maximizes public emergency coordination, response and resource allocation;

(c) a program of coordination with county, regional, state, and federal emergency agencies, schools, hospitals, and utility companies and their plans; and

(d) a program of coordination with the police.

1B. Amend the Emergency Operations Plan to include evacuation plans, and include provisions for emergency shelter, transportation, clothing, food and medical aid, identifying the facilities and persons within the community that may be utilized in an emergency and communicating this information to neighborhood associations and the American Red Cross.

1C. Continue to maintain the Emergency Operations Center (EOC) and provide for its adequate support and staffing, including the acquisition and maintenance of a mobile Incident Command Support vehicle for emergency response.

1D. Continue the function of an emergency management coordinator within the Police Department. The duties of this position shall include, but not be limited to, ongoing training for and operation of the Emergency Operation Center, neighborhood emergency planning and support, ongoing maintenance of the Emergency Operations Plan, general public training and education, and implementation of the City's emergency planning and coordination.

1E. Ensure the periodic participation of appropriate City staff members in exercises designed to familiarize them with disaster response procedures and operational support for the Emergency Operations Center.

1F. Promote public awareness in emergency response preparedness by any effective informational media, such as an Emergency Preparedness Newsletter, neighborhood posters, and regular presentations at neighborhood association/neighborhood watch meetings.

1G. Ensure that disaster preparedness exercises by involved agencies are frequent enough to help improve the efficiency of participating mutual aid agencies.

1H. Ensure that any new street that serves as access to residential development of 5 or more dwelling units has a minimum of 2 contiguous 10-foot-wide paved travel lanes that will remain unobstructed at all times.

1I. Undertake a comprehensive emergency access evaluation and upgrade program that:

(a) will evaluate each public and private road and neighborhood in terms of providing emergency vehicle access and evacuation routes, including pedestrian accessways or trails;

(b) will establish a program to upgrade access-deficient roads by retrofitting them with no-parking fire lanes (established in conjunction with the affected homeowners), turn-arounds, and/or secondary access; and

(c) will develop a primary and secondary emergency circulation plan for evacuation and emergency response.

1J. Encourage emergency vehicular access that is of a sufficient width to allow people and emergency equipment into the hazard area and still allow for evacuation, if needed.

1K. Establish and maintain no parking/tow away zones in all critical areas where feasible to keep travel lanes and street turn-around areas unobstructed at all times.

1L. Evaluate the location of all public facilities necessary for emergency response in relation to the City's current Hazard Maps and the level of risk associated with their locations, and move facilities located in high or extreme hazard areas to areas less subject to hazards, if feasible.

1M. Ensure that any new public facilities are designed and located in such a manner as to eliminate potential hazard impacts that may reduce the utility of the facility following a disaster.

1N. Inform utility companies of potential conflicts between the location of their facilities and the currently identified high or extreme hazard areas and encourage them to program for relocation or undergrounding of potentially impacted facilities, especially along designated primary emergency routes.

1O. Evaluate the City's ability to relocate service equipment, facilities, and the seat of government on an emergency basis in the event of the occurrence of a hazard that might impact existing service locations.

1P. Initiate discussion with utility companies to identify, establish, and maintain local emergency service facilities.

1Q. Continue to encourage the underground conversion of overhead utilities in existing developed areas of the City and continue to require any new development to underground utilities.

1R. Ensure compliance within the City of Seal Beach with the Notice Requirements of Federal Aviation Regulations Part 77, "Objects Affecting Navigable Airspace," and with the referral requirements of *Public Utilities Code*, Chapter 4, Article 3.5, §21676.

Topic 2: Hazardous Materials

There are many definitions and descriptive names being used for the term *hazardous materials,* each of which depends on the nature of the material. For the purposes of this topic, the definition in §25501(k) of the *Health and Safety Code* will be utilized:

> Any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the work place or the environment. Hazardous materials include, but are not limited to hazardous substances, hazardous waste, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the work place or the environment.

Hazardous materials are manufactured, transported, stored, used, and disposed of on a regular basis. Although hazardous materials incidents can happen almost anywhere, certain areas are at higher risk. Areas near roadways, railways, pipelines, airways, and waterways that are frequently used for transporting hazardous materials and areas near industrial facilities that use, store, or dispose of such materials have an increased risk. The primary transportation routes of hazardous materials in Orange County near the City of Seal Beach are the I-405 and I-605 freeways. Some transportation of hazardous materials occurs on Pacific Coast Highway and Seal Beach Boulevard within the City. The City does not have direct authority to regulate the transport of hazardous materials on state highways. The United States Department of Transportation has established regulatory criteria for safe handling and transportation of hazardous materials.

Numerous petroleum product producers with large storage facilities maintain hundreds of miles of pipelines throughout the county. However, no major oil pipelines pass through the City of Seal Beach. Westminster Avenue has a 12.75-inch Southern California Edison fuel line, which provides fuel to the generating stations in Long Beach and Huntington Beach, located within its entire right-of-way within the City. A 16-inch Long Beach Gas line follows the southerly right-of-way of the I-405 Freeway through its entire length in the City. Southern California Gas Company maintains a 34-inch gas line generally along

Lampson Avenue, Seal Beach Boulevard, and the I-405 Freeway right-of-way.

Statistically, the greatest danger to petroleum products lines and natural gas lines is an accidental dig-in due to road maintenance and utility or traffic signal systems repairs, renovations, and new construction. Protection against dig-ins is provided by Dig Alert (Underground Service Alert of Southern California), a utility-locating service paid for by the subscribers of the service ad made up of counties, cities, and public/private utility companies in Southern California. A valuable tool now available to the City is the geographical information system (GIS) computer program. Imputing the locations of major petroleum products lines and natural gas lines into the City's GIS database will provide valuable information for the Emergency Services Plan. In this manner, the City will be able to isolate graphically those areas where these facilities would be in danger of failure during a seismic event or other emergency and then develop a planned response to the failure.

The airspace around the City of Seal Beach is among the busiest in the nation. Hazardous materials may be transported by air over Seal Beach or to destinations at John Wayne Airport, Long Beach Airport, and Los Alamitos Joint Forces Training Base. Finally, because Seal Beach is a coastal city, it is exposed to oil tanker traffic as well as other ships carrying hazardous materials, particularly Navy ships utilizing the Seal Beach Naval Weapons Station.

Because of the distance of the major hazardous materials transportation routes to the residential areas of Seal Beach, the threat of a significant hazardous materials emergency is minimal. Prevailing weather conditions and topography at the incident scene will largely affect the potential magnitude of hazardous materials incidents. Wind direction and velocity, ambient air and ground temperature, and precipitation and humidity will affect the spread of gases, vapors, mists, and the dusts of hazardous materials. Topography can greatly affect the behavior of gases and liquids.

The most likely hazardous materials exposure is use of hazardous materials within the City limits. Household cleaning products, pool chlorine, dry cleaning chemicals, film processing, jewelry making, hospitals, and automobile servicing involve hazardous materials and wastes. The Orange County Fire Authority needs to continue to identify and monitor commercial and industrial users of hazardous materials. It is not reasonable to closely monitor the use of household hazardous materials, but the City has committed, through its state-mandated Household Hazardous Waste Plan, to several actions, including educational campaigns regarding reduced usage and proper disposal; promoting the County's Household Hazardous Waste Collection Centers (the nearest is located in Huntington Beach); and negotiating for annual County-sponsored collection events in Seal Beach. (Each of these collection events costs between $30,000 and $50,000 for an estimated 300 to 400 users or participants.)

The City of Seal Beach planned responses to radiological and hazardous chemical release conditions are provided for in the County of Orange Hazardous Materials Area Plan. This is a state-mandated plan with established criteria. The primary goal of this plan is to achieve the preservation of life, property and environment with the most effective and economical allocation of resources during a hazardous materials emergency. The City of Seal Beach is a participant in the Orange County Hazardous Waste Management Plan, which provides options for siting of hazardous waste collection, treatment, recycling and disposal facilities throughout the County. Together, these plans establish the City's responsibilities and goals and policies in dealing with a hazardous materials incident and with the identification, storage, and disposal of hazardous materials and wastes.

The City currently requires the participation of businesses in the Hazardous Materials Disclosure Program. This involves the disclosure, at the time of obtaining a City business license, of whether the business will generate or use any of the hazardous materials contained on the list of such materials, as well as their quantities. This information is forwarded to the Orange County Fire Authority, Hazardous Materials Program Office, which determines a schedule of onsite inspections. These inspections currently occur at one- to two-year intervals. During the inspections, there is a review of the businesses' hazardous material safe-handling, storage, dispensing, and disposal criteria. Any noted disposal violations are appropriately followed up by the Fire Authority.

The City currently contracts for services for small hazardous material spills, which primarily entails cleaning up spills associated with vehicular accidents. Large spills of hazardous materials would involve a response from the Orange County Fire Authority, which has four Level A Hazardous Materials Mobile Units. The City has a joint powers agreement with the County for mutual aid and joint cost support of these units. In very large spills of hazardous materials, a responsible party is identified, and private firms are contracted for an appropriate and safe clean-up of the site at the responsible party's expense.

Gasoline in underground storage tanks in service stations is considered to be a hazardous material. State, county, and city Health and Fire Codes require special tanks for underground storage. Seal Beach is in the process of removing the known non-complying tanks. Monitoring of some sites is still taking place to identify any contaminants requiring clean-up.

Marine oil spills are considered to be a hazardous material emergency and are typically multi-jurisdictional events. The City of Seal Beach is a participant in the Orange County Operational Area Marine Oil Spill Contingency Plan (OSCP). The OSCP is a component of the Orange County Hazardous Materials Area Plan. The Office of Oil Spill Prevention and Response (OSPR) and the U.S. Coast Guard have primary responsibilities for the clean-up and response effort in coordination with the responsible party. The shoreline is a very significant environmental and recreational resource to the City that could be adversely affected in the event of an oil spill, particularly with the Seal Beach National Wildlife Refuge being directly exposed to ocean waves through Anaheim Bay. The City of Seal Beach will continue to oppose offshore oil drilling when environmental, aesthetic and economic resources are threatened and will continue to monitor the federal government's offshore leasing program to ensure that the impacts of the program on the coastal environment are known and considered.

The Seal Beach Naval Weapons Station and the Los Alamitos Joint Forces Training Base are both involved in Installation Restoration programs to remediate past practices that have resulted in violations of appropriate groundwater, surface water, and soil contamination standards of the state and federal government. Both of these facilities have established a Restoration Advisory Board (RAB), which comprises appropriate state and federal reviewing agencies and the general public. The City is represented on the Naval Weapons Station RAB, and city staff provides information to the City Council and the Environmental Quality Control Board regarding proposed restoration activities, and will propose comments regarding those proposed activities. Although not a member of the Los Alamitos Joint Forces Training Base RAB, the City does receive documents relating to restoration activities, and does review and comment on those activities also.

As a storage facility for naval ordnance, the Seal Beach Naval Weapons Station is a source of hazardous materials. As such, the Navy has developed weapons handling procedures to safeguard against the potential of an accident involving hazardous materials.

Another possible source of a hazardous material is a sewage spill or a mixing of sewage, industrial waste or pollutant discharges with storm drainage waters. This is naturally not acceptable, but operational maintenance and system capacities must support the strict performance standard of proper separation and treatment.

In Seal Beach the San Gabriel River has been particularly problematic in regards to water quality. The State Water Quality Control Board is charged with the responsibility for improving water quality in creeks and the ocean. The Los Angeles Regional Water Quality Control Board has jurisdiction over the San Gabriel River. Each year, a winter storm "first flush" will adversely impact the water quality in the San Gabriel River, which directly impacts water quality along the beach area adjacent to the mouth of the San Gabriel River. These adverse water quality incidents have caused Orange County health officials to close Seal Beach to water recreation activities on many occasions. Adverse water conditions can have serious health consequences for swimmers. Human and animal wastes carry bacteria and viruses that can cause hepatitis and typhoid fever, although the most common ailment is diarrhea according to Orange County health officials. The Seal Beach City Council has requested the appropriate water quality agencies to develop programs to protect the water quality of water emptying into the San Gabriel River, and ultimately into the Pacific Ocean.

The Santa Ana RWQCB, under the authority of the State Water Resources Control Board, has the authority for permitting waste discharges to land or surface waters through a National Pollution Discharge Elimination System (NPDES) permit and also formulates and adopts a Basin Plan for the Santa Ana Region that defines water quality objectives and beneficial uses. The Santa Ana Basin Plan sets narrative and numerical objectives that must be attained (or maintained) and describes implementation programs to protect all waters in the region. The NPDES storm water management program also calls for the implementation of Best Management Practices (BMPs) to the "maximum extent practicable (MEP) in providing control for non-point source pollution and urban runoff. BMPs consist of activities, practices, and/or procedures that reduce non-point sources of pollution such as automotive by-products, trash, food wastes, landscape and agricultural runoff, including fertilizers and pesticides, and runoff from construction sites."

Policies

2A. Coordinate with federal, state, and county hazardous waste management plans to protect the health and welfare of the public, the environment, and the economy of the City of Seal Beach through comprehensive programs that ensure safe and responsible management of hazardous waste and materials.

2B. Implement the measures outlined in the City's Household Hazardous Waste Plan, Orange County's Hazardous Waste Management Plan and Hazardous Materials Area Plan, and the County's Operational Area Marine Oil Spill Contingency Plan to ensure the effective management, transportation and disposal of hazardous waste on a City-wide level.

2C. Support enforcement of state "right to know" laws, which outline the public's right to information about local toxic producers.

2D. Encourage and support the use of alternatives to toxic materials in the home and yard.

2E. Encourage and support the use of central drop-off centers and/or mobile collection vehicles for proper disposal of hazardous materials. Investigate the establishment of drop-off centers and/or mobile collection vehicles within the City and the establishment of a user fee to pay for such services.

2F. Facilitate coordinated, effective response to hazardous materials emergencies in the City to minimize health and environmental risks.

2G. Promote public awareness in hazardous materials emergency response preparedness by any effective informational media, such as an Emergency Preparedness Newsletter, neighborhood posters, and at least annual presentations at neighborhood association meetings.

2H. Support the continuation of the Orange County Fire Authority's hazardous materials disclosure program. Ensure annual inspections of businesses that generate or use hazardous materials, and identify and monitor any historical hazardous materials sites within the City for public health and safety issues.

2I. Promote public participation and education in the implementation of the programs identified in the County's Hazardous Materials Management Program.

2J. Encourage the Fire Authority to monitor the flow of hazardous materials through the City to ensure public safety.

2K. Encourage coordination between the Orange County Fire Authority and the Seal Beach Police Department in the designation of routes and enforcement of hazardous materials, routing ordinances, and laws, with the I-405 Freeway as the primary designated route.

2L. Oppose offshore oil leasing because potential offshore oil spills are a hazard to people and marine resources.

2M. Monitor the federal government's offshore oil leasing program to ensure that the impacts of the program on the coastal environment are known and considered.

2N. Facilitate the proper separation of sewer and storm drain systems through construction upgrades and operation and maintenance of sewer and storm drain infrastructure to eliminate the flow of sewage into the City storm drains.

2O. Facilitate coordination and participation by all of the jurisdictions that make up the Los Angeles and Santa Ana Regional Water Quality Control Boards to improve water quality. Encourage the elimination of sewer discharges and non-point source pollution into the San Gabriel River.

2P. Monitor the Installation Restoration activities of the Seal Beach Naval Weapons Station and the Los Alamitos Joint Forces Training Base, and attempt to ensure that any site restoration activities are conducted to residential clean-up standards and comply with all appropriate regulatory agency requirements.

2Q. Minimize the presence of animal fecal waste, which jeopardizes the public health.

2R. Limit disturbance of natural water bodies and drainage systems, conserve natural areas, protect slopes and channels, and minimize impacts from storm water and urban runoff on the biological integrity of natural and drainage systems and water bodies.

2S. Minimize changes in hydrology and pollutant loading, require incorporation of control, including structural and non-structural BMPs to mitigate the projected increases in pollutant loads and flows, ensure that post-development runoff rates and velocities from a site have no significant adverse impact on downstream erosion and stream habitat, minimize the quantity of storm water directed to impermeable surfaces and the MS4s, and maximize the percentage of permeable surfaces to allow more percolation of storm water into the ground.

2T. Preserve wetlands, riparian corridors, and buffer zones and establish reasonable limits on the clearing of vegetation from the project site.

2U. Encourage the use of water quality wetlands, biofiltration swales, watershed-scale retrofits, etc. where such measures are likely to be effective and technically and economically feasible.

2V. Provide for appropriate permanent measures to reduce storm water pollutant loads in storm water from the development site.

2W. Establish development guidelines for areas particularly susceptible to erosion and sediment loss.

Topic 3: Geologic Hazards

Seismic Hazards Mapping Act

Prompted by damaging earthquakes in northern and southern California, in 1990 the state legislature passed the Seismic Hazards Mapping Act. The purpose of this Act is to protect public safety from the effects of strong ground shaking, liquefaction, landslides and other ground failures, and other hazards caused by earthquakes. The State Geologist is mandated to prepare "Seismic Hazard Maps" that delineate the following seismic hazard zones:

- Amplified shaking hazard zones,
- Liquefaction hazard zones, and
- Earthquake-induced landslide hazard zones.

The seismic hazards maps are 7½° California Geological Survey Quadrangles (Scale 1-24,000). The seismic hazards maps for the Seal Beach area were released on March 25, 1999. The map shows areas where liquefaction or landslide movement is known to have occurred and areas where the potential exists for liquefaction or landslide movement (refer to Figure S-6 on page 51).

Geology

Regional Setting

Southern California is composed of several tectonic plates that move relative to each other. The primary zone of contact between these plates is the San Andreas Fault zone, lying about 60 miles north/northeast of the City of Seal Beach. The area west of the San Andreas Fault is known as the Pacific Plate, which is moving north relative to the North American Plate on the east side of the fault. Each large plate is composed of smaller plates, moving relative to each other. The relative movements and collisions of these plates have created structures and geomorphic features with various orientations.

The City of Seal Beach is in the Los Angeles coastal plain in the Peninsular Ranges of southern California, made up of hills and ranges with intervening, long, and narrow valleys that trend northwest. Some of the higher peaks in Southern California, such as San Jacinto peak at 10,831 feet above sea level, are in the Peninsular Ranges. Much of the coastal margin has single or multiple wide flat benches upon which the highways and coastal cities are situated. The City is shown on the Regional Seismic Map (Figure S-4 - Regional Seismic Map).

The City of Seal Beach is in a zone of deformation extending from the foot of the Santa Monica Mountains near Beverly Hills, southeasterly as far as Newport Beach. It is called the Newport-Inglewood belt of hills and plains. This belt is actually the surface expression of the Newport-Inglewood Fault zone. The zone varies in width from one to four miles and includes a series of folds that have given rise to most of the surface hills, plains, and mesas. The flat areas represent segments of the Pleistocene land surface that was uplifted, tilted southward, and folded by earth movements.

Topography

The majority of the City is located within an alluvial plain that extends southward from the convergence of Coyote Creek and the San Gabriel River. The two channels drain from the northeast and north, respectively, and the combined flow reaches the sea at Alamitos Gap. Landing Hill, located within Seal Beach, and Alamitos Heights in Long Beach and Bolsa Chica Mesa in Huntington Beach, consisting of uplifted blocks within the Newport-Inglewood Fault zone, are the major topographic features within and near the City. Elevations within the City vary from approximately sea level along the Pacific Ocean to 60 feet at Landing Hill. The Landing Hill area is part of the Newport-Inglewood Fault System.

Faulting and Seismicity

Seismic Measurement

Earthquakes are measured two different ways – the Richter scale (magnitude of energy released) and the Modified Mercalli scale (intensity of movement or affects of shaking).

The Richter scale is a well known, but often misunderstood, system used primarily by seismologists to evaluate and compare the energy of individual quakes according to an absolute and objective scale. The magnitude of energy released is calculated from the instrumental record made by the event on a calibrated seismograph. Seismographs record a zigzag trace that shows the varying amplitude of ground oscillations beneath the instrument.

Magnitude is expressed in whole numbers and decimal fractions. Because of the logarithmic basis of the scale, each whole number increase in magnitude corresponds to the release of about 30 times more energy than the amount associated with the preceding whole number value. The 1906 San Francisco earthquake with a magnitude 8.3 generated 1 million times more energy than the 4.3 magnitude earthquake that occurred in Laguna Beach in 1969. Furthermore, the Richter magnitude does not give any indication of the actual damage caused by the quake. Other factors must be considered: distance to the epicenter and its focal depth, as well as geological conditions at the location of damage. Even with these data, the Richter magnitude is more meaningful and useful to the scientist than the layman.

The Modified Mercalli scale is subjective and related not to the energy released, but to people's perception of the quake and the damage done, as determined by field surveys. This scale is more significant to the public, since its steps are delineated by cracked plaster, fallen buildings, ground failure, and citizens' panic, rather than energy relationships measured by instruments. The Modified Mercalli Scale provides a description of the effect of the different levels of earthquake intensity with the corresponding Richter scale (refer to Table S-1).

The Los Angeles Basin in which the alluvial plain is located is one of the most active seismic regions in the United States. Each year, low and moderate intensity earthquakes occur within or near the region. Southern California is likely to experience, on average, one earthquake of M 7.0 and ten earthquakes of M 6.0 over a period of ten years. There are several active and potentially active fault zones that could affect development in the area. Maximum credible earthquake (MCE) magnitudes resulting from potential seismic activity on various active faults are discussed in the following section and presented in Table S-2 on page 42.

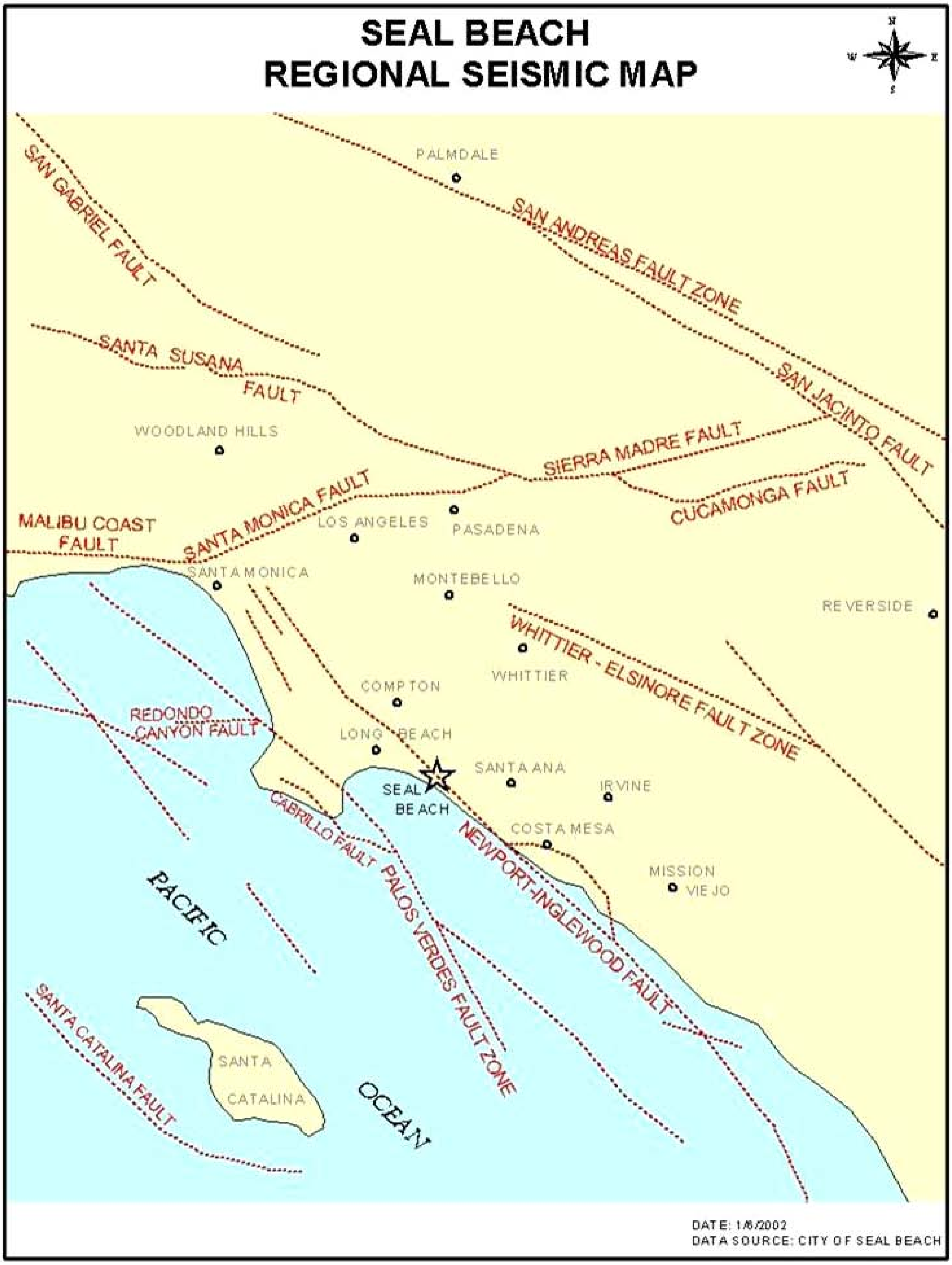


Figure S-4 - Regional Seismic Map

Table S-1 - Modified Mercalli Intensity Scale

The first scale to reflect earthquake intensities was developed by de Rossi of Italy and Forel of Switzerland in the I880s. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology, and in 1902 the Italian seismologist, Mercalli, devised a new scale of a I to XII range. The Mercalli Scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neuman to take into account modern structural features:		
I	(2)	Not felt except by a very few under especially favorable circumstances
II	(2)	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	(3)	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Vibration like a passing truck. Duration estimated.
IV	(4)	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	(4)	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken. A few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	(5)	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	(5-6)	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly-built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	(6)	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	(7)	Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	(7-8+)	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundation; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	(8+)	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	(8+)	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.
Note: Numbers in parenthesis denote Richter Magnitude Source: "California Geology," September 1984		

Active and Potentially Active Faults

Active faults are considered likely to undergo renewed movement within a period of concern to humans. These include faults that are currently slipping, those that display earthquake activity, and those that have historical surface rupture. The California Division of Mines and Geology defines active faults as those that have had surface displacement within Holocene time (about the last 11,000 years). Such displacement can be recognized by the existence of sharp cliffs in young alluvium, unweathered terraces, and offset modern stream courses. Potentially active faults are those believed to have generated earthquakes during the Quaternary period, but prior to Holocene time.

Regional Seismic Conditions

Southern California is located in a seismically active area. There have been many earthquakes throughout recorded history; some have been large. The 1933 Long Beach quake was the most powerful and closest shock to hit Seal Beach in living memory, and the 1994 Northridge quake was the most recent powerful shock. Both of these were felt widely across the Los Angeles basin and caused considerable damage. In October, 1969, a quake occurred that was felt predominantly in Laguna Beach and South Laguna. By way of comparison, the three quakes listed above had the following Richter magnitudes: 1933 Long Beach - 6.3; 1994 Northridge - 6.8; 1969 Laguna Beach - 4.3. The respective Mercalli magnitudes as perceived in Seal Beach were VI, V, and III.

Table S-2 shows that among the 10 active faults and fault zones identified within 100 km of the City of Seal Beach, 3 faults are expected to generate earthquakes of significance. These are the Newport-Inglewood, the Whittier-Elsinore and the Palos Verdes Fault zones. Despite MCE values of M7.5 and larger, the San Andreas, Raymond, San Fernando-Sierra Madre, and San Jacinto systems are of secondary consideration because of their large distances from the City. With expected accelerations below 0.4 g, damage from ground shaking generated along the Whittier-Elsinore Fault and the offshore Palos Verdes Fault could be reduced effectively by complying with ordinary California Uniform Building Code requirements for Seismic Zone 4. However, the proximity of the northwestern tip of the Newport-Inglewood northern (upper) branch, calls for extremely detailed site-specific geotechnical investigations in areas impacted by the Newport-Inglewood Fault. These earth-engineering studies would better and more accurately estimate the reaction of the surficial sediment to the design-earthquake for this segment of the Newport-Inglewood Fault.

Newport-Inglewood Fault Zone

This zone (see Figure S-5), made up of several faults and fractures, extends southeast through the Los Angeles Basin. The north branch of the Newport-Inglewood Fault (distinctly different from the fault zone) is made up of up to 3 segments; thus, the accurate location of individual fault traces is likely to be uncertain. The fault is at least 10 miles long, and its Holocene activity is revealed by characteristic offset stratigraphy and groundwater cut-offs in young Quaternary alluvium. The activity of this fault was proven by the 1933 Long Beach M6.2 earthquake. The Seal Beach Fault, a segment of the Newport-Inglewood Fault zone, is located within the City and generally parallels the coastline, extending from Long Beach generally through the Hellman Ranch property and the Seal Beach Naval Weapons Station, southerly through Huntington Beach and along the coast to Newport Beach. Exploration wells have identified the Seal Beach Fault at a depth of over 4,000 feet. The Seal Beach Fault is considered potentially active and is included in the Earthquake Fault Zones established under the Alquist-Priolo Earthquake Fault Zoning Act.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The main purpose of the Act is to prevent the construction of buildings used for occupancy by humans on the surface trace of active faults.

Under the Act, the State Geologist has established regulatory zones on the surface traces of active faults and is distributing maps of these zones to all affected cities, counties, and state agencies. The zones are referred to as "Earthquake Fault Zones" (formerly called "Special Study Zones") and provide the municipality or jurisdiction with a tool to plan and control new or renewed construction within the fault zones.

Before a proposed project can begin, a geotechnical investigation must be undertaken in order to ascertain whether the project is on or near an active fault. A structure for human occupancy cannot be placed over the trace of an active fault, and must be set back a specified distance from the fault (generally 50 feet).

Whittier-Elsinore Fault Zone

This zone is located approximately half way between the San Andreas Fault and the Pacific shore. The Elsinore Fault system bounds the northern edge of the Santa Ana Mountains. The Glen Ivy North and Glen Ivy South Faults are the two Elsinore system members that could most likely affect the City, and are 20 to 25 miles away. The north branch, at least 17 miles in length, shows Holocene activity through offset stratigraphy and characteristic physiographic features. Moreover, this fault is believed to be the originator of the M6 earthquake of 1910 in the area. The Whittier Fault, 16 miles away from the City, offsets Holocene stratigraphy near the Santa Ana River. It is believed that the 1987 Whittier-Narrows M5.9 earthquake occurred along concealed thrust segments of this fault, located 6 to 10 miles below the earth surface. For a given earthquake magnitude, a thrust faulting mechanism may generate the highest peak acceleration when compared with other mechanisms, and thus may cause damage in excess of that anticipated.

Palos Verdes Fault

This fault separates the Palos Verdes hills from the Los Angeles basin. The fault has an active offshore component crossing the San Pedro shelf, and is located 15 miles away from the City.

Potentially Active Faults

Potentially active faults – i.e., those that show evidence of displacement during the last 2 million years, but not during the last 11,000 years – are represented in the general area of the City by the Camarillo-Simi-Santa Susana, Indian Hill-San Jose, Eagle Rock-San Rafael, and Mission Hills fault systems. Because their effect on the overall seismicity of the City is minimal when compared to the activity of Holocene faults, they are not considered further.

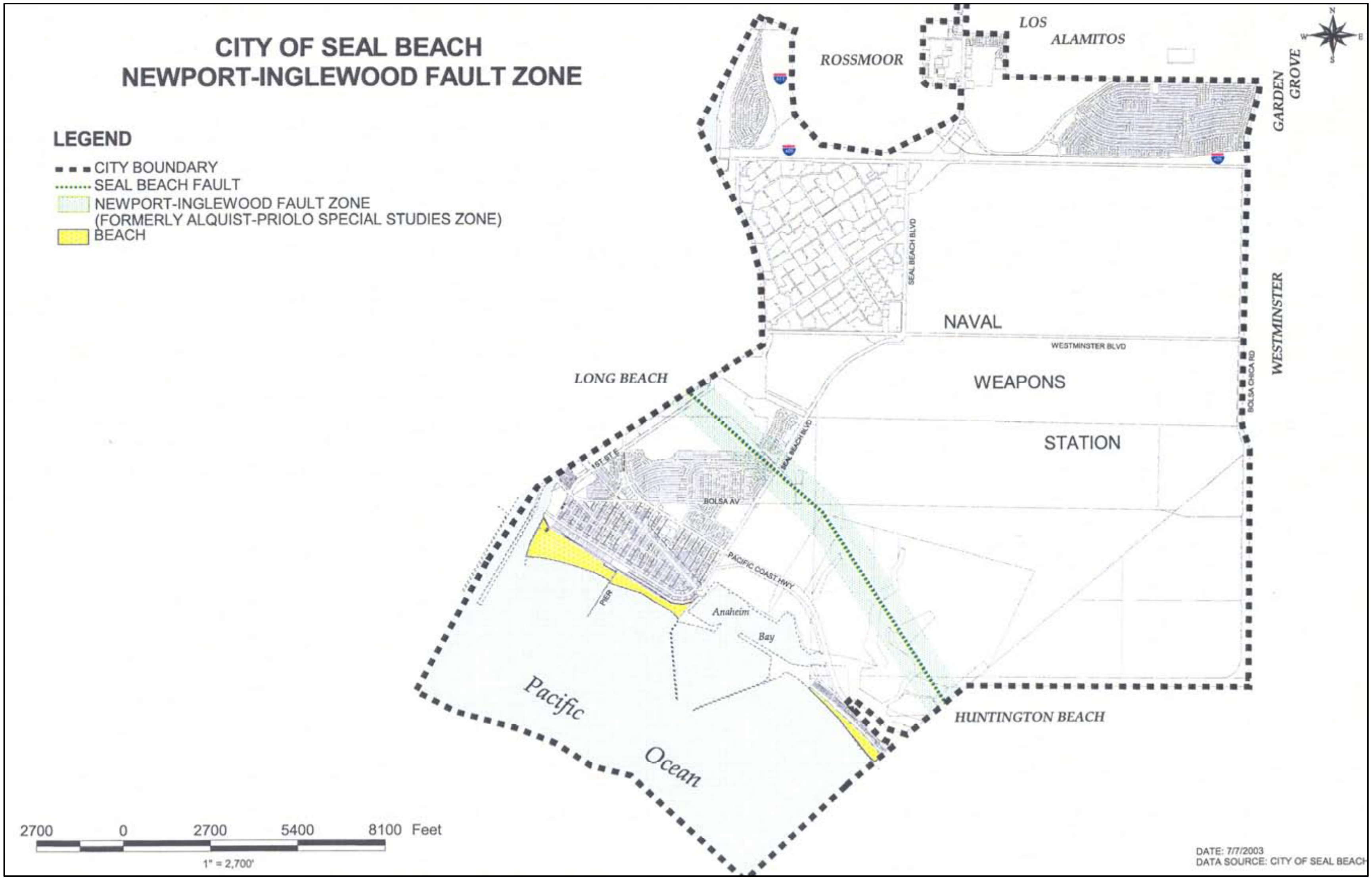


Figure S-5 - Fault Zone Map

Seismicity

The expected ground motion characteristics of earthquakes at a given location depend on the distance of the source of the earthquake to the site, the characteristics of the generating fault (intensity of the earthquake and duration of shaking), and the site-specific geologic and geotechnical conditions. All other conditions being equal, the severity of groundshaking increases with proximity to the epicenter of the earthquake. Assuming equal distance to the epicenter and equal seismic energy output, the least amount of damage would occur on a site underlain by bedrock at a shallow depth. A site underlain by thick alluvium would experience considerably more damage because of the soil's tendency to permanently deform to a greater degree than the bedrock. The intensity of groundshaking (maximum horizontal ground acceleration) is measured relative to the acceleration caused by gravity (g). California Uniform Building Code standard engineering designs for Seismic Zone 4 can be applied to accelerations less than 0.4g. Special designs are necessary for values above 0.4g.

The most likely source of strong earthquake shaking within the general area would be a major earthquake (up to M8.25) on the San Andreas Fault, 58 miles to the north-northeast. This active fault is believed to have a recurrence interval of 100 to 200 years. Although the San Andreas Fault is expected to generate strong earthquakes, because of the great distance between this fault and the City, the average peak acceleration is expected to be within the 0.4 g bound as indicated in Table S-2. The Newport-Inglewood fault zone, located within the City and designated the Seal Beach Fault, is likely to generate 0.5g or higher ground accelerations.

The greatest hazard from ground-shaking is the effect on the structures and the occupants of the structures. The manner in which structures respond to earth movements is dependent upon the type of construction, the underlying geology, and the magnitude of and distance from the earthquake.

Table S-2 - Maximum Credible Earthquake Magnitudes for Selected Active Southern California Faults within 62 Miles of the City, Their Distance to the City and Average Peak Rock and Stiff-Soil Acceleration

Active Faults and Active Fault Zones[1]	MCE[2] (Magnitude)	City-to-Fault Trace Distance[3] (miles)	Estimated Average Peak Acceleration in City During Maximum Credible Earthquake (as fraction of acceleration due to gravity)	
			Average of 6 Studies[4]	According to Idriss, 1985
Cabrillo Fault	6.5	16	0.15	0.14
Cucamonga Fault	7.0	36	0.08	0.08
Malibu-Santa Monica-Raymond fault zone (Raymond Active)	7.5	30	0.14	0.13
Newport-Inglewood fault zone	7.0	-	0.52	0.49
Palos Verdes fault zone	7.0	15	0.21	0.20
San Andreas (Central)	8.25	58	0.10	0.12
San Andreas (Southern)	7.75	60	0.07	0.08
San Fernando-Sierra Madre fault zone	7.5	32	0.135	0.12
San Jacinto fault zone	7.5	55	0.07	0.07
Whittier-Elsinore fault zone	7.5	16	0.25	0.23

1 Compiled from Ziony and Yerkes (1985).
2 Following Mualchin and Jones (1992), similar to Greensfelder (1974); Cucamonga fault upgraded from M6.5 to M7.0. Retained Greensfelder's M 8.25 for San Andreas fault (Central) and upgraded MCE for San Andreas (Southern) from M7.5 to M7.75.
3 Approximated graphically from Greensfelder's map (1974).
4 Studies included in Mualchin and Jones (1992).

Statewide seismic design standards for new construction were not included in building codes until 1933, after the Long Beach earthquake. Although seismic design standards have improved over the years, they are minimum standards and will not make buildings completely resistant to damage from earthquakes. Seismic design standards are only meant to increase structural stability, reduce damage, and minimize loss of life.

Generally, certain types of construction withstand ground movement better than others. Wood frame, single-story residential structures are the most stable during an earthquake. Structures with unreinforced masonry walls are the structures most susceptible to damage. Unreinforced masonry construction was prevalent during the late 1800s to early 1900s for commercial structures. There are no unreinforced masonry buildings in Seal Beach today.

The local geology affects the intensity of earthquake shockwaves as they pass through the area. All of Seal Beach is located on thick alluvial sediments. Severe damage to structures can result where tall structures are built over thick, soft, water-saturated soils. The presence of a high water table can make damage worse. Areas of thick surficial soils on hillsides may also be susceptible to increased shaking. Geologic conditions vary so markedly that each individual site must be evaluated to determine the seismic standards necessary for construction.

Some facilities warrant special seismic standards because of their occupancy and/or their function. Schools, hospitals, and facilities necessary for emergency operations fall into this category. Other facilities, such as utility lines, warrant special attention to siting and seismic design standards. The Uniform Building Code addresses these facilities under the classification of "essential facilities." Public schools in California fall under the approval authority of the State Architect, who enforces the high standards of earthquake bracing for all new schools. Hospitals, clinics, and nursing homes fall under the jurisdiction of the Office of Statewide Health Planning and Development. Seismic standards are enforced on all other structures by the City.

A major earthquake of magnitude 7 or greater (Richter) on the Newport-Inglewood Fault could have serious effects on the lifelines (facilities such as highways, bridges, electrical power lines, gas lines, water and sewage lines and communication lines) in Seal Beach according to Special Publication 99, prepared by the Division of Mines and Geology and the Department of Conservation. The hypothetical earthquake is postulated as a possible worst case for emergency planning. Potentially damaging shaking could continue for about 25 seconds within 25 miles of the Newport-Inglewood Fault Zone, with surface displacements averaging 3 feet to 6 feet occurring on discontinuous segments of the active fault segments.

This planning scenario earthquake could have the following major impacts in the Seal Beach area:

- Pacific Coast Highway through Long Beach is closed (open to local emergency traffic only) from the Los Angeles River east to 7th Street.
- Pacific Coast Highway south of 7th Street in Long Beach to Corona Del Mar is closed due to many pavement breaks and settlements. Short portions are open, but no significant through traffic is able to use the route. Reopening the entire route in less than 72 hours is not expected. However, short

portions may be accessible to emergency traffic in less than 24 hours.

- Garden Grove (SR 22) Freeway is damaged at the interchange with the 405 Freeway.
- Moderate damage at the Garden Grove/405 Freeway interchange combined with fill settlements has blocked traffic flow on the Garden Grove Freeway for 36 hours.
- The 405 Freeway is closed from the Garden Grove Freeway to San Diego Creek. This route in the Westminster and Fountain Valley area has suffered considerable pavement and liquefaction damage. The 405 Freeway is not expected to be reopened to through traffic in less than 72 hours. However, short segments north of the Santa Ana River may be opened to restricted traffic in 36 hours.
- At the 405/605 Freeway interchange, minor bridge damage in the interchange area has restricted traffic to a single lane.
- Los Alamitos Joint Forces Training Base is closed for 24 hours due to runway damage due to liquefaction.
- Seal Beach Naval Weapons Station railroad facilities closed for more than 72 hours due to major disruption of tracks within the Station.
- Telephone service severely restricted to emergency service providers for at least 72 hours.
- Harbor, Long Beach, Los Alamitos, Haynes, and Huntington Beach power plants all shut down for more than 72 hours. Able to operate at no more than 50 percent of capacity for 30 to 60 days.
- All along and adjacent to a zone of surface rupture, there are thousands of damaged and leaking gas lines, valves, and service connections. There are numerous fires in streets at broken gas lines.
- Substantial damage to water distribution systems is expected. Within the fault zone, the distribution system will be 95 percent out of order.
- About 25 percent of all electrical service connections within the impact area are expected to be without electrical power for the first 24 hours. Restoration of power could vary from 1 to 14 days.
- Orange County Sanitation District Plants #1 and #2 are expected to be shut down for several weeks, with sewage overflows being bypassed to the Santa Ana River Channel, contaminating nearby beaches.
- Ground failures in the Seal Beach area have damaged oil storage facilities and related piping with consequent fuel spillage into Alamitos Bay.

Underground waste water pipelines could be expected to perform reasonably well except in liquefaction areas, where significant damage should be anticipated. Potential failure locations are at connections between service lines and transmission lines. In addition to loss of sanitary sewer service to thousands of people, the most serious impact of the projected damage to the waste water system would be the contamination problems of the discharge of untreated sewage into the ground, the streets, and the ocean. The primary impact on natural gas facilities would be fires, which could be expected due to broken gas mains and service connections in the areas of high liquefaction potential. Fires can be very difficult to deal with when there are damaged roadways and broken water lines, combined with disrupted communication lines. Preparedness for seismic disturbance is of very great importance relative to gas service.

Geologic Hazards

Geologic hazards affecting the City area are direct, construction-related effects and indirect effects that occur only during earthquakes. Table S-3 presents five construction-related effects and two indirect, earthquake-induced impacts. Other generally recognized impacts are simply not expected within the majority of the City for various reasons. Tsunamis would only affect the shoreline along the Pacific Ocean and at Anaheim Bay. Similarly, the potential impact on mineral resources exists only on the Hellman Ranch property and the Seal Beach Naval Weapons Station, as those are the only mineral production areas within the City. Landsliding, either as a direct impact or as an earthquake-induced event, would only occur in close proximity to Landing Hill, due to the practically flat site topography of the remainder of the City.

Because the most hazardous impacts are those related to, and triggered by, seismic events, detailed presentations on "Groundshaking" and "Soil Liquefaction" are included in the next two sections.

Table S-3 – Summary of Geologic Impacts

Impacts	Impact			
	Occurrence Probability	Effect	Duration	Significance
1. Alteration of natural topography, caused by grading at a project site	Certain	Direct	Long-term	Insignificant
2. Wind and water erosion during project development	Possible	Direct	Short-term	Significant
3. Sloughing/caving of excavations in saturated unconsolidated/ noncohesive sediments	Possible	Direct	Short-term	Significant
4. Secondary soil consolidation; uneven and/or excessive settlement	Possible	Direct	Long-term	Significant
5. Prime farm land removed from agricultural inventory	Certain	Direct	Long-term	Significant
6. Earthquake hazard; strong groundshaking of unconsolidated alluvium, danger to humans and structures	Possible	Indirect	Long-term	Significant
7. Earthquake hazard; unconsolidated alluvium liquefaction	Possible	Indirect	Long-term	Significant

Groundshaking during Moderate to Strong Earthquakes

Groundshaking is the movement of the earth during an earthquake. This type of deformation does not necessarily cause permanent ground displacement, but improperly designed structures can be damaged by groundshaking, with considerable property losses and possible endangerment of human life.

At present there are several ways of estimating shaking magnitude at a particular site. Seismic intensities or peak horizontal acceleration and velocity can be calculated. Such calculations provide an estimate of the shaking potential that is essential for design and building codes.

Because the Los Angeles Basin is an earthquake-prone area, it is not possible to plan and construct buildings that are completely risk-free in the region. Strong ground movements are unavoidable during major earthquakes. However, at present, buildings are constructed in Southern California with a quantitative knowledge of the magnitude and shaking intensity the buildings can safety accommodate, with knowledge of the seismic parameters expected at the site, and with information obtained specifically at the site regarding the ground reaction to seismic events. This generally reduces ground-movement risk to a less-than-significant level.

Site-specific data regarding geologic characteristics and earth-engineering properties are determined by geotechnical investigation at an early phase of a project design. Earth engineering consulting firms can generate a picture, based on site-specific data, that quantifies ground motion during any assumed magnitude earthquake. The major geologic data on which the assessment is based include the thickness of Holocene and Quaternary deposits, the depth to cemented alluvium, and the depth to the crystalline basement. It is generally accepted that the thicker the Quaternary alluvium and the more deeply buried the crystalline base, the stronger the ground response to any given seismic event.

The necessary earth-engineering data are the textural characteristics, such as the proportion of silt and clay, and the mean sediment void ratio. It is also accepted that the higher the proportion of fines and the higher the void ratio (strongly correlated in unconsolidated Holocene sediments), the stronger the groundshaking. The sediment wetness at the time the earthquake occurs amplifies the potential for earthquake induced damage. However, such an effect is not unquestionably supported by all specialists in the field. Information on sediment wetness is presented in publications as a parameter that expresses the depth to perched water or to the regional water table; the shallower the depth to water, the stronger the shaking.

Liquefaction

During strong earthquakes, unconsolidated and water-saturated sediments may experience bulk densification leading to an instantaneous rise in sediment pore-water pressure. During this extremely short period, the load within the soil mass is carried by the water, and the soil acquires the mechanical consistency of a suspension; for a short, but critical period, the soil becomes fluid. This process of consistency change from solid to fluid is called liquefaction.

When a soil beneath a structure liquefies, the structure loses its integrity with extremely dangerous consequences. Although liquefaction is always the result of an increase in pore-water pressure, it manifests in several ways. Lateral spreading occurs when large, superficial, and otherwise stable earthen blocks float over liquefied, unstable ground. Such events are associated with slightly tilted surfaces, generating considerable damage to utility lines, pipes, etc. Flow failure occurring on slopes larger than 5 percent (1 to 20 V:H) represents a liquefaction mode in which the whole surface soil moves down slope. Ground oscillation is essentially a lateral spread occurring on areas of flat topography. Loss of bearing strength under structures is the most potentially damaging liquefaction mode because it leads directly to losses in the strength of the structure's foundation and thus great danger for people and property.

Because liquefaction is a particular expression of groundshaking, the potential of which was previously indicated to be a function of site geology and earth-engineering characteristics, the liquefaction potential is also assessed based on geologic and site-specific geotechnical data. The geologic data that determine the liquefaction opportunity (distinctly different from potential) are mainly earthquake related; they are the existence of active faults, their characteristic (average) strain if known, and the recurrence of large earthquakes on such faults. The earthquake magnitude is an all-important geologic parameter when assessing liquefaction potential because it is strongly correlated with shaking amplitude and duration, both of which have been found to trigger liquefaction in susceptible soils. This element of susceptibility, discussed in the next paragraphs, combined with the liquefaction opportunity previously mentioned, leads to the estimation of the liquefaction potential at any particular site.

Liquefaction susceptibility is based on both geologic and geotechnical data. The geologic data refer to the age of the sediment and the depositional process leading to sediment formation. Thus, river-channels and flood-plains are considered most susceptible to liquefaction, while alluvial fans have a lower susceptibility. From the standpoint of sediment age it is also accepted that, in the Los Angeles area, latest Holocene (deposited in the last 1,000 years), Holocene (deposited within the last 11,000 years), and late-middle Pleistocene (deposits formed in the last 1 million years), are associated with distinctly different susceptibilities to liquefaction: the young Holocene is characterized by a very high and the Pleistocene by a minimal susceptibility to liquefaction. The sediment deposition period is important because aging leads to at least a partial cementation of the earth matrix and thus an increase in the geologic consolidation. Generally, the older the sediment, the higher the likelihood that the sediment is consolidated, or even over-consolidated, which implies that soils are of high strength and are therefore not liquefiable.

Another important element that has appreciable impact on the susceptibility to liquefaction is the hydrologic condition of the site, namely the existence of, and the depth to, a body of groundwater. This is significant because the liquefaction event can take place only in water-saturated soil. Thus, it is accepted that groundwater shallower than 30 feet corresponds to conditions of high and very high susceptibilities, while deeper water represents low and very low susceptibilities.

The geotechnical characteristics that dramatically influence liquefaction behavior are the particle-size characteristics, gradation, confining pressure, and relative density of the deposit. The particle shape, the general fabric, and the principal stress ratio in the earth mass are potentially important characteristics. Unlike general geologic characteristics, geotechnical investigation leading to detailed soil engineering characterization must be done on a site-specific basis. The liquefaction risk can only be mitigated through designs based on meticulous geotechnical site investigation. Only following such an investigation one can state that ". . . the environments that favor the occurrence of liquefaction can be delineated with reasonable precision . . ."

The State Division of Mines and Geology Seismic Hazards Maps for the Seal Beach area show areas where historically liquefaction occurred *or* where geological, geotechnical, and groundwater conditions point to a potential for the occurrence of a liquefaction event (refer to Figure S-6).

Landslides

The Federal Emergency Management Agency (FEMA) defines a *landslide* as:

> "Downward and outward movement of slope forming materials composed of natural rock, soils, artificial fills, or combinations of these materials. The moving mass may be preceded by any of three principal types of movement: falling, sliding, or flowing or by their combinations."

Although the term *landslide is* generally assumed to mean any slide of rock or soil down a hill, the term actually encompasses a number of different types of earth movements. Lateral shifts of level ground or rotational movement of land triggered by heavy saturation, liquefaction, or earthquakes are also classified as landslides. An ancient landslide can lie dormant for years with imperceptible creep and gradual consolidation and settlement.

Gradually the shear strength of the old slide mass is overcome and reactivation occurs as a slow or rapid movement.

The occurrence of landslides is a part of the continuous, natural process of the downhill movement of soil, rock, and rock debris. The speed at which this earth material moves down slope can range from imperceptible creep of soil to sudden mass movements of an entire hillside. The size of a landslide can range from several square feet in area to several square miles. Slide thickness may range from less than a foot to several hundred feet. It is important to remember that the complex arrangement of earth and rock units sometimes results in one piece of land having a sound and stable geological foundation while another piece immediately adjacent, perhaps on the same lot, may be entirely different and potentially unstable. It is therefore necessary to study each development proposal individually.

Landslide Hazard Reduction

Damage due to landslides can be reduced through avoidance, removal, or permanent stabilization. The first step is to recognize the existence of an ancient landslide or the probability of a future landslide. This is accomplished through detailed geologic mapping, trenching, drilling, and photo interpretation of surface geologic conditions. Ancient landslides located in undisturbed and undeveloped areas are the easiest to detect through the use of photo interpretation. Detection in developed areas may be much more difficult because the characteristic features of landslides' lobe-like forms and track-like hollows are often obscured. Probable future slides can often be anticipated in areas where other landsliding has already taken place. Hillsides covered with deep soils or that are heavily saturated with groundwater may be potential landslide areas. Additionally, landslide possibilities are greatly increased where the bedrock and hill slope directions tend to be the same.

In order to determine the precise origin of the topographic form, it is necessary to conduct supplementary subsurface explorations. Once the configuration of a potentially active landslide is known by subsurface investigation, the threshold values of failure can be calculated. A value of 1.0 represents equilibrium, where the forces resisting failure or movement equal those forces that cause failure. A value below 1.0 would indicate where a geological failure (i.e., landslide) is expected to occur. The present minimum accepted level of safety value is 1.5, which means that the geological feature is 50% stronger than equilibrium or the forces promoting failure.

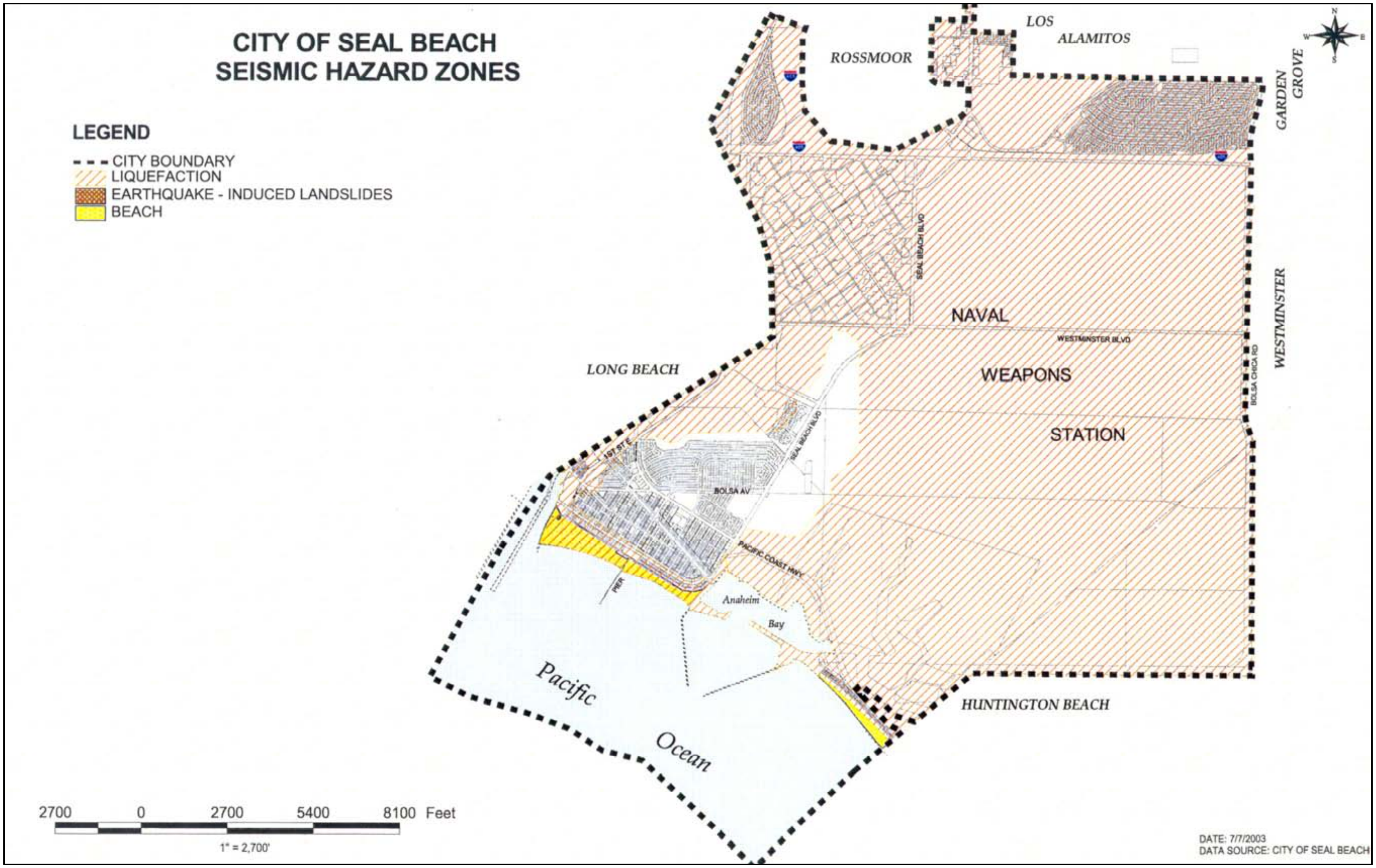


Figure S-6 - Seismic Hazards/Liquefaction Zones

When an area is recognized as a potentially hazardous landslide area, future development can be designed to take this into consideration and existing development can take mitigating actions to reduce potential hazards to an acceptable level. Several methods of minimizing landslide risks include:

1) Leaving hazardous areas undeveloped.

2) Removing unstable slope material.

3) Engineering grading prior to construction.

4) Providing for roof, surface, and subsurface drainage.

5) Constructing retaining walls or other barriers to buttress ancient slides.

6) Reducing the driving forces acting on the slope by reducing the slope angle or the weight of objects placed on the slope.

7) Planting drought-resistant vegetation with deep, strong root systems.

Although these techniques represent effective mitigation to protect development from geologic instability, they cannot ultimately guarantee control over the forces of nature. Diligent investigation, analysis and reporting is essential in making informed land use decisions, but should not be viewed as being absolutely definitive because extreme events, such as unusually heavy precipitation or severe seismic events, are not predictable.

Within Seal Beach there are few areas where landsliding would be a concern. The steep slope areas adjacent to Landing Hill would be the primary areas of concern. The State Division of Mines and Geology Seismic Hazard Maps for the Seal Beach area show areas where landslide movement previously occurred *or* the topographic, geological, geotechnical, and subsurface water conditions point to a potential for earthquake-induced landslides to occur (refer to Figure S-6 on page 51).

Tsunamis and Seiches

Tsunamis are seismic sea waves generated by large submarine earthquakes, volcanic eruptions, or large submarine landslides.

Seiches are stationary oscillations of enclosed or partly enclosed bodies of water caused by landslides, sudden changes in atmospheric and wind pressure or earthquakes. Seismically induced seiches are not considered a potential hazard. The tsunami hazard is considered to be low for the elevations above the principal sea bluff in Seal Beach. Areas on the beach or below the sea bluff are considered to have a moderate tsunamic hazard, depending on tidal conditions and their elevation with respect to sea level.

The Army Corps of Engineers has estimated a 7- to 8-foot potential run-up for the coastal area. Assuming a coincidental highest tide, areas below the 16- to 17-foot contour level could be inundated by a tsunami. The chance of this occurring appears to be low based on existing data; but if an earthquake happened along the Newport-Inglewood fault, a tsunami of a much higher inundation level could be expected.

Policies

3A. Require a soils and geology report to be prepared and filed for all development projects as specified in the City's Municipal Code.

3B. Require geological surveys to be prepared after onsite borings or subsurface explorations at the time subdivisions are submitted to the City for approval.

3C. Require supervision by a state licensed soils engineer for grading operations which require a grading permit.

3D. Maintain and enforce protection measures which address control of runoff and erosion by vegetation management, control of access, and site planning for new development and major remodels, including directing runoff to the street and compliance with setbacks.

3E. Restrict development projects that will cause hazardous geologic conditions or that will expose existing developments to an unacceptable level of risk until the causative factors are mitigated.

3F. Require independent review of the geologic and soils reports as appropriate.

3G. File and reference copies of pertinent site-specific geologic information and index the information in the City's Geographic Information System.

3H. Provide ongoing maintenance and inspection of all public drainage facilities and eliminate or mitigate uncontrolled storm drain flow on hillsides or bluffs.

3I. Require the use of drought-resistant vegetation with deep root systems where appropriate for safety reasons in new development projects to reduce the potential for over-irrigation. Encourage the use of drought-resistant vegetation throughout the City through public education efforts.

3J. Maintain the present City practice of adopting the latest edition of the Uniform Building Code (as amended and published by the International Conference of Building Officials at approximate three-year intervals) because it incorporates the latest accepted standards for seismic design that reflect advances in technology and understanding of hazards.

3K. Prohibit the location of new essential facilities such as hospitals, fire and police stations, emergency centers and water tanks in geologically hazardous areas unless it is determined that there is no feasible alternative and the hazard is adequately mitigated.

3L. Require that earthquake survival and efficient post-disaster functioning be a primary concern in the siting, design and construction standards for new essential facilities.

3M. Evaluate the long-term risks and their associated costs versus the costs of relocation when major improvements to existing essential facilities are proposed and the facilities are located in known hazardous areas. Relocate the facility if the analysis indicates this is more cost effective in the long term.

3N. Determine the liquefaction potential of a site prior to development and require that specific measures be taken, as necessary, to reduce damage in an earthquake.

3O. Promote the collection of relevant studies on fault location and history of fault displacement and liquefaction for future refinement of the geological information within and around the City.

3P. Identify the effects of the most probable seismic event (Modified Mercalli intensity value VIII or more) on the infrastructure within the City.

3Q. Incorporate information on the probable seismic event impacts on infrastructure into the development of capital improvement programs so as to upgrade the survivability of the infrastructure.

3R. Work with governmental agencies (i.e., Caltrans and Water Districts) and the public utility companies to identify and promote effective mitigation of the effects of the most probable seismic event on the infrastructure which supports the City of Seal Beach.

3S. Prepare a Geological Hazards Map based on a study of the geological formations and hazards of the entire City, employing a format compatible with the City's GIS mapping system.

3T. Integrate the latest information about earthquake survivability into the City's public safety education program. Encourage the retrofitting of every home within Seal Beach for earthquake survival, especially in the area of adequate anchoring (tie-down) of the homes to their foundations.

Topic 4: Fire Hazards

California experiences large, destructive wildland fires almost every year. In October and early November of 1993, 26 major fires burned more than 200,000 acres in Southern California. The potential for a severe wildfire to occur is increased when dense vegetation growth and large accumulations of dead plant material are present. Weather conditions and steep terrain also increase the hazardous wildfire potential; however, these conditions do not cause wildfires. Human error, arson, high-voltage lines, vehicles, and lightning are the primary causes of wildfires. Moreover, an expanding population seeking living space and recreation in the fire hazardous wildland contributes to the problem. The City of Seal Beach, typifying the more urban conditions throughout the State, does not face a serious threat of wildland fires.

Structural fires, which typically involve only a single structure, are the most common fires that are battled routinely by local fire departments. Some of the common causes of structural fires are arson, electrical problems, combustibles too close to heat sources, unattended cooking, and misuse of smoking materials. The combination of building materials, density, fire flow, hydrant location, response time of emergency equipment and natural conditions can exacerbate potential structural fire disasters.

Orange County Fire Authority

The Orange County Fire Authority contracts with the City to provide needed fire, emergency medical and rescue services. The Fire Authority also works with the City's Planning Department and developers on construction projects that impact fire protection services from the projects inception all the way through to approval.

Fire Hazard Severity Classification System

There are three levels of fire hazard zones within wildland of Orange County. These zones are adapted from a fire hazard severity classification system for California wildland developed by the State of California Department of Forestry. These classes are moderate, high and extreme fire hazard. This classification utilizes field investigation and present topographical information to define the fire hazard classes based upon three criteria: (1) Fuel Loading; (2) Fire Weather; and (3) Slope.

Fuel-Loading includes three classes. Light fuels represent flammable grass and annual herbs. The majority of Seal Beach fits in this category. Most of these have been altered by man's actions: urban development, cattle grazing, fuel breaks, etc. Medium fuels include brush and other perennial shrubs less than six feet in height with a crown density of 20 percent or more. This comprises a very small area in Seal Beach, primarily at the Hellman Ranch property. Heavy fuels are the heavier brush species, woodland types and timber types over six feet in height with a crown density of 20 percent or more. In Seal Beach these areas are predominantly defined by stands of Eucalyptus globulus (Blue Gum) located on the Bixby Old Ranch Golf Course and at Gum Grove Park.

Fire Weather includes three classes. Each class is related to the frequency of critical fire weather days occurring in each of the State's Fire Danger Rating Areas over an eight to ten year period (Fire Danger Rating Areas are wildland geographical areas having similar climate.). The Low Class (Class 1), includes all those Fire Danger Rating Areas which have experienced fire weather in the very high or extreme ranges on an annual average of less than one day; the High Class (Class 2), has an annual average of 1 to 9.5 days; and the Extreme Class (Class 3), has an annual average of more than 9.5 days. Each United States Geological Survey topographic map in the State is keyed to one of the Fire Danger Rating Areas and assigned that area's critical fire weather frequency classification. Based on the above methodology, Seal Beach has been classified as a Class 1 Fire Danger Area.

Slope is divided into four classes as part of the Fire Hazard Severity Classification Scale. The following classes are based on the slope: 0-9.9 percent, 10 to 19.9 percent, 20 to 39.9 percent and over 40 percent. Slope is recognized as having an effect on fire behavior similar to the effect of wind (i.e., an increase in slope produces an increase in the rate of fire spread). The system therefore assigns values to slope, which modify the various fire danger indices accordingly. Seal Beach falls within the 0-9.9 percent classification.

Each class of fuel loading, fire weather, and slope is assigned a severity factor value. The values are multiplied in a matrix to produce a Fire Hazard Severity Scale. This scale is relative, that is, a fire occurring in an area determined to represent a moderate fire hazard will be less severe than a fire occurring in an area representing an extreme fire hazard. It is important to note that this information represents a synthesis and necessary generalization of more detailed information, and thus is not an exhaustive description of the vegetation, slope patterns, etc., that exist. Rather, it represents the interpretation/generalization of available information as it relates to suitability of development based on fire safety.

Wildland Fire Hazard Potential

Several factors affect the hazard potential one can expect from a wildland fire in any given area. These factors include topography, vegetation, climate, development patterns, access, and fire fighting capabilities to the area. All of the factors combined to contribute to the devastating wildfire in Laguna Beach on October 27, 1993, which engulfed 16,682 acres, destroyed 366 homes (286 homes within the City limits) and damaged 642 homes.

Topography

The topography of Seal Beach can best be described as being flat with a single high elevation point of Landing Hill. This topographical condition has not much effect on wildland fire behavior and on the ability of fire fighters and their equipment to take action to suppress those fires. This topography also allows for a dispersal of air flow, thereby not creating extremely erratic winds.

Vegetation

Along with the local topography, marine influences play a significant role in shaping the fire hazard potential for the area. The topography and soils encountered within the City of Seal Beach, along with climatic conditions, predominantly influenced by the Pacific Ocean, and the urbanization of the City, have contributed to the plant environment found in Seal Beach. The urbanization of the area, with the exception of the Seal Beach Naval Weapons Station, has eliminated most native plant regimes within the community. The general vegetative characteristic of the City of Seal Beach is of typical urban landscaping, with primary ground cover being devoted to decorative grass and landscape species.

Gum Grove Park is an urban forest area of approximately 14.9 acres located north of Pacific Coast Highway and west of Seal Beach Boulevard. The primary vegetative species of the park is eucalyptus trees, which were introduced in the 1920s.

Climate

Climate is the single most important contributing factor to the fire problem. The Santa Ana winds are a phenomenon caused by very dry and warm air originating from high-pressure systems over California, Utah, and Nevada. Winds can reach 70+ miles per hour and have a humidity of near zero. Precipitation (its annual total, seasonal distribution, and storm intensity) has further effects on the moisture content of dead and living vegetation and hence has important effects on fire ignition and behavior potential. Precipitation in Orange County averages between 9 and 15 inches per year and generally falls during the period from November to April. Most of the large fires occur during the fall, following abnormally wet winters.

The wind is a separate factor once a large brushfire has begun. It drives the fire before it, increasing the rate of spread downwind in proportion to its velocity. Passing through and beyond the fire, it then becomes a super-heated current of air that can move downhill rapidly and uphill many times faster, especially when funneled by the shape of gullies and canyons. Where the wind and topography combine to direct such an effect, the heat can be so intense that temperatures may reach 2,400 to 2,600 degrees. A strong wind can also carry burning debris, igniting many spot fires, oftentimes from one-half mile to a mile downwind.

If enough area is ablaze simultaneously, the updraft from rising heat can generate a vortex or tornado that can lift up and propel firebrands over a wide area outside the original fire, which can then rapidly expand. The updraft can generate an unbalanced condition on uneven terrain, which *presses* the flames against any nearby steep slopes, igniting them. Therefore, even in the absence of any prevailing wind, the fire can generate fire whirls that may move uphill with great rapidity. Auto-generation effects can arise because of the fire itself, if it is sufficiently large. These are usually referred to collectively as a firestorm.

Development Patterns

Development patterns can have considerable effect on fire ignition and rate of spread. This is especially true in the open space interface areas where the presence of man near highly flammable brush creates a critical situation.

Building design and material, small lots, and the resulting proximity of adjacent structures compound the potential impacts of structural fire. When these combine with the threats of brush fires, fire hazards reach critical concerns. The Surfside and the Seal Beach Trailer Park neighborhoods have been identified as having critical development patterns with respect to fire. The development patterns of these two areas of the City affect the potential for fire hazard; high-intensity development, small setbacks, and narrow roads all work to reduce the effectiveness of fire fighting efforts. In addition, small setbacks and flammable building materials, especially within close proximity to similar structures, tend to increase the propensity for fire and accelerate its spread. In recognition of these issues, the City of Seal Beach has required the provision of automatic sprinkler systems in all new residential development in Surfside and in all new two-story cabanas in the Seal Beach Trailer Park for many years.

The most significant factor determining overall fire risk is human proximity. The human element is often responsible for the ignition of major structural fires, as evidenced by the abundance and frequency of fires in the vicinity of residential neighborhoods. Unsupervised children, wood burning fireplaces, increased recreational use of the wildlands (off-road vehicles), and arson all contribute to the largest single source of fires – man.

Access

Any discussion of access must simultaneously be concerned with egress, as well as ingress. Chapter 21 of the Seal Beach Municipal Code "Subdivisions" sets forth standards for roadway development. As a result of early lifestyles and concomitant developmental patterns, numerous neighborhoods are currently served by roads that do not meet current design standards.

Upgrading these roads to conformity is not, in certain areas, feasible or desirable. For the purposes of hazard identification, the Fire Authority has established a minimum unobstructed roadway width of 20 feet.

For a variety of reasons, streets that fail to meet fire department minimum requirements for access can restrict emergency mobility in the neighborhoods they serve. Among other reasons for road width inadequacy are subdivisions approved in the early 1900s, when roadways were by nature much narrower than current standards, lack of available off-street parking, and insufficient fire department turn-arounds. Due to the lot depths in the Old Town portion of the City, the Fire Authority would be able to access a restricted access area from an adjoining street. Situations are untenable where personnel and equipment may be trapped or unable to reach the fire or flee from its path. The City Council will direct the Fire Authority to identify those areas with only a single access to and from the community, and to assist in developing alternative access points. By providing a second access roadway, movement of fire apparatus can be deployed as evacuation is taking place. Deployment of fire fighting equipment is critical to successful fire defense of any community.

Fire Fighting Capabilities

The Fire Authority provides fire protection and emergency services for the City. Four of the Fire Authority's stations serve Seal Beach; two are located within the City and two are located within the Cities of Sunset Beach and Los Alamitos. Stations 44 (718 Central Avenue) and 48 (3131 Beverly Manor Road) are located within the City. Station 2 is located at 3642 Green Avenue in the City of Los Alamitos, and Station 3 is located at 16861 12th Street in the City of Sunset Beach. The Fire Authority has automatic aid agreements with the Cities of Long Beach, Garden Grove, and Huntington Beach for additional units when needed or when closer.

Average emergency and non-emergency response times are approximately 3 to 5 minutes for Stations 44 and 48. The response times for Stations 2 and 3 vary from 5 to 12 minutes, depending on the location of the emergency response to the responding station.

Station 44 has one paramedic assessment engine, one paid call fire fighter engine with three personnel, and one reserve squad (personnel varies), and Station 48 has one engine with three personnel and one paramedic van with two personnel. Station 2 has one paramedic assessment engine with three personnel and one reserve squad (personnel varies), and Station 3 has one reserve engine (personnel varies) and one squad (personnel varies).

A four-year average (1997-2001) reveals that the Fire Authority responded to approximately 200 calls per year. Of theses 200 calls, 77 were actual structure fires and the balance were vehicle and other types of fires.

Local Programs and Legislation

As experienced by the City of Seal Beach in the January 1995 floods, the Mutual Aid system works very well. However, mitigation measures must be implemented to ensure that the vulnerability to structural fires is reduced. The success of increasing public safety regarding fire hazards relies on systematically fighting the threat of fire before the fire occurs through a host of programs.

These programs include systematic amendments to the building codes and fire codes, developing guidelines for the placement and location of fire hydrants, developing landscape guidelines, defensible space management on a city-wide basis, and analyzing the water system for fire fighting use.

Building Codes and Landscaping Guidelines

The Fire-Zone Mapping Bill (Bates Bill, AB 337) requires the identification of fire zones within the 15 most vulnerable counties within California based on fuel load, weather, slopes and housing density. No portion of the City of Seal Beach is located within a Very High Fire Hazard Severity Zone.

Wildland fires and structural fires spread by Santa Ana winds have demonstrated the need for fire-resistive building construction requirements that are more restrictive than the provisions in the Uniform Building Codes (UBC). The City of Seal Beach has adopted special building and fire code provisions that exceed the UBC requirements.

The City should also develop, implement, and maintain a community and neighborhood hazard identification and abatement program to support defensible space management. Defensible space is the private property, usually landscaped, which is managed in such a manner that the ornamentals or native plants do not increase the fuel loading in relation to structures.

Planning and Maintenance of Outdoor Areas Adjacent to Homes

While fuel modification deals with the treatment of the urban/wildlands interface, the concept of defensible space applies to all areas of the City. Creation of defensible space means the arrangement of access on the property for ease of fire fighting and maintenance of properties to minimize buildup of fuel that could ignite and cause fire to spread to the home.

Better access for fire fighting should include the following:

- providing safe walkways around all sides of the house; and keeping side yards unobstructed and free of flammable stored items.

Maintenance for fire safety should include the following:

- thinning of planting to remove dead wood and to reduce build-up of branches and foliage;
- removal of dried leaves and grasses, dead limbs and twigs; and chipping, composting and mulching planting areas where feasible;
- spacing and pruning of trees and shrubs to avoid continuous canopies and "fuel ladders" from ground to canopy;
- removal of plants growing up under eaves;
- pruning of tree branches and shrubs within ten feet of a chimney;
- removal of leaves, pine needles and debris from roofs and rain gutters;
- removal of combustible stored material and debris from around and under the house and decks; and
- stacking of firewood as far away from the home as possible.

When planning the landscape of a home, access for fire fighting should be considered in the design. Maintenance considerations outlined above should be considered in the choice and placement of plantings. When located adjacent to a natural vegetation area, construction of combustible structures – fences, decks, and gazebos – should be minimized. Wood decks with open areas underneath should be enclosed to reduce potential for ignition from fires below.

Planting and Fire-wise Plant Choices

While much has been written and suggested regarding fire-resistant or fire-retardant plantings, the 1993 Laguna Beach fires demonstrated that any plant will burn. However, reasonable planting selections combined with sound arrangement and spacing and good maintenance can improve the chance that a structure will survive a wildlands/fire-storm fire. Lists of suggested and not-recommended plants for the wildlands interface zone have been prepared by many public agencies, including the Orange County Task Force, County of Los Angeles Fire Department, and the City of Oakland, as well as by the garden publications. The County of Orange "Report of the Wildland/Urban Interface Task Force," July 1994, also includes a recommended plant list for fuel modification zones. A comparison of these often conflicting lists reveals certain criteria for fire-wise planting as follows:

- Low fuel volume;
- High moisture content;
- High salt content;
- Low aromatic oil content;
- Low heat value;
- Minimal production of dry litter; and
- Suited to the site and climatic conditions so that plants will be healthy.

Consistently "not recommended" plants include conifers (pines, cypress, cedar, and junipers). Also "not recommended" are acacia, bougainvillea, and ornamental grasses. Eucalyptus is "not recommended" on many lists because of the high aromatic oil content and the tendency of some species to produce high amounts of dry litter. The use of "not recommended" plants should be avoided adjacent to natural vegetation areas.

Because of eucalyptus's importance in the landscape of Seal Beach, it is important to look at this genus in more detail. There are over 700 species of eucalyptus, and they vary greatly in their size, fuel volume and litter production. An unmaintained blue gum, for example, has a great deal more flammable material in its shedding bark, leaf litter, and branches than a lemon gum. Many of the lemon gums survived the 1993 Laguna Beach fire with some charred trunks and loss of foliage. The County of Orange "Report of the Wildland/Urban Interface Task Force" did not single out or condemn eucalyptus. It emphasized irrigation, thinning and spacing as keys to any fire-safe landscape. The City emphasizes the importance of eucalyptus groves by ordinance provisions. Gum Grove Park is a public nature park and comprises the major stand of Eucalyptus trees within the City. The City has been actively involved in establishing a program to improve the health of the grove and increase the safety of the grove from a fire protection standpoint.

Irrigation, thinning and clean-up to keep the amount of litter and dried materials low, arrangement and spacing to avoid continuous canopies, and keeping foliage away from structures are as important as the type of plants chosen.

Weed Abatement

The City of Seal Beach has had a weed abatement program for over 30 years. Property owners are notified when property they own is determined to be a weed nuisance. They then have the option of either abating this problem themselves or having the City do it and bill them for services rendered. In recent years the City has had this work performed through contract services. This program addresses only weed abatement and generally does not address native plant material that may be growing adjacent to an urbanized area.

Water System

Approximately 75 percent of the water used in the City is local groundwater, with the additional 25 percent provided by the Metropolitan Water District (MWD). The City currently has three wells with a total pumping capacity of 11.2 million gallons of water per day (mgd). However, delivery capacity is limited to 5 mgd by the capacity of the City's reservoirs. The sources of MWD's water include northern California and the Colorado River. The City currently has an average daily water demand of 2.5 mgd and a maximum daily demand of 4.1 mgd.

The amount of water required for extinguishing a single structure fire can be calculated by using a complex formula that takes into account the building type, building construction materials, building area, material types stored inside the building, and the surrounding terrain. A fire similar in nature to the October 1993 Laguna Beach firestorm would tax the water supply and delivery system substantially beyond its design capability. In order to maximize the fire safety system within the City, the City should continue to work with the City Water Department, in conjunction with the Fire Authority, to analyze aspects of the water system that would require improvement for fire fighting use.

Policies

4A. Ensure that adequate facilities and fire service personnel are maintained based on population, fire hazards in and around the City, and a performance standard of an average total reflex time of seven minutes or less.

4B. Educate and inform the public on fire safety, especially regarding landscaping installation and maintenance in urban areas, to further protect the community and the environment from unnecessary fire hazards.

4C. Enhance the ability of all structures within the City to resist wildland and structural fires through ongoing, appropriate and cost-effective changes to the City's Zoning, Building and Fire Codes and standards.

4D. Work with the Water Department and the Orange County Fire Authority to analyze the supply and delivery aspect of the water system for fire fighting use to help identify and correct deficiencies.

4E. Develop an early warning system of Santa Ana wind fire danger to alert the public of possible precautions or safety measures that may be taken during those critical times.

4F. As a condition of new development, require private responsibility for development and maintenance of necessary new fire flow water lines and hydrants in accordance with the recommendations of the Orange County Fire Authority.

4G. Encourage property owners to create defensible space surrounding their homes, including providing access for firefighters, maintaining plantings and outdoor areas, and minimizing combustible structures.

4H. Encourage property owners to consider "fire-wise" planting and the use of fire-resistent building materials, especially in landscaped and developed areas adjacent to Gum Grove Park.

Topic 5: Flood Hazards

Historically, flooding has been beneficial to agricultural soil, wildlife and the general ecological balance. In the unaltered state, water systems have considerable built-in capacity for detaining storm waters that would otherwise surge too rapidly downstream and into estuarine basins. Hydrologists emphasize that, along natural watercourses, flooding is a routine process. Flooding in an urban setting can also be viewed as a natural hazard.

Virtually all stages of the natural hydrologic cycle, including flooding, have been significantly altered by human intervention. Changes in land use have profound effects on runoff and erosion on the land surface. As vegetation is removed and soil is exposed during construction, erosion rates may increase significantly. The creation of impermeable surfaces that accompany urbanization increases and concentrates runoff, leading to a greater incidence of flooding.

A flood may be defined as a temporary rise in stream flow that results in water overtopping its banks and inundating areas adjacent to the channel not normally covered with water. The lowland area adjacent to the stream that is subject to periodic inundation by floodwater is known as the floodplain.

The magnitude of a flood is measured in terms of its peak discharge, which is the maximum volume of water (in cubic feet per second) passing a point along the channel. Floods, however, are usually referred to in terms of their frequency of occurrence. For example, the 100 year flood is a flood magnitude which has a 1% chance of being equaled or exceeded in any given year. There is a certain element of risk involved using this type of designation because the prediction of a flood of a particular magnitude is based on probability and an element of chance is involved. According to statistical averages, a 25-year flood should occur on the average once every 25 years. However, two 25-year floods could conceivably occur in any one year. For planning purposes the flood magnitude most often used in delineating floodplain boundaries is the 100-year flood. This flood is also referred to as the *intermediate regional* or *baseflood.*

The climate of Seal Beach is typically Mediterranean, characterized by warm, dry summers and cool, rainy and foggy winters.

The average annual rainfall is 13 inches. Over 90% of this rainfall occurs between late October and early April.

Flooding is a direct response to the amount, distribution, and intensity of precipitation. Most flooding damage is brought by sudden deluges of already soaked ground, or in the case of the coastal areas of the city, the combination of a storm surge with a high tide. Storms that combine high total rainfall, long duration, and high daily maxima, as in the 1995 storm, are the most destructive. Heavy runoff and accelerated erosion are associated with this type of short period torrential rain, as well as with storms of longer duration and greater totals.

Historically, floods causing significant damage occurred in Seal Beach in 1937, 1938, 1941, 1966, 1969, 1978, 1983 and 1995. Flood potential exists in the form of temporary floods related to winter rains and wave run-up. Most of the flood activity is isolated along the various drainage channels within the City or the immediate coastal area. Most flood conditions in Seal Beach are short lived in nature due to the limited size of the available watershed and the presence of drainage improvements. Damage resulting from flooding in Seal Beach is more inundative than erosive in nature.

In general, three separate and distinct types of inundation are known to exist in Seal Beach. Flood inundation hazards are those associated with major atmospheric events that result in inundation of developed areas, due to overflow of nearby stream courses, or inadequacies in local storm drain facilities. Facility inundation hazards are those associated with downstream inundation that would occur given a major structural failure in a nearby impoundment. Such failures would most likely be caused by geologic phenomena including seismic events and slope instability. The third inundation hazard is storm surge run-up that may occur during a high tide.

Sections of Seal Beach are subject to flooding due to *wave run-up*. This type of flooding is typically caused by large swells produced by storms at sea occurring at high tide. Wave run-up was especially damaging to the residences located on Seal Way between the Seal Beach Pier and the Navy Jetty, and at Surfside, in 1984. The water and debris left by the waves caused no damage to the commercial area; however, damage to the interior of homes near the beach area was substantial.

In north Orange County, increased urban development is perhaps the most serious change in drainage basin and floodplain characteristics that can influence the magnitude and frequency of flooding. Urbanization often leads to a greater percentage of impervious surfaces, which increases the total volume of storm runoff by decreasing the amount of water that infiltrates into the ground. Development can also result in placing artificial fill and other objects in the floodplain.

To protect development from the impacts of flooding, stream channels are often channelized (e.g., straightened, lined) to move the water off the land more efficiently. However, when water emerges from the improved section of stream channel, it is often delivered to the unchannelized downstream section at rates and velocities that the natural section of stream is not capable of carrying. Piecemeal channelization efforts often exacerbate the flooding potential downstream. Therefore, it is important that flood hazard reduction operations be comprehensive, well planned programs.

Local Setting

A "Master Plan of Drainage" was prepared for the City of Seal Beach in February 1999. This document identified the local network of existing flood control facilities and the condition and capacity of each one. The existing data was then combined with the estimated contributions from future anticipated land use to determine the total storm runoff for the City. The document then outlined a prioritized list of system improvements and a basis for establishing funding mechanisms. To continue to be effective, the Plan should be periodically updated to reflect new hydrologic modeling techniques, revised rainfall runoff data, changed land use and development patterns, and current costs.

The effects of storm water runoff in the City of Seal Beach are typical of problems in inland areas, where run off from several tributary areas combines to inundate low-elevation areas, for the non-coastal areas of the City. River, stream, and drainage channel channelization involves straightening the natural meanders, clearing the banks and widening and deepening the channel. It is undertaken to assist in flood control and to increase developable land. Channelization lowers the level of the river or stream and the riparian water table, increases the rate of surface run off, increases the stream flow rate, enhances bank and bottom erosion, and transports a heavier sediment load than the unchannelized stream. Channelization also affects the beach replenishment process which is discussed in Topic 6, Shoreline Protection.

The San Gabriel River is a major watercourse adjacent to westerly boundary of the City. The headwaters commence in the San Gabriel Mountains, approximately 30 miles from the outlet into the Pacific Ocean, adjacent to the City of Seal Beach. The drainage area of the San Gabriel River and its tributaries is about 679 square miles.

Development in the floodplain of the San Gabriel River ranges from sparse at the headwaters in the mountains to dense along portions of the river channel located on the alluvial plains. The floodplain in this area has been completely developed. Residential and light industrial development is predominant in the area between the San Bernardino Freeway and the Pacific Ocean.

Flood Protection Measures

As part of the National Flood Insurance Program, a report was prepared which delineated flood-prone areas in Seal Beach. The generation of this report and accompanying maps help illustrate where development has been permitted into the flood zones, creating a potentially hazardous condition during 100-year storms (see Figure S-7).

A majority of the City's storm drain infrastructure, unless otherwise noted, is designed for the 25-year flood. This design standard reflects the standards in use during the time of the construction of the major storm drain systems within the City. It would, therefore, be inadequate for the more recent, and generally accepted, standard of a 100-year flood.

The major storm drain facility located within the City is the Los Alamitos Retarding Basin, owned and operated by the County of Orange. This facility is located south of Westminster Avenue, west of Seal Beach Boulevard and adjacent to the Haynes Cooling Channel. The Retarding Basin serves a drainage area of approximately 5,420 acres, generally located east of the San Gabriel River and Coyote Creek Channel, south of Carbon Creek Channel, west of Bolsa Chica Channel, and north of Westminster Avenue. The drainage area includes portions of Seal Beach, Los Alamitos, Cypress, and the unincorporated area of Rossmoor. The Retarding Basin was built in 1958 by the Orange County Flood Control District. The basin has a storage capacity of about 200 acre feet and four pumps discharge storm waters into the San Gabriel River. Los Alamitos Channel, which drains directly into the basin, was designed in 1957 for a discharge of 1,460 cubic feet per second (cfs) and is inadequate to carry the 100-year discharge of 2,650 cfs. The existing pumping station was designed for a discharge of 450 cfs, comparable to a 25-year storm design, which is inadequate to hold a maximum water surface in the basin of +1.0 elevation necessary to prevent upstream flooding. The County of Orange recognizes the deficiency of this drainage system, and is currently investigating ways to improve the system to provide for increased storm drainage protection to the drainage basin. As future plans are finalized, the City will review this discussion as part of its biannual review of the Safety Element.

Of the numerous other drainage facilities throughout the City of Seal Beach, most drain areas are of insignificant size or have the capacity to pass the 25-year storm. The concept of 100- year protection remains desirable, but may not be achievable in the foreseeable future due to financial factors. Therefore, the concept of providing reasonable level of drainage control to meet the 10-, 25-, or 50-year design frequency should be considered while waiting for the ultimate, 100-year design to be designed and funded. Drainage structures that do not meet the standards of the 25-year storm and/or drain areas of sufficient size will be noted in drainage studies.

In 1995 the City of Seal Beach revised and updated its "Floodplain Overlay District" provisions in the Code of the City of Seal Beach to promote sound land use and floodplain development standards pursuant to the rules and regulation of the Federal Insurance Administration and Federal Emergency Management Agency. Areas of special flood hazard have been identified by the Federal Emergency Management Agency on the Flood Insurance Rate Map (FIRM) which has been adopted by the City and are referenced in the Floodplain Overlay District provisions of the Code.

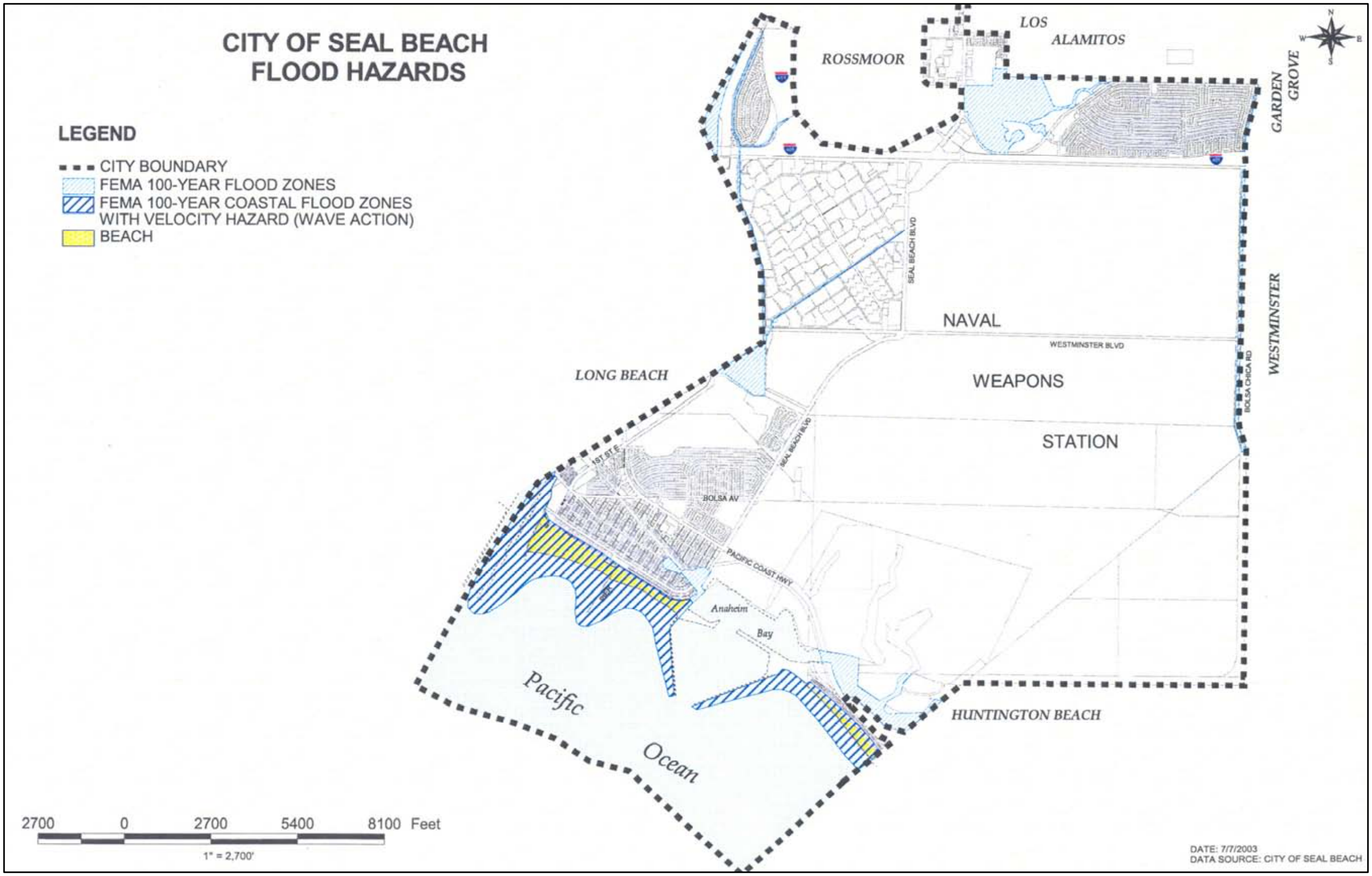


Figure S-7 - FEMA Flood Zones

Water Quality Control

In 1990 the City, along with the County of Orange, the Orange County Flood Control District, and the other Cities of Orange County (as Co-Permitees), were issued a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit as part of the implementation of the Federal Clean Water Act, by the Environmental Protection Agency (EPA) through the State of California and the State Water Resources Control Board. The permit is renewed, generally speaking, every five years. The First Term Permit expired early in 1996 and was replaced by the Second Term Permit. The current permit, the Third Term Permit, subsequently replaced the Second Term Permit in September 2001.

The NPDES Permit established two major requirements: 1) an effective prohibition of non-stormwater pollutant discharges into the storm drainage system; and 2) implementation of water quality Best Management Practices (BMPs) through the development and adoption of a Drainage Area Management Plan (DAMP). The BMPs are intended to reduce the amount of erosion sediment discharging into the stormwater drainage system to the "maximum extent practicable" (MEP).

Central to an effective prohibition of non-stormwater discharges is the enactment by local jurisdictions of ordinances preventing such discharges. On April 24, 1995, the City of Seal Beach adopted a "Storm Water Management Program" ordinance. The Storm Water Management Program Ordinance is intended to prevent industrial waste pollution, as well as other non-stormwater pollutant discharges, and all new development will be required to comply with the water quality management techniques as outlined by the Best Management Practices of the DAMP. Furthermore, in an ongoing effort to protect and enhance coastal waters, the City developed a "Storm Water Quality Management Plan" in July 2001.

On January 18, 2002, the Santa Ana RWQCB adopted the Orange County Municipal NPDES Storm Water Permit for the northern portion of Orange County (the San Diego RWQCB jurisdiction covers the remaining portion of Orange County). The new permit updates water quality standards for new development, and these standards have been incorporated and applied to this project. These updated standards include numerical sizing criteria for water quality treatment and proper monitoring and maintenance of storm water facilities. Numerical sizing criteria specifically state that a certain quantity of first flush runoff shall be treated to remove the pollutants of concern (those introduced by the project) to the MEP. The permit supports the use of bio-swales, detention ponds, infiltration landscaping, constructed wetlands, and structural BMP devices as means for meeting the MEP and best available technology (BAT) requirements.

Policies

5A. Periodically inspect and maintain all public drainage structures and remind property owners to maintain private drainage structures in order to maximize capacity.

5B. Implement a public education program pertaining to flood hazards and ways in which citizens can protect themselves and their property.

5C. Contain and utilize runoff from impervious surfaces on-site to the greatest extent possible. Transmit excess runoff to the nearest street or facility capable of conveying the runoff without impacting downstream areas.

5D. Plan capacity for the 100-year flood and provide short term reasonable protection for locations that would benefit from 10-, 25- or 50-year storm drainage facilities.

5E. Consider the effects on beach sand replenishment of improvements to drainage channels.

5F. Pursue a regional approach to watershed management, particularly in regards to the San Gabriel River, and coordinate improvement plans with local, state, federal, and community-based organizations and agencies, including all of the jurisdictions located upstream on the San Gabriel River.

5G. Review and update the Master Plan of Drainage to integrate the drainage systems of the entire City into one plan and include an implementation schedule and priorities for improvements.

5H. Continue the practice of preventive maintenance, including storm tracking and proactive street and storm drain maintenance.

5J. Monitor the effects of inland development on the City's watershed and its management and attempt to minimize their impacts.

5K. Monitor the Los Alamitos Retarding Basin improvement program proposed by the Orange County Flood Control District.

5L. Continue to participate in the National Flood Insurance Program and utilize the most recent Flood Insurance Rate Maps in the implementation and enforcement of the City's "Floodplain Overlay District" requirements.

Topic 6: Shoreline Protection

The California coastline has been eroding for thousands of years. Erosion did not present economic or safety issues as long as the coastal areas were left undeveloped or were used for agriculture or low-intensity recreation. The desire for magnificent ocean views and convenient beach access has induced many people to build at the ocean's edge, even in high-risk locations. For such dwellings, each severe winter storm is a potential disaster. Coastal erosion is likely to continue or even to accelerate in the future.

Damage from storms and erosion are episodic in nature. The winter storm of 1982-83 resulted in substantial losses to Orange County beaches, including the Seal Beach area. With continued coastal community growth and development, property values continue to increase. Costs from damage due to major storms could be greater each year as coastal land is increasingly upgraded and developed. Owners of oceanfront properties become more concerned with protecting their investment from storm erosion and structural damage. During and after severe storms, many oceanfront property owners attempt to construct protective devices that do not consider the complex interrelationships of the land and sea.

Beach retreat is a natural process. When considered over a long period of time, the sea cliffs and beaches are retreating. This retreat is episodic, infrequent, site-specific, directly related to wave climate and rainfall, and highly impacted by urbanization. The protection, preservation, and restoration of sandy beaches and the desire of private property owners to protect their investments are closely interrelated. The value and enjoyment of oceanfront property depends, to a great degree, upon the existence of a sandy beach. As sandy beach widths are reduced, an increase in the amount of wave attack on beachfront property and the base of the existing sea cliff occurs.

Sand management is the act of controlling the littoral sediment resource, to the extent possible, to benefit the recreational and protective functions of a beach. It requires that changes in beach width be anticipated before they occur. Only then can enlightened decisions be made and cost-effective methods be implemented to deal with undesirable shoreline behavior.

The Effects of Man

Since the early 1900s, man has permanently altered the natural cycle by developing the coastal lands and harbors. The major sources of sediment no longer provide the necessary quantities of sediment to keep the natural cycle in balance. Under natural conditions, 1.2 million cubic yards of sand per year would be delivered to the San Pedro cell by the Los Angeles, San Gabriel, and Santa Ana Rivers. Due to the construction of dams, channel lining, detention basins, and the urbanization of the land within the watershed, relatively little coarse sediment, beach sand, reaches the coast. Most sediment deposited on the beaches occurs in the form of urban silt, the mix of dust, hydrocarbons, and other man-made materials, or when the inland storm facilities fail and spot erosion occurs.

The construction of other man-made devices such as breakwaters, jetties, groins, and revetments has interrupted the littoral transport of sediment. Breakwaters are structures that are constructed offshore to dissipate wave action to permit safe harbors. Since wave action is reduced within the protected harbor, littoral transport is effectively reduced to an insignificant level. Jetties are constructed to permit clear channels for river flood control purposes and to keep harbor entrances clear of sediment. Sand that is transported by littoral current is trapped updrift of the jetty. Without an adequate system to bypass the jetty, the opposite downdrift jetty experiences erosion. Groins are structures that are usually built perpendicular to the beach. They are constructed to form small cells or compartments that are filled with sand. The small distance between the groins limits the erosion and traps the sand. All of these structures alter wave patterns by reflecting and diffracting waves so that the adjacent shorelines will be modified and will seek new equilibrium shapes.

In 1933, two parallel jetties were constructed along with a channel for the San Gabriel River to prevent flooding and enable the development of the Southern California Edison and Los Angeles Department of Water & Power electric generating plants which require cooling intakes and outfalls. The easterly jetty was built at 725' long and the westerly jetty was built at 375' long and was later extended to the 725' length. By 1940, an additional 800' jetty was built to separate the river from the Alamitos Bay. Over the years the Alamitos Bay jetties were extended to 3,400' to provide for a navigational access to the Long Beach Marina. These improvements further impeded the littoral transport of sand to the south.

During that same time period, the Navy constructed the Naval Weapon Station (1945-47). Included in that project were two (3,000' and 3,400') rubble mound arrowhead jetties to form a safe harbor at Anaheim Bay for the loading of armament for Navy vessels. These structures further interrupted nature's process of sediment transport.

The construction of the Los Angeles and Long Beach Harbors created more than eight miles of breakwaters by 1949. The breakwater effectively prevents littoral transport of sediments from the northerly cell and the bluffs at San Pedro from reaching beaches in Long Beach, Seal Beach, and downdrift beaches. The beaches behind the breakwater have minor wave action and are relatively stable, but the beach and water quality have suffered.

In the 1950s, concern over the continuing erosion problem between the San Gabriel River jetty and the Anaheim Bay jetty caused a groin to be constructed adjacent to the Seal Beach Pier. The existing concrete sheet pile groin was constructed in 1959 by the Army Corps of Engineers. The groin was constructed to extend 750 feet into the ocean, and each cell (now named West and East Beaches) was filled with sand. The groin was proposed as "the solution" to the shoreline erosion problem that had been caused by the construction of the jetties and breakwaters. It was thought that with the construction of the groin, the beach would remain relatively stable. However, replenishment and backpass (sand transfer) projects are required to maintain both beaches.

The combined effects of these various structures produce unique problems along the shoreline in Seal Beach. The East Beach has water quality problems. This has been attributed to three conditions: the absence of a littoral current at its northwestern edge due to the breakwater; the trash that flows out of the San Gabriel River and Alamitos Bay (Long Beach Marina); and the position of the groin at the pier, which reflects the prevailing westerly waves into a counterclockwise current similar to an eddy. The West Beach experiences severe erosion due to a northwesterly longshore current that is generated by waves that are reflected by the jetty at the entrance to Anaheim Bay. The Surfside Beach downdrift of the Anaheim Bay jetty has historically experienced severe erosion adjacent to the jetty, which often jeopardizes the beach front residences. The fear of loss prompted the Surfside community to construct a rock revetment wall as a last line of defense to protect the existing homes along the shore.

The non-structural solutions to shoreline erosion include replenishment and backpassing. Replenishment places beach sand on the shoreline from inland supplies or dredged from offshore bars. Sand replenishment can be very successful in mitigating shoreline erosion. In general, any solution to a coastal problem that closely imitates the natural process will have a greater chance of success than solutions that attempt to overwhelm or counteract the process. The placement of sand in the appropriate quantities can mitigate a man-made obstruction to littoral sand transport. Backpassing is a technique where sand is moved from one area to another adjacent or nearby area in the cell. The net sum gain in the sand budget within the cell is zero since the shoreline will seek its dynamic equilibrium. The temporary movement of sand can be beneficial in temporary protection during the winter storm season.

Beach sand replenishment has been the predominant method of maintaining the shorelines in Seal Beach. Since 1945, 16,237,000 cubic yards of sand was placed on the beach at Surfside. This beach nourishment occurred with the understanding that the Surfside Beach would serve as a feeder beach to the beaches to the south. Recently, new data has indicated that the sand does not entirely reach the beaches at the southern end of the cell as anticipated. The Corps of Engineers has recently designated the West Newport Beach as an additional feeder beach. Between 1954 and 1988, approximately 2,055,000 cubic yards of sand was replenished on the East and West Beaches. In addition to the replenishment, approximately 250,000 cubic yards of sand was backpassed to combat shoreline erosion. Based on today's costs to dredge sand at $4 to $6 per cubic yard, for trucking in sand at $10 to $15 per cubic yard and to backpass sand at $2 to $3 per yard, one can speculate that several millions have been spent and will continue to be spent to maintain the shoreline within the Seal Beach and Huntington subcells.

Local Conditions

The Seal Beach coastline is characterized by short, generally narrow sandy beaches separated by protruding manmade jetties for the San Gabriel River and the Seal Beach Naval Weapons Station. Beaches formed prior to the construction of these jetties are now modified and maintained in the embayments because there they are partially protected and contained by the jetties. The natural feeding of these beaches has been substantially modified by the construction of the jetties and the reduction in sediment discharge material from the San Gabriel River due to upstream modifications. The sand is held in the bay or compartment and the compartment functions as a closed sand system (sand moving parallel to shore) that can be managed separately from other coastal compartments.

No residential or commercial structures in the City are exposed directly to ocean wave attack. Periodically, a high storm surge has caused local flooding in beachfront homes along the main beach in Seal Beach and in the Surfside area. In an ongoing effort to arrest this process and to maintain the beach front for recreational use, the City has undertaken beach nourishment projects, and will continue to investigate long-term solutions to the beach erosion issue within the community.

Beach replenishment is an active management response to an imbalance in the sediment budget of a coastal compartment. Beach or sand replenishment could be an aesthetically attractive and economic alternative to the construction of hard shoreline protection devices. Beaches are very effective in dissipating wave energy. It is important to understand that sand replenishment cannot be expected to solve all shoreline problems, especially areas that are experiencing failures independent of wave attack. Nevertheless, the potential benefits of using a natural material such as sand for shore protection should remain the primary focus of the City. The development of a database could help to prepare for a long-range planning effort.

Knowledge of the natural and actual rates of shoreline erosion is important for planning purposes. Comprehensive studies of rates of erosion by oceanographers and marine geologists have not been done during past decades. The City of Seal Beach is participating in a five-year study of the Orange County Coast. The cost is shared by the federal government, Orange County, and five coastal cities, including Seal Beach. The study began in 1991 and covers the portion of the Orange County coastline from the mouth of the San Gabriel River to the Dana Point headlands, approximately 32 miles. The product of this report will provide a database of sediment type, movement and location, wind, currents, and wave height and frequency that will establish a "normal" condition. A primary goal is to provide comprehensive coastal data and information in a format that helps coordinate and enhance the efforts of federal, state, and local agencies involved in managing and maintaining valuable coastal resources. Such information can be invaluable in designing beach nourishment projects and in preparing oil spill contingency plans, both of which are regional issues. The study will provide an opportunity for commencing a regional benchmark investigation and will enable the City to more effectively conduct "resource monitoring" along the City's coastline.

Policies

6A. Prohibit the construction of buildings and other man-made structures on the sandy portion of the beach, unless necessary for public health and safety.

6B. Review any development application for shoreline construction with respect to the effects of beach encroachment, wave reflection, flood and wave hazards, public access and public recreation, shoreline sand supply, and aesthetics.

6C. Prohibit shoreline protective devices unless there is evidence that existing structure(s) are in imminent danger from erosion and wave/flooding hazards, and the shoreline protection device is designed to mitigate adverse impacts on local shoreline sand supply, public access, and public recreation, and unless all reasonable alternatives have been explored.

6D. Enforce current building setback standards on local beaches to prevent exposure of structures to large sea waves of seismic or storm origin.

6E. Prevent shoreline development that would place structures in danger of wave attack or degrade natural means of shoreline protection.

6F. Ensure that storm water and drainage are contained, controlled, and discharged in an appropriate manner.

6G. Explore possibilities for beach or sand replenishment as the primary alternative to the construction of hard shoreline protection devices.

6H. Consider the impacts of flood control improvements on sand replenishment of the beach.

6I. Require the repair of damaged shoreline protection devices to be consistent with prevailing zoning regulations and general plan policies.

Implementation

The policies of the Safety Element of the General Plan establish the actions and requirements necessary to direct safety-related decisions in the City. It is recognized that the implementation of the policies in this document may already be underway or may evolve dependent upon City staffing levels, economic conditions, and manmade or natural physical events. The time-frame objectives delineated in this section are goals for actions to be accomplished over the next several years. This section also identifies actions that need to be undertaken on an ongoing basis. The time-frames are based on a snapshot of the community values, politics, and conditions at a particular moment in time. Since these factors are continually in flux, the City must continually monitor the relevance of the Safety Element policies and their implementation progress, so that the main goal of protecting the public's health and safety over time is maintained and improved. The City Council recognizes this charge and will bi-annually review the safety objectives achieved during the preceding time period, and will set new safety objectives for the next bi-annual time period, based upon changing conditions, new information and revised City policies and priorities.

Many of the implementation actions will require additional staffing and/or additional funding for their successful and timely completion. Funding constraints beyond the City's control may make it difficult or impossible to allocate funds for the necessary staff, equipment, or consulting services necessary to complete some of the items. It is recognized that the necessary staff, equipment, and consultants are dependent upon an annual appropriation by the City Council as part of the annual budget process and review and prioritization of safety objectives. It is also recognized that the implementation measures identified in this Safety Element will realize substantial cost benefits in the preparation for disasters and their avoidance or impacts.

Some of the implementation measures require capital improvement projects to be constructed. These projects may require a review according to the provisions of the California Environmental Quality Act, and environmental degradation and grading shall be minimized to the greatest extent possible. However, it is also likely that some of these projects, such as emergency access improvements, may prevent the literal consistency with all of the pertinent General Plan and environmental protection policies, thereby necessitating a careful balancing of competing objectives. Public health and safety should be of primary concern when prioritizing these competing objectives.

The City's Safety Element includes actions which range from measures necessary to insure consistency between the City's general plan and federal, state, and local regulations to those actions required to fulfill the policies in the plan. These actions have been divided into four time frames with the designation the primary department(s) responsible for their implementation.

Within one year of adoption of this Safety Element, these City Departments are primarily responsible for the following:

- Police Department (in cooperation with Fire Authority)
  - Updating the Emergency Services Plan, incorporating a citizen response model, evacuation plans, emergency aid, a comprehensive communications component, and a coordination program with other local government agencies, schools, hospitals and utility companies.
- Development Services Department/Engineering Department
  - Maintaining and updating, as appropriate, a Master Plan of Drainage for the entire City, providing for a minimum protection objective of 25-year flood through the use of flood water conveyances, retention and holding basin facilities, including a prioritization of projects.
  - Investigating the establishment of interim holding or drop-off centers for hazardous materials.
  - Evaluating the location of all public facilities in relation to hazard areas for possible relocation.
  - Establishing and maintaining critical no parking/tow away zones for public safety.
  - Developing an informational hazardous material and disaster preparedness educational program for individual households and neighborhood associations.
  - Identifying utility facilities in hazard areas for relocation or undergrounding.
  - Preparing a pamphlet regarding fire safety as it relates to landscaping installation and maintenance.
  - Evaluating the relocation of equipment and services for emergency purposes.

Within two years of adoption of this Safety Element, these City Departments are primarily responsible for the following:

- Police Department (in cooperation with Fire Authority)
  - Undertaking a comprehensive emergency access and evacuation evaluation program and implementing its recommendations.
  - Coordinating local emergency service facilities with utility companies.
- Development Services Department/Engineering Department
  - Identifying the effects of the most probable seismic event on the City's infrastructure.
  - Developing an education program promoting emergency response preparedness, especially for earthquake survivability, and home retrofitting and adequate anchoring.
  - Maintaining and updating, as appropriate, an information pamphlet on flood hazards and protection measures.

Within three years of adoption of the Safety Element, these City Departments are primarily responsible for the following:

- Police Department (in cooperation with Fire Authority)
  - Maintaining the Emergency Operations Center.
- Development services Department/Engineering Department
  - Preparing a Geological Hazards Map of the entire City.

Finally, the last part of the implementation section lists actions to be taken on an ongoing basis and include the following:

- City Council
  - Bi-Annually review the Safety Element objectives achieved during the preceding year and set the safety objectives for the time period, based upon changing conditions, new information, revised City policies and priorities and budget constraints.
  - Ensure that adequate facilities and police and fire services are maintained to protect the citizens of Seal Beach.
  - Oppose offshore oil leasing.
- All City Departments

  - Participate in emergency response exercises and operational support for the Emergency Operations Center.

- Police Department (in cooperation with the Fire Authority)

  - Maintain mutual aid arrangements and hold disaster preparedness exercises.
  - Maintaining an Emergency Management Coordinator function in the Police Department.

- Fire Authority

  - Monitor local sources of toxic wastes.
  - Encourage and support the use of alternatives to toxic materials.
  - Maintain the performance standard of an average total reflex time of seven minutes or less.
  - Encourage property owners to create defensible space surrounding their homes.
  - Work with the Water Districts to maintain an adequate supply of water, both for consumptive use and emergency fire-fighting supply.

- Development Services Department

  - Require that new streets have a minimum unobstructed width of 20 feet.
  - Require the undergrounding of utilities for new development.
  - Require soils and geology reports based on subsurface explorations and their independent review for new development. Maintain these reports on file and index in the City's Geographic Information System. Restrict development where there is a geological unacceptable level of risk.
  - Require supervision of a soils engineer for grading operations.
  - Enforce bluff and hillside protection measures.
  - Require erosion control measures for new development.
  - Adopt the latest editions of the Uniform Building Code, especially in regards to earthquake standards and fire resistive construction.
  - Prohibit the location of new essential facilities in geologically hazardous areas.
  - Require the latest earthquake standards for new essential facilities.

- Encourage property owners to consider "fire-wise" planting surrounding their homes.
- Monitor the effects of inland development on the City's watershed and attempt to minimize their impacts.
- Prohibit the construction of structures on the sandy portion of the beach.
- Enforce current building setback standards from beaches and bluff tops.

- Engineering Department
  - Ensure that new public facilities or major additions are designed and located to minimize or eliminate any potential hazard impacts.
  - Promote and implement safe transport and/or disposal of hazardous wastes.
  - Facilitate effective response to hazardous materials emergencies.
  - Facilitate the proper separation of sewer and storm drain systems through proper design, infrastructure upgrades, and timely maintenance.
  - Provide for ongoing maintenance and inspections of all public drainage facilities and encourage property owners to maintain private drainage structures.
  - Maintain and improve the City's storm drainage infrastructure capacity. Ensure that storm water and drainage are contained, controlled, and discharged in an appropriate manner.
  - Eliminate or mitigate uncontrolled storm drain flow on hillsides or bluffs. Utilize only proven and effective erosion control methods after fire disasters. Develop, adopt, and construct flood control plans. Minimize their environmental consequences.