

VI. ENVIRONMENTAL HAZARDS ELEMENT

A. BACKGROUND

1. Purpose

This Environmental Hazards Element of the Belvedere General Plan examines some of the special problems of developing property in Belvedere's unique environment, and proposes strategies to insure that Belvedere remains a safe, as well as an environmentally attractive, setting.

The text is arranged to:

- Provide an introduction to the environmental setting of Belvedere, in geologic, seismic and other hazard terms.
- Describe the relationships of these natural hazards.
- Propose policies designed to lessen the costs and dangers of these hazards.
- Append and reference important technical and background information.

The objectives of this element are to reduce potential injury or loss of life and to lessen possible property damage. City initiated measures to lessen risk to human life and property should focus upon:

- Areas identified as known or suspected greatest natural hazard areas; and
- Those hazards which can be avoided or mitigated for new development through improved land development practices.

a. Why an Environmental Hazards Element?

This element is intended to comply with the State law that requires the inclusion of a seismic safety and safety element as part of every local government's adopted General Plan.¹

1. Government Code Section 65302(65302.1)-A Seismic Safety Element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to the effect of seismically-induced waves such as tsunamis and seiches. The Seismic Safety Element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves. A Safety Element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirement, minimum

Beyond this mandate, however, there are compelling reasons for citizens and decision-makers to concern themselves with identifying and mitigating hazards inherent in Belvedere's natural setting.

Homeowners, developers, and government officials experience environmental hazard impacts, often with significant property losses and occasionally with danger to people in their daily activities.

There have been small landslides, differential ground settlements, and soil shrinkages causing foundation cracking, road buckling, utility breakage and sometimes complete destruction of structures. In addition to these impacts by the environment in response to inadequately planned or engineered projects, there are unavoidable sudden dangers of flood or wildfire. These, too, draw most of their threat from the lack or inadequacy of land planning of an earlier time. Looming over all is the ever-present potential for another major earthquake as in 1906.

While these costs and dangers are impressive, they can often be avoided altogether, almost always be reduced, and, in the case of major earthquakes, at least be well prepared for.

Varying degrees of protection can be taken to safeguard against the hazards associated with the environmental conditions discussed in this element. The costs necessary to insure against damage can be very great, and judgments about the risk entailed must include the weight of the consequences for not undertaking such measures. Many of the recommendations which take the form of policies are measures which the City, as a rule, implements at the present time. Every year brings us a greater knowledge of the sciences which explain the complex phenomena and earth processes involved in these environmental hazards; each year our ability to assess risk and develop measures to preclude or mitigate such risk increases. The policy recommendations attempt to reflect the evolution of the "state of the art," and they demand a sophisticated degree of case by case evaluation.

There are many possible environmental hazards. Seismic and non-seismic geologic hazards, as well as fire and flood, are specifically included in this element because:

- They have all occurred in Belvedere in recent history, sometimes with devastating effect, and they all could occur again in the future, and

- These topics are mandated by state law to be part of each

road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard.

jurisdiction's adopted General Plan.

Environmental hazards not in this element include: vector-related health hazards, air pollution, water supply contamination, noise, airport landing and takeoff safety zones, and other issues which are not likely to significantly impact Belvedere.

B. SETTING

1. Geology

The terrain of Belvedere and Corinthian Islands consists of a complex assemblage of Franciscan formation rocks, such as serpentine, greenstone, graywacke, chert, shale, sandstone, and glaucophane schist. While most of these formations exist in small amounts on the islands, predominant are greenstone -- rocks of volcanic origin -- and sandstone -- tough, nonporous, thick-bedded graywacke. Quaternary deposits -- fine to medium grained sands, with minor amounts of clay possibly included, characterize the geology of some lower portions of the east side of Belvedere Island, including lower Beach Road and San Rafael Avenue. The Lagoon area is 1-1/2 feet to 3 feet of homogenous artificial fill materials over younger bay mud. The mud ranges in depth from a minimum of 20 feet to over 90 feet, according to tests by preconstruction borings.

2. Slope Stability

Belvedere has two different topographic settings that define sharply contrasting geologic conditions and stability problems which exist independent of any triggering seismic event. These are:

- The steep hills and ridges which are subject to landslides and downhill creep.
- The bay plains, marshlands, and mud flats subject to subsidence and differential settlement.

Until there is a major earthquake, these conditions are expected to be the source of most of the losses due to natural hazards in Belvedere.

3. Seismic Risks

Marin County occupies a geologic setting that is both complex and dynamic. The County lies astride the San Andreas fault, an active rupture between two great plates of the earth's crust. For many millions of years the Pacific Plate, which includes the Point Reyes Peninsula, has been migrating northwest, sporadically jerking and sliding past the North American Plate along this rup-

ture. As a result, different bedrock sequences that originated up to hundreds of miles from each other have been juxtaposed on

opposite sides of the fault, which follows the trough-like Olema Valley and Tomales Bay.

Other than the San Andreas, no active faults, established as potential sources of earthquakes, are known within Marin County. However, most of the County is sandwiched between two major active fault zones, the San Andreas and the Hayward, both of which have generated significant earthquakes during the 200 years of recorded history of the area.

The predominant sources of earthquake damage to be expected in the uplands of Belvedere are from landslides and fires triggered by the shaking.

Because many streets in the hills traverse upslope landslide deposits, and streets are the usual routes of underground utility pipes, it should be expected that a significant earthquake generated in the north Bay Area will result in the disruption of some transportation routes and the rupturing of water, gas, and sewer lines as a result of earthquake-induced landslides.

The levels of risk both on Belvedere and Corinthian Islands and in the Lagoon area, based on the available information, suggest radical action is not warranted. In support of this view is the fact that, in housing areas similar to the Lagoon, where risks are obviously highest, houses of wood frame construction have survived ground shaking and subsidence -- even in the strongest known earthquake -- without loss of life. Structures with the highest potential hazard -- those on the Lagoon, and those of brick or stone or having large areas of glass -- could be made safer through remedial measures to reduce structural hazards. The earthquake in October of 1989 damaged several houses, sidewalks and roads in the Lagoon area of Belvedere. Older homes on Belvedere and Corinthian Islands may not meet seismic safety standards, especially with respect to proper attachment of framing to foundations, bracing of structural members, and shut-off systems for electrical, water, and gas lines. Such defects should be noted during the residential resale inspections so that they can be corrected.

In the absence of more definitive information indicating problems more severe than those known, community consensus is that these levels of risk are acceptable.

4. Fire Hazard

Fire protection for the City is provided by the Tiburon Fire Protection District, along with the volunteer fire department. However, the fire hazard potential in Belvedere continues to be a community concern. In part, the hazard is caused by the large number of eucalyptus trees with their highly inflammable droppings. It is also caused by the steep down and upslope portions

of some lots which, due to difficult access, grow wild and contain flammable debris and brush. Houses with wooden roofs and decks built close together, particularly on Corinthian Island and in the Lagoon area, also contribute to the fire hazard potential. The extremely narrow and winding streets on Belvedere Island and Corinthian Island are also an impediment to quick response by the Fire District. In 1987 the City Council adopted a Fire Sprinkler Ordinance which requires installation of fire sprinkler systems in new homes and during major additions or remodeling projects. In 1992 an Ordinance was adopted prohibiting the use of wooden roof materials.

In April of 1992 a Task Force on Fire Preparedness, appointed by the Belvedere City Council, submitted a report with 48 recommendations for fire preparedness. Many of their recommendations are incorporated in Sections C and D of this Element.

5. Emergency Access

Access for fire and police vehicles has been and will continue to be a significant concern. The narrow city roads present access difficulties, particularly where on-street parking by residents, guests, and construction vehicles makes the right-of-way too narrow to permit a fire truck, ambulance, or even a police car to pass. This problem was addressed to a large degree in 1989 when the City created a restricted parking program on Belvedere Island that requires all on-street parking to be within designated parking areas that are delineated by pavement markings. Parking within these designated areas provides the minimum 10' clearance required for emergency vehicular access. Violators of the restricted parking program should continue to be subject to substantial fines if their vehicles are found parked outside of the marked areas of the designated parking zone.

6. Flooding

During the January 1982 storms, a number of the properties fronting on Belvedere Lagoon experienced yard and house flooding. To some degree, this may have been partially due to poor maintenance of storm drainage systems. Further, there was little advance warning of the severity of the storm, which exceeded all recorded storms in Marin County. Since 1982, street drainage has improved and runoff decreased. A list of flooded properties is maintained by the City Engineer.

C. POLICIES AND OBJECTIVES

The following objectives serve to guide the development of Belvedere in a healthy and balanced environment.

- Closely regulate all construction activity in areas prone to fire, flood and landslides.

- To assure public safety in flood plains, and severe geologic risk areas, regulate the construction of concentrated or sensitive uses, such as schools, community facilities, and housing.
- Require thorough field investigation of geologic hazards as a prerequisite to Design Review and construction approval and require site stabilization to minimize such risks.

The following policies are a means of achieving a safe and high quality environment:

1. Expand public awareness of environmental hazards by actively advising citizens of the availability of local area hazard studies, sources of hazard information, and existing public services.
2. Continue to support scientific geologic investigations to refine, enlarge and improve the knowledge about active fault zones, areas of instability, severe ground shaking and similar hazards in Belvedere.
3. Construction shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, and fire.
4. In the areas identified as subject to ground-shaking, the development of structures for human habitation, including residential and commercial uses, shall incorporate engineering measures to mitigate against risk to life safety, at least to the extent provided by the current Uniform Building Code adopted by the City of Belvedere.
5. Applications for developments or additions proposed to be sited on landslide deposits, non-engineered fill, or bay mud shall be accompanied by a geotechnical engineering investigation satisfactory to the Belvedere City Engineer directed to the problem of ground shaking and ground failure. The engineering geologist and civil engineer shall submit recommendations regarding site development, structural engineering, and drainage.
6. Projects² proposed for slopes rated 3 or 4 in stability classification (on maps prepared by the California Division of Mines and Geology) shall be evaluated for stability prior to consideration of site design or use. The evaluation shall include the structural foundation

 2. "Project" includes the construction or modification of an existing single-family home or accessory structure or larger project.

engineering of the actual site and shall include possible impact of the project on adjacent lands. Where, in the course of land development review, it is determined by the Belvedere City Engineer to be necessary, this evaluation shall also apply to remodeling and/or additions on existing single family lots.

7. In projects where such evaluations indicate that state-of-the-art measures can correct instability, the City should require that the foundation and earth work be supervised and certified by a geotechnical engineer, and where deemed necessary, by an engineering geologist.
8. Known landslides and landslide-prone deposits on steep slopes should not be used for development except where engineering and geologic site investigations indicate such sites are stable or can be made stable providing appropriate mitigating measures are taken. In such cases, it must be shown to the satisfaction of the City that the risk to persons or property or public liability can be minimized to a degree acceptable to the City.
9. Filled land which is underlain by compressible materials (bay mud, marsh, slough) should receive special attention during site planning. Soils investigations should include borings and sufficient examination to determine the location of former sloughs and other factors which would accentuate differential settlement. And, the investigation should delineate those areas where settlement will be greatest, subsidence will occur, etc., and should recommend the site preparation techniques which could be employed to preclude hazard.
10. The Fire Protection District and City's program of systematic lot and eucalyptus cleanup should be stepped up. The program works as follows: the owner is informed his property constitutes a fire hazard and is given a time limit to clean it up. If he fails to do so, the City cleans up the lot and assesses the owner.
11. The Planning Commission, with input from the Building Inspector and Fire Marshal should periodically review the building code to ensure maximum reasonable fire hazard protection.
12. All plans for development of vacant sites and major remodeling shall be referred to the Fire Marshal at the Tiburon Fire Protection District for review and recommendations.

13. To assure emergency and public service vehicular access in places where 10 foot road width is critical, vehicles which overhang those limits shall be cited for parking violations.

D. IMPLEMENTATION

The majority of the following implementation steps pertain to the review of development applications and to guiding staff and decision-makers in the consideration of land development in hazard zones. It is recommended that the first level of implementation be achieved in the following fashion:

1. Institutionalize the Environmental Hazards policies through review for possible amendment of the grading, subdivision, zoning, building code, design review, and other sections of City Code. Particular attention should be paid to the adequacy of building setbacks with respect to fire safety concerns.
2. Prepare for general public availability the hazard zone delineation maps, including floodways, seismic zones, and areas of relative slope stability enabling site plans to be designed according to the constraints of the site.
3. Consult the hazard zones maps in the preparation of Initial Studies required by the California Environmental Quality Act.
4. Address the hazard in the preparation of Environmental Impact Reports required by the California Environmental Quality Act.
5. A public education program should be initiated which periodically informs Belvedere residents about fire codes and encourages them to remove dead vegetation and to prune plants located too close to buildings.
6. An Evacuation Map should be prepared to illustrate evacuation routes for vehicles and pedestrians. Belvedere residents with special evacuation needs should be inventoried and planned for.
7. A program should be developed to place all power lines underground in Belvedere. The existing Belvedere Without Wires Committee should be encouraged to create an undergrounding priority list and schedule.

8. Belvedere Way has been improved to provide for safe pedestrian use and should be further improved to make the Grade available for vehicular use during emergencies.