PROCEDURAL GUIDANCE DOCUMENT:
BEACH EROSION AND RESPONSE

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PURPOSE AND USE OF THIS DOCUMENT

The Task Force members hope that this manual will support informed analyses of activities that may affect beach erosion, and the recommendations upon which the decision-making bodies (such as the California Coastal Commission or local governments) base their decisions. This manual is intended to provide information and to identify other sources of information that is useful to those making regulatory and land use planning decisions. This manual does not establish any requirements and is not intended to be the basis for Coastal Commission or local government agency decisions. This manual should not be cited as the basis of a Coastal Commission or local government action.

Material in this manual should be useful to everyone in California who reviews applications for shoreline protection projects or develops land use policies that address shoreline development.* A detailed Table of Contents has been provided to help readers easily find the subjects in which they are most interested. General information on shoreline types and shoreline protection devices and a glossary of terms have been provided as basis reference material. Numerous references have also been provided for anyone who wishes to get more detailed information. This manual also provides detailed information on how applications for shoreline protection projects are reviewed and analyzed by Commission staff. This includes identification of the information that is required by regulations to be provided in a complete application, and the major analytic steps that the Commission takes in evaluating a proposal for a shoreline protection project. Guidance is also provided for developing Local Coastal Program policies that will eliminate the need for or minimize the impacts from shoreline protection.

This Procedural Guidance Document, Beach Erosion and Response, is a work in progress. The working version is presented in a three-ring binder format to make it easier to update as new material is developed or as new policies and tools are identified. The Task Force hopes that as new material is developed, analysts will share the new material and update this document regularly.

This document has not been reviewed or adopted by the California Coastal Commission. It is not binding on the Commission, its staff, local government, or the public. This manual has been developed for informational purposes only.

* Since shoreline protection devices, by their very nature, will alter the shoreline and shoreline processes, they are of significant concern to the California Coastal Commission and local coastal governments.
1.0 Introduction

California’s beaches annually attract millions of tourists; the surf and sun spawned a cultural and musical revolution; California’s ports annually ship billions of dollars in cargo and provide the United States a critical link to international commerce; California’s coast provides housing and employment opportunities for approximately one out of every three residents; the wetlands feed and shelter trillions of local and migratory birds; and, the open coast supports a multi-million dollar fisheries industry. Yet California’s fragile link between land and ocean — its beaches — is being threatened from all directions. Threats from the ocean come from natural sources such as wave and storm conditions, and longshore currents, and from human sources such as marine debris, oil spills, and pollution. Other threats come from...
the removal of beach sand for building material, reduction of sand supplies as a result of dams and flood controls, interruption of normal sediment transport, placement of permanent structures in or on top of the sand, and modification of natural accretion and erosion activities. Most of these threats are not from activities that directly affect the beach, but are secondary effects from other activities such as property protection, flood control, energy development, and harbor expansion. Regardless of the purpose or intent, the end result has been the loss of sandy beach, loss of public beach access, and limitations on beach recreation.

Persons familiar with the California coast have long observed that California is losing its beaches. Articles have been written about sand loss, conferences have been held to discuss “The Battered Coast”, and millions of dollars have been spent to study sand movement and how to replenish our vanishing beaches.

In 1972, the “Save the Coast” initiative was passed (precursor to the California Coastal Act of 1976). Two of the main goals of the campaign were to recognize the coast as a special resource deserving protection and to preserve everyone’s right to access the coast. As a planning and regulatory agency, the California Coastal Commission’s (CCC) primary role has been to achieve these goals through the development of Local Coastal Plans (LCP) and individual project reviews. Recently, through the Regional Cumulative Assessment Project (ReCAP)\(^1\), focused on the Monterey Bay area from the Santa Cruz–San Mateo County line south to Point Lobos, Coastal Commission staff found that substantial beach loss was occurring from individually small projects. The ReCAP study found that, since 1976, permits have been issued for revetments and seawalls which cover approximately 5 acres of sand beach, adding to the 20 acres of beach covered by seawalls and revetments built prior to the Coastal Act. This was in addition to the numerous other effects to the beaches that had not been or could not be quantified. This study substantiated the perception that California is losing its beaches.

Documentation of beach loss through ReCAP occurred at the same time that the Commission was trying to find ways to allow protection of upland development while minimizing impacts to littoral sand supplies. One such action was an In-Lieu Fee program in northern San Diego County to place sand on the beach in a quantity equivalent to the beach area and sand volume removed by the shoreline protection. These efforts led the Coastal Commission’s Management Team to support an internal effort to review and address loss of sandy beach statewide, resulting in the Beach Erosion and Response (BEAR) Task Force and this Procedural Guidance Document.

While most people feel that the coast belongs to all of us, they usually are not aware that the State holds in trust for its citizens the area seaward of the mean high tide. At statehood in 1850, our state legislature recognized the extreme importance of the coastal edge for navigation, commerce, fishing, and recreation, and protected this area in perpetuity for all citizens to enjoy.

\(^1\) California Coastal Commission, Regional Cumulative Assessment Project, (September 1995). “Findings and Recommendations: Monterey Bay Area.”
As private shoreline development has moved closer to the ocean and bluff edge, especially over the last twenty years, the State has allowed installation of shoreline protection devices — often on state owned beaches — to protect private upland development. As we examine cumulatively this private encroachment onto public trust areas, we realize that the public has been losing increasingly more and more public beach area and public trust land. Private shoreline protective devices that the public sometimes funds through federal subsidy programs are covering up our beaches and tidelands. One of the goals of the Task Force is to look at the many impacts to public beaches from shoreline protection, quantify these impacts when possible, and develop recommendations to prevent or reduce it.

1.1 A NOTE ON THE USE OF THIS DOCUMENT

The Guidance Document presents information to assist coastal analysts with development of recommendations concerning shoreline protection in the context of both coastal development permits (CDP) and local coastal programs (LCP). Since shoreline protection options often vary with the type of shoreline, the document presents a general overview of shoreline types, and information on traditional shoreline protection options and applicability. Planning and regulatory tools for shoreline protection projects follow this.

The following flow chart Figure 1-1 is a guide for reviewing a new CDP application for a shoreline protective device. It outlines the steps involved in reviewing an application. These steps are a critical component of the permit process because the Commission relies on the applications for information that will help identify the impacts of the proposed project and to determine the consistency of the proposed project with Chapter 3 policies. The flowchart cites to various sections of this guidance document in order to help analysts understand the relationship between the information required in the application and the analysis of the consistency of the proposed development with the Coastal Act.

Sections 2 and 3 provide the analyst with general information on various types of shorelines and of various types of structures that might be proposed for shoreline protection. Individual applications should be reviewed for consistency with either Chapter 3 policies (Section 4) or LCP policies (see Section 5). Section 4.1 provides a brief discussion of impacts and alternatives that can help with review of a permit application for completeness. Section 4.2 provides several filing checklists that can be used to guide a determination of completeness and help with the preparation of a “non-filing” letter, if needed. These sections try to cover most foreseeable concerns but should be modified by the analyst to address the specific project.
Figure 1-1: Flow Chart for Reviewing a CDP Application for Shoreline Protection

Shoreline protection application received

Review for completeness (10- to 30-day review period)
Chapter 3 policies (Section 1)
LCP if applicable (Section 5)
Check adequacy of information for analysis and staff recommendation:
- Regular & special filing requirements (Section 4)
- Shoreline type (Section 2)
- Project description (Section 3)
- Project need & erosion danger (Section 4)
- Alternatives (Section 4)
- Impacts on coastal resources
- Impacts on local sand supplies
- Other information, as needed

Is application complete?

No

Incomplete filing letter

Yes

Accept for filing
- Set for hearing within 49 days and take action within 180 days under Permit Streamlining Act.

Are there existing structures?

No

Not required to approve shoreline protection under Coastal Act 30235. Review under other Coastal Act policies. Consider alternatives. Go to staff recommendation.

Yes

Are existing structures in danger from erosion? Consider:
- Engineering geologic report
- Coastal process information
- Existing setback
- Past Commission actions

(continued on next page)
Figure 1-1: Flow Chart for Reviewing a CDP Application for Shoreline Protection

(continued from previous page)

Is shoreline altering construction required? Consider alternatives which do not alter natural shoreline processes but provide required protection.

- Ground/surface water control
- Landscaping
- Beach nourishment
- Remove/relocate accessory structures
- Past Commission actions

No

Staff recommendation

APPROVAL WITH CONDITIONS
- Identify alternatives to shoreline altering construction to increase stability, reduce risk, and avoid shoreline altering construction in future. (Ref. Section 30253)

Yes

Identify impacts of proposed project on coastal resources.

DENIAL
- Identify inconsistencies with Coastal Act.
- Identify alternatives.

Identify feasible design alternatives to reduce impact, e.g., width, height, location, type, etc.

Identify mitigation measures for identified impacts, including sand supply.

APPROVAL AS PROPOSED
- Identify Coastal Act consistency.
- Identify lack of feasible mitigation measures or alternatives that lessen significant adverse impacts.

Staff recommendation

APPROVAL WITH CONDITIONS
- Identify mitigation measures and/or design alternatives that lessen significant adverse impacts on coastal resources.
Section 4.3 describes the general analytic steps that an analyst uses to determine if a shoreline protection device is needed.

The first examination of the proposed project must consider whether there is an existing structure on the site and if the existing structure is in danger from erosion. If so, the analyst should look for the source of the erosion danger. The Engineering Geologic Report should provide detailed information about threats to or instability of the site. Clear identification of the erosion danger can help identify available options and direct the review of alternatives.

As soon as a geologic hazard or shoreline erosion issue is identified the analyst should immediately notify the senior coastal engineer and the senior coastal geologist in the Commission’s Technical Services Unit. A copy of the geologic report should be forwarded to the Technical Services Unit with a work request form (Appendix D).

As long as they are given adequate notice of the project, the senior coastal engineer and/or senior geologist will provide technical review and advice and work with the analyst to develop the staff recommendation.

Final staff recommendations can be for denial, approval, or approval with conditions. A recommendation for denial may be warranted if there is no evidence that an existing structure is in danger from erosion or that a shoreline protection device is required to protect the structure from erosion. A recommendation of approval may be warranted if the project, as proposed, is consistent with the Coastal Act and no mitigation is required. A recommendation of approval with conditions may be warranted if there are identified inconsistencies with the Coastal Act that can be minimized or avoided through conditions.

Section 5 provides an overview of the LCP concerns that would be appropriate for reviewing either a new LCP or amendments to an existing LCP. Appendix A provides a Glossary of frequently used coastal terms. Appendix C is a listing of recent commission permits that have addressed critical shoreline protection issues that may be useful reference for future permit analysis.

The Task Force Members hope that this manual will support informed analyses of activities that may affect beach erosion, and the recommendations upon which decision-making bodies (such as the California Coastal Commission or local governments) base their decisions. This document has not been reviewed or adopted by the Coastal Commission. This manual has been developed for informational purposes only. The information contained in the manual (i.e. coastal development permit conditions, local coastal program policies, and referenced works) can be used to inform regulatory or land use planning decisions. This manual does not establish any requirements and is not intended to be the basis for Commission or local government agency decisions. This manual should not be cited as the basis of a Coastal Commission or local government action.
This Procedural Guidance Manual, Beach Erosion and Response, is a work in progress. The working version is presented in a three-ring binder format to make it easier to update as new material is developed or as new policies and tools are identified.

1.2 COASTAL ACT POLICIES FOR SHORELINE PROTECTION

Sections contained within the Coastal Act form the basis for the legal authority of both the Commission and local governments to regulate the location and construction of shoreline development including shoreline protective devices. The following discussion of the citations from the Coastal Act will, first, provide several critical definitions and define the Commission’s legal authority to review shoreline development and, second, discuss the standard of review for such development as defined by Chapter 3 of the Coastal Act.

Definitions

Coastal Act Section 30106. "Development" means, on land, in or under water, the placement or erection of any solid material or structure; discharge or disposal of any dredged material or of any gaseous, liquid, solid, or thermal waste; grading, removing, dredging, mining, or extraction of any materials; change in the density or intensity of use of land, including, but not limited to, subdivision pursuant to the Subdivision Map Act (commencing with Section 66410 of the Government Code), and any other division of land, including lot splits, except where the land division is brought about in connection with the purchase of such land by a public agency for public recreational use; change in the intensity of use of water, or of access thereto; construction, reconstruction, demolition, or alteration of the size of any structure, including any facility of any private, public, or municipal utility; and the removal or harvesting of major vegetation other than for agricultural purposes, kelp harvesting, and timber operations which are in accordance with a timber harvesting plan submitted pursuant to the provisions of the Z'berg–Nejedly Forest Practice Act of 1973 (commencing with Section 4511).

As used in this section, "structure" includes, but is not limited to, any building, road, pipe, flume, conduit, siphon, aqueduct, telephone line, and electrical power transmission and distribution line.

Discussion: Most shoreline protective devices and beach nourishment projects fit the Coastal Act definition of development. Examples of shoreline protective devices that have been regulated as development include but are not limited to vertical seawalls, riprap, gunnite, sand bags, and building sand berms.

Coastal Act Section 30105.5. “Cumulatively” or “cumulative effect” means the incremental effects of an individual project shall be reviewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.
Discussion: The California Environmental Quality Act (CEQA) requires the Coastal Commission to address the cumulative effects of proposed development in its analysis of a project and in its findings. (Also see Section 30250 that addresses siting of new development.)

Permit Review

Coastal Act Section 30600 (in part). (a) Except as provided in subsection (e), and in addition to obtaining any other permit required by law from any local government or from any state, regional, or local agency, on or after January 1, 1977, any person wishing to perform or undertake any development in the coastal zone, other than a facility subject to the provisions of Section 25500, shall obtain a coastal development permit.

(e) This section does not apply to any of the following projects, except that notification by the agency or public utility performing any of the following projects shall be made to the commission within 14 days from the date of the commencement of the project:

1) Immediate emergency work necessary to protect life or property or immediate emergency repairs to public service facilities necessary to maintain service as a result of a disaster is a disaster-stricken area in which a state of emergency has been proclaimed by the Governor pursuant to Chapter 7 (commencing with Section 8550) of Division 1 of Title (a) of the Government Code.

2) Emergency projects undertaken, carried out, or approved by a public agency to maintain, repair, or restore an existing highway, as defined in Section 360 of the Vehicle Code, except for a highway designated as an official state scenic highway pursuant to Section 262 of the Streets and Highways Code, within the existing right-of-way of the highway, damaged as a result of fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide, within one year of the damage. This paragraph does not exempt from this section any project undertaken, carried out, or approved by a public agency to expand, widen a highway damaged by fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide.

Discussion: The above section provides the authority for the Commission and local governments to require coastal development permits for development in the coastal zone, and specifies certain emergency actions that can be undertaken to protect public facilities and highways without a permit.

Coastal Act Section 30610 (in part). Notwithstanding any other provision of this division, no coastal development permit shall be required pursuant to this chapter for the following types of development and in the following areas:
(b) Improvements to any structure other than a single-family residence or a public works facility; provided, however, that the commission shall specify, by regulation, those types of improvements which (1) involve a risk of adverse environmental effect, (2) adversely affect public access, or (3) involve a change in use contrary to any policy if this division. Any improvement so specified by the commission shall require a coastal development permit.

Discussion: Section 13253 of the California Code of Regulations identifies those types of improvements which involve a risk of adverse environmental effect, adversely affect public access, or involve a change in use contrary to the policy of Division 20 of the Public Resources Code. These listed improvements require a coastal development permit. Section 13253(b) states (not in its entirety):

(1) Improvements to any structure if the structure or the improvement is located: on a beach; in a wetland, stream, or lake; seaward of the mean high tide line; in an area designated as highly scenic in a certified land use plan; or within 50 feet of the edge of a coastal bluff;

(2) Any significant alteration of land forms including removal or placement of vegetation, on a beach, wetland or sand dune; in a wetland or stream; within 100 feet of the edge of a coastal bluff, in a highly scenic area, or in an environmentally sensitive habitat area;

(4) On property not included in (b)(1) above that is located between the sea and the first public road paralleling the sea or within 300 feet of the inland extent of any beach or of the mean high tide of the sea where there is no beach, whichever is the greater distance, or in significant scenic resource areas as designated by the commission or regional commission an improvement that would result in an increase of 10 percent or more of internal floor area of the existing structure, or constitute an additional improvement of 10 percent or less where an improvement to the structure has previously been undertaken pursuant to Public Resources Code Section 30610(b), and/or increase in height by more than 10 percent of an existing structure;

... (6) Any improvement to a structure where the coastal development permit issued for the original structure by the commission, regional commission, or local government indicated that any future improvements would require a development permit.

Coastal Act Section 30610 (in part). Notwithstanding any other provision of this division, no coastal development permit shall be required pursuant to this chapter for the following types of development and in the following areas:
(d) Repair or maintenance activities that do not result in an addition to, or enlargement or expansion of, the object of those repair or maintenance activities; provided, however, that if the commission determines that certain extraordinary methods of repair and maintenance involve a risk of substantial adverse environmental impact, it shall, by regulation, require that a permit be obtained pursuant to this chapter.

Discussion: Section 13252 of the California Code of Regulations identifies those extraordinary methods of repair and maintenance that involve risk of substantial adverse environmental impact. These listed methods of repair and maintenance require a coastal development permit. These include, as follows (not in its entirety):

(a)(1) Any method of repair or maintenance of a seawall, revetment, bluff retaining wall, breakwater, groin, culvert, outfall, or similar shoreline work that involves: (A) repair or maintenance involving substantial alteration of the foundation of the protective work including pilings and other surface or subsurface structures; (B) the placement, whether temporary or permanent, of rip-rap, artificial berms of sand or other beach materials, or any other forms of solid materials, on a beach or in coastal waters, streams, wetlands, estuaries and lakes or on a shoreline protective work except for agricultural dikes within enclosed bays or estuaries; (C) the replacement of 20 percent or more of the materials of an existing structure with materials of a different kind; or (D) the presence, whether temporary or permanent, of mechanized construction equipment or construction materials on any sand area, bluff, or environmentally sensitive habitat area, or within 20 feet of coastal waters or streams.

(a)(2) Any method of routine maintenance dredging that involves: (A) the dredging of 100,000 cubic yards or more within a twelve (12) month period; (B) the placement of dredged spoils of any quantity within an environmentally sensitive habitat area, on any sand area, within 50 feet of the edge of a coastal bluff or environmentally sensitive habitat area, or within 20 feet of coastal waters or streams; or (C) the removal, sale, or disposal of dredged spoils of any quantity that would be suitable for beach nourishment in an area the commission has declared by resolution to have a critically short sand supply that must be maintained for protection of structures, coastal access or public recreational use.

(a)(3) Any repair or maintenance to facilities or structures or work located in an environmentally sensitive habitat area, any sand area, within 50 feet of the edge of a coastal bluff or environmentally sensitive habitat area, or within 20 feet of coastal waters or streams that include: (A) the placement or removal, whether temporary or permanent, of rip-rap, rocks, sand, or other beach materials or any other forms of solid materials; (B) the presence, whether temporary or permanent, of mechanized equipment or construction materials.
(b) Unless destroyed by natural disaster, the replacement of 50 percent or more of a single family residence seawall, revetment, bluff retaining wall, breakwater, groin or any other structure is not repair and maintenance under Section 30610(d) but instead constitutes a replacement structure requiring a coastal development permit.

Coastal Act Section 30610 (in part). Notwithstanding any other provision of this division, no coastal development permit shall be required pursuant to this chapter for the following types of development and in the following areas:

(g) (1) The replacement of any structure, other than a public works facility, destroyed by a disaster. The replacement structure shall conform to applicable existing zoning requirements, shall be for the same use as the destroyed structure, shall not exceed either the floor area, height, or bulk of the destroyed structure by more than 10 percent, and shall be sited in the same location on the affected property as the destroyed structure.

(2) As used in this subdivision:

(A) "Disaster" means any situation in which the force or forces which destroyed the structure to be replaced were beyond the control of its owner.

(B) "Bulk" means total interior cubic volume as measured from the exterior surface of the structure.

(C) "Structure" includes landscaping and any erosion control structure or device which is similar to that which existed prior to the occurrence of the disaster.

Discussion: Replacement of existing structures that have been destroyed by a disaster is exempt from the Commission’s review under the Coastal Act, if the activities are within the limitations specified above.

Coastal Act Section 30611. When immediate action by a person or public agency performing a public service is required to protect life and public property from imminent danger, or to restore, repair, or maintain public works, utilities, or services destroyed, damaged, or interrupted by natural disaster, serious accident, or in other cases of emergency, the requirements of obtaining any permit under this division may be waived upon notification of the executive director of the commission of the type and location of the work within three days of the disaster or discovery of the danger, whichever occurs first. Nothing in this
section authorizes permanent erection of structures valued at more than twenty-five thousand dollars ($25,000).

Discussion: This section authorizes the executive director to waive the requirements for a permit for development that is needed to repair, maintain or protect public works, utilities or services that have been destroyed or damaged by natural disaster, serious accident, or other emergency. The repair or maintenance actions must be valued at less than $25,000 and not involve permanent structures.

Coastal Act Section 30624 (in part). (a) The commission shall provide, by regulation, for the issuance of coastal development permits by the executive director of the commission or, where the coastal development permit authority has been delegated to a local government pursuant to Section 30600.5, by an appropriate local official designated by resolution of the local government without compliance with the procedures specified in this chapter in cases of emergency, other than an emergency provided for under section 30611…

Discussion: The above section authorizes the Commission to adopt regulations that allow for issuance of coastal development permits without following typical procedures, in emergency cases. The Commission has adopted regulations that define the term “emergency.” Emergency permits can be issued for development in situations that meet the definition of “emergency.” (California Code of Regulations Section 13009.)

Coastal Act Section 30604 (in part). (c) Every coastal development permit issued for any development between the nearest public road and the sea or the shoreline of any body of water located within the coastal zone shall include a specific finding that the development is in conformity with the public access and public recreation policies of Chapter 3 (commencing with Section 30200).

Discussion: This section requires that the Commission review the public access and recreational impacts of all new shoreline development and make a finding that the approval of shoreline development is in conformance with the public access and recreation policies of the Coastal Act. This finding must be made by the local government in those cases where a local government has the authority to issue coastal development permits.

Coastal Act Section 30601.5. Where the applicant for a coastal development permit is not the owner of a fee interest in the property on which a proposed development is to be located, but can demonstrate a legal right, interest, or other entitlement to use the property for the proposed development, the commission shall not require the holder or owner of any superior interest in the property to join the applicant as coapplicant. All holders or owners of any other interests of record in the affected property shall be notified in writing of the permit application and invited to join as coapplicant. In addition, prior to the issuance of a
coastal development permit, the applicant shall demonstrate the authority to comply with all conditions of approval.

Discussion: The applicant is required to demonstrate legal interest in the property on which the development is proposed. On oceanfront parcels, public trust lands typically bound private property on at least one side. In many areas, the boundary between the private and public trust lands is the mean high tide line and therefore is ambulatory. State Lands Commission is the agency entrusted with the regulation and management of all public trust lands and is responsible for determining the boundary line between public trust lands and private property. (Also refer to Coastal Act Sections 30401 and 30416.)

Chapter 3 Standards of Review

The citations from Chapter 3 of the Coastal Act indicate that there are several sections that specifically address development on the shoreline and its relationship or impact on public access and recreational opportunities and natural shoreline processes. The Coastal Act also contains sections that require the Commission to consider the relationship of development to the coastal scenic qualities and environmentally sensitive habitat areas. Additionally, because the Coastal Act requires the Commission to retain jurisdiction over tidelands, submerged lands and public trust lands, the standard of review for most shoreline protective devices is Chapter 3 policies.

Public Access

California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.

Article X, Section 4 of the California Constitution. No individual, partnership, or corporation, claiming or possessing the frontage or tidal lands of a harbor, bay, inlet, estuary, or other navigable water in this State, shall be permitted to exclude the right of way to such water whenever it is required for any public purpose, not to destroy or obstruct the free navigation of such water; and the Legislature shall enact such laws as will give the most liberal construction to this provision, so that access to the navigable waters of this State shall be always attainable for the people thereof.

Coastal Act Section 30211. Development shall not interfere with the public’s right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.
Coastal Act Section 30213. Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided. Developments providing public recreational opportunities are preferred.

The commission shall not: (1) require that overnight room rentals be fixed at an amount certain for any privately owned and operated hotel, motel, or other similar visitor-serving facility located on either public or private lands; or (2) establish or approve any method for the identification of low or moderate income persons for the purpose of determining eligibility for overnight room rentals in any such facilities.

Discussion: The public access policies of the Coastal Act require the Commission to consider the impacts of development in the coastal zone on public access to and along the ocean and recreational opportunities, taking into consideration the right of private property owners and the protection of natural resources. The public beach area that is located seaward of the mean high tide line is often significantly reduced by shoreline protective devices. Impacts from these structures have been found to include: (1) occupy the sandy beach area, eliminating its use by the public; (2) permanently fix the back of the beach which leads to narrowing and eventual disappearance of the beach in front of the structure; (3) contribute to the sustained erosion of the public beach during the winter season and impair the ability of the public beach to rebuild through accretion during the summer season; and, (4) exacerbate erosion of the resultant narrow public beach area by accelerating erosion of the beach and by increasing the time that the public beach is covered by ocean waters. For these reasons, the commission has frequently found shoreline protective devices to be inconsistent with the above cited Coastal Act policies.

Recreation

Coastal Act Section 30220. Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.

Coastal Act Section 30221. Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreation activities that could be accommodated on the property is already adequately provided for in the area.

Discussion: These Coastal Act sections afford protection to areas suited for coastal recreation and state a preference for shoreline development that provides public recreational opportunities over private use.
Shoreline Development

Coastal Act Section 30235. Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fish kills should be phased out or upgraded where feasible.

Discussion: The above section of the Coastal Act acknowledges that there is existing development along the shoreline, some of which is pre-Coastal Act and some of which has been approved by the Commission, that may require protection in the form of armoring. Further, the Coastal Act specifies that the Commission is required to approve devices that alter natural shoreline processes when the applicant demonstrates that the development is necessary to: (1) serve a coastal dependent use; (2) protect an existing structure in danger from erosion; or, (3) protect public beaches in danger from erosion. The Coastal Act acknowledges that devices such as revetments and seawalls alter natural shoreline processes, and that, if approved, any impacts to sand supply that cannot be eliminated, must be mitigated.

Coastal Act Section 30250 (in part). (a) New development shall be located within, contiguous with, or in close proximity to, existing developed areas able to accommodate it or, where such areas are not able to accommodate it, in other areas with adequate public services and where it will not have significant adverse effects, either individually or cumulatively, on coastal resources.

Discussion: The Coastal Act requires that new development such as shoreline protective devices, be permitted only where public services are adequate and only when public access and coastal resources will not individually or cumulatively be affected adversely by such development. Coastal resources include, in part, highly scenic areas, areas of significant recreational value and areas that are considered a significant visitor destination. The individual and cumulative adverse effects of constructing shoreline protective devices on bluff faces, sandy and rocky beach areas, and on sensitive coastal resources include the following: (1) direct loss of sandy and rocky intertidal areas that often have been found to be a critical component or the marine ecosystem; (2) interruption of the natural shoreline processes, that may contribute to erosion of the shoreline in many areas; (3) impeding public access to and along the coastline as a result of the structure’s physical occupation of the beach; and, and (4) erosion impacts.
Coastal Act Section 30253. (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.

(2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

Discussion: This section of the Coastal Act requires that risks to life and property in areas of hazards, such as those that result in bluff failures, flooding, high waves and storm surge, be minimized. This section applies to all new development on bluff top lots, requiring that new development be sited, designed and constructed to avoid the need for a protective device that would alter the natural bluff. For bluff top lots along the coast, such stability is typically sought through a combination of foundation design and building setbacks.

This section of the Coastal Act; however, also applies to any new shoreline protection that may be proposed as protection for bluff top or shorefront development. The applicant must demonstrate that any proposed shoreline protective device required to protect an existing structure is of adequate design to minimize the risk of developing is a hazardous area. The Coastal Act also requires that development neither create nor contribute significantly to erosion, geologic instability or destruction of the site or surrounding area. Shoreline protective devices, whether along bluff backed beaches or nonbluff backed beaches, when not properly designed and installed, may cause substantial erosion and scour of the sandy beach that results in a significantly altered beach profile and eventually, total loss of beach. The Coastal Act recognizes that shoreline protective devices can substantially alter natural landforms, and that new development should be sited and designed to avoid the need for such structures.

Environmentally Sensitive Habitat Areas (ESHAs)

Coastal Act Section 30240. (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.

(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.

Discussion: This section of the Coastal Act authorizes the Commission to assure that shoreline protective devices that are proposed to be located in or adjacent to ESHAs are
sited and designed to avoid significantly degrading those areas. The Coastal Act defines Environmentally Sensitive Area (ESA) (Section 30107.5), in part, as habitats that are especially valuable because of their special nature or role in an ecosystem. Beaches, sand dunes and other types of oceanfront land may be environmentally sensitive habitat areas that meet the Coastal Act definition of ESA. Such areas can include the following: (1) coastal bluff faces; (2) rocky intertidal habitat; (3) sandy intertidal habitat; (4) subtidal habitat; and, (5) sand dunes. Potential impacts that could result from the development of a protective device include: (1) elimination of habitat areas; (2) the physical occupation of habitat areas with structures; (3) alteration of natural beach profiles as a result of placement of shoreline protective devices; and, (4) changes in water quality from turbidity. Where development occurs on a sandy beach, shoreline structures can change the physical processes of the beach area such as beach slope, sand texture and wave patterns that can alter the biological composition of the beach’s invertebrates. Therefore, if the beach qualifies as an ESHA, the shoreline protective device should be designed to avoid significantly degrading the beach.

**Scenic**

Coastal Act Section 30251. The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.

Discussion: This section of the Coastal Act acknowledges the scenic values of coastal areas as unique resources of public and statewide significance that are worthy of protection. Development in these areas should occur in a manner that protects the scenic and recreational value of the beaches and coastal areas. The Coastal Act recognizes natural landforms as part of the scenic quality of the coast and that development can alter these natural landforms. Natural landforms of the coast include coastal bluffs and cliffs, which make up some of the most scenic areas of the coast. Under this section, development should be sited and designed to avoid the need for structures that alter these scenic bluffs and cliffs.
2.0 OVERVIEW OF THE CALIFORNIA COAST AND BEACH EROSION

The California Coast is varied and diverse, stretching 1,100 miles from Oregon to Mexico. It provides coastal visitors and residents with shorelines ranging from rugged rocky cliffs to broad sandy beaches. This section discusses some of the general characteristics of the basic types of shorelines — sandy beaches, sand dunes, pocket beaches, cobble beaches, and narrow beaches backed by bluffs. There are clearly some omissions in this listing; however, the intent is to provide a general overview of shoreline types and not an exhaustive inventory of the entire coast.

Each shoreline type is described and the major benefits from the shoreline type are listed along with the primary activities which can harm the shoreline, options for protection and special issues, if any, which can be considered when projects are proposed for the shoreline type. These discussions cannot cover every foreseeable situation. Instead, they highlight some of the more common ones and may help familiarize coastal analysts with the range of basic shoreline types and concerns that occur throughout the state.

©1991, California Coastal Commission, reprinted from the California Coastal Access Guide
Clockwise from top left: Montara State Beach; Morro Rock; Pocket Beach in Laguna Beach

2 The California Coastal Resources Guide, prepared by the California Coastal Commission and published by the University of California Press, provides further discussion of the different types of shorelines and resources specific to each county.
2.1 SANDY BEACHES

The classic California coastal image is a broad sandy beach with surfable waves forming just offshore. The natural formation of these beaches was mainly through deposition of river sediments and bluff material, although these natural processes have been altered dramatically in recent years by human activities such as harbor dredging and flood control. This section deals mainly with the general characteristics of a sandy beach and with those areas that are dominated by the sand beach, rather than the back beach environment.

The “River of Sand” concept has been used to describe the basic processes of natural beach formation. Rains impinge on upland soils, dislodge sediment, and carry it downslope into a stream or river. Sediment loads build up in the riverbed until a large rain or storm event creates a river flow large enough to transport some of the built up bedload downstream to the coast. The two conditions necessary for a river to transport sediment are loose sediment on the riverbed and a sufficiently energetic flow to mobilize and carry material. Therefore, annual river sediment transport tends to vary dramatically from year to year — ranging from hundreds to millions of cubic yards per year. During high transport years, deltas often form at river mouths, and this deltaic material is then spread along the shoreline by wave action and currents. On the shoreline, the sand can be part of a sand dune system, a narrow beach backed by a bluff, or a pocket beach. Eventually it stops its journey along the shoreline, either when it is trapped in a harbor, carried offshore into deep water, swept down a submarine canyon, incorporated into a dune, or removed by human mining operations.

Rivers are not the only source of coastal sand. A second mechanism that can supply sand to the beach is the natural erosion of cliffs by wave attack and rain-wash. Bluff contributions to sand
Supply can occur throughout the year; but, normally, supplies of sand from bluff erosion are greatest during the winter storm period. During winter storms, waves break on or near the bluff and erode the lower portion of the bluff. As the lower bluff retreats landward, the upper bluff will have no lower support, so landward retreat of the lower bluff will propagate to the upper bluff area, causing a landward retreat of the entire bluff. Also, the entire bluff face will be exposed to rain during winter storms. Rain can dislodge bluff face sediments and carry the loose material from the bluff to the beach.

Sand beaches have been studied extensively and many of the general characteristics are well understood. Sand is a mobile substance, and it moves both up and down coast, as well as on and offshore. The accumulation of sand along the shoreline is strongly influenced by the width of the continental shelf, and the offshore, wave-cut platform that develops immediately seaward of coastal bluffs.

A sandy shoreline is a three-dimensional system and the dry sand area used for sunbathing or walking is only a small part of the overall sand system. The width extends from the offshore to the backshore spanning the area through which waves can move sand. The offshore, seaward limit is often termed the closure depth and is the depth where ocean waves begin to affect the seafloor and have enough energy to pick up sand and carry it landward. In California this depth is usually 30’ to 40’, MSL. There will often be sand, silt and clay deposits further seaward that this depth, but there will be little, if any, natural movement of sand at depths greater than the closure depth, and minimal shoreward movement. The backshore limit of the sand system will depend on the shoreline type; but it is often considered to be the bluff, the vegetation line or dune face. The backshore is most inland point of regular changes to the shore profile. The length of the sand shoreline is the alongshore dimension. The third dimension of a sand shoreline is the depth or thickness of the sand above a layer of bedrock or hard sea bottom.

In a dynamic coastal setting, all three of these dimensions change as there are changes to sediment supply, wave energy or other shoreline conditions. Sand depths change constantly, and the regular seasonal shifts are described below and shown in Figure 2-1. Alongshore and onshore/off-shore dimensional changes are less regular than changes in sand depth. Alongshore changes occur when a new barrier is established (for example, migration of a stream mouth) or an existing barrier is removed (for example, eroding a headland). Onshore/offshore changes occur as the line of vegetation or dune face moves or as bluffs retreat, as the offshore platform is worn down or as seismic activity raises or lowers the shore profile. Human activity can also
change these dimensions – sand mining can reduce the depth of sand; groins and jetties can change the alongshore length; and seawalls and revetments can change, or prevent changes to, the onshore/offshore dimension. (Preventing changes to the location of the backshore has been termed “fixing the location of the backshore”. Some of the consequences of the “fixing” are discussed in the sections on vertical seawalls, riprap revetments and shotcrete and gunnite.)

The movement of sand is strongly dependent on wave energy, wave direction, and prevailing winds. Sand movement typically varies with season. During mild wave periods (such as mid-spring to mid-fall) small, low-energy waves carry sand on shore and down coast. The result is a wide beach characterized by a well-developed berm and smooth offshore profile (See Figure 2-1). These broad sand beaches, commonly called summer beaches, provide obvious recreational opportunities, and also protect the backshore areas from wave erosion.

During storm periods with large, high-energy waves, sand is often carried away from the dry beach and deposited offshore in small bars or submerged berms, leaving behind a narrow “winter” beach (See Figure 2-1). The submerged berms store sand and protect the backshore area by causing large waves to break and release some of their energy offshore, on the bars, rather than directly against the backshore. Ideally, there will be enough sand left on the beach to absorb the energy from the waves which get past the bars. On many California beaches, there is often not enough sand to maintain a dry beach during the entire year, and storm waves will break on the backshore, potentially damaging whatever they hit.

Studies of the dynamics of sand beaches have led to the development of the general concepts of littoral cells, sediment budgets and littoral transport. The normal components of a littoral cell are 1) firmly established end points such as a submarine canyon or rocky headland past which little, if any, sediment can be carried; 2) sources of sediment within the two end points, such as a river mouth or eroding bluff; and, 3) sinks for the sediment, such as harbors, sand dunes or offshore bars. Rivers and bluffs supply sediment into the cell; waves and currents move sediment through the cell; and lagoons, harbor areas, or offshore canyons temporarily or permanently trap sediment and prevent it from moving freely through the cell. Figure 2-2 is a schematic diagram of the sediment pathways within a littoral cell.

With information on the supplies of and demands for sediment in the cell, it is possible to construct a sediment budget and to determine if there is a net sediment gain, loss, or equilibrium within the cell. If the cell is losing sediment over time, it is an erosive shoreline; if it is gaining sediment over time, it is an accreting shoreline. This long-term (multi-year) dynamic of the shoreline is the dominant influence on the effects of any modifications to the coast.

Significant changes to any of the components of the littoral cell can disrupt the sediment budget and cause the cell to shift from erosive to accreting, or vice versa. Changes to the cell can accelerate an existing trend, for example, shifting a cell from slightly erosive to highly erosive.
The available area of dry beach will quickly reflect modifications to the cell, as they are one of the primary “accounts” for sediment changes: excess sand will lead to wide beaches and sediment deficits will shrink the size of the dry beach.

In the past one hundred or so years, human intervention has been the largest single cause for changes to sediment supply along most of the California coast. Over the years, dams and flood control projects have impounded millions of cubic yards of sediment, preventing it from reaching the coast; harbor construction disposed of millions of cubic yards of excavation material by placing it on beaches — creating miles of wide sandy beach in areas like Santa Monica and El Segundo; harbor construction also created new sediment sinks and barriers to longshore transport in areas such as Santa Barbara, Santa Cruz and Oceanside.

**Benefits from Stable Sandy Beaches**
- support public access, recreation and tourism
- often provide the only publicly available areas adjacent to the ocean
- protect back beach areas from storm waves
- provide habitat for protected, threatened and endangered species such as least terns and grunion
- provide ideal beach volleyball and location spots for the film industry
- store sand reserves for temporary periods of sediment deficit
- enhance visual quality

**Activities which can Destabilize Sandy Beaches**
- decreasing sediment supplies from river impoundments or modifications to bluff erosion
- removing beach material from the littoral cell through sand mining
- increasing diversion of material to littoral sinks such as lagoons or canyons
- exposing it to increased wave energy or greater wave reflection
- obstructing longshore transport by groins, jetties, and other structures
Protective Options

- prevent removal of sediment from the beach (by activities such as sand mining)
- pass sediments around dams or flood control structures to “restore” riverine delivery system
- prevent losses of sediments down submarine canyons through barriers, backpassing, etc.
- encourage nourishment using all appropriate offshore sediments, dredge materials, or material from inland construction

Special Issues for Engineering Geologic Reports for Sandy Beaches

- seasonal and inter-annual changes to beach profiles
- effects of project on local sediment supplies and movement within the littoral cell
- Tsunami Run-up: Sandy beaches can be susceptible to tsunami dangers. A normal technique to address tsunami dangers is to elevate the development out of the flood range and insure that the lower levels will not create a “dam”. In some areas, this protective measure may conflict with restriction on building height to protect scenic views.
- liquefaction: Liquefaction often occurs during earthquakes in areas where loose sandy soils become saturated with water. While the potential for liquefaction is very site-specific, beach areas with a deep layer of sand are clearly areas where sandy soils can be combined with available water. For projects that will place the foundation of a structure in sand, the geotechnical reports should examine the potential for liquefaction. Liquefaction hazards can be greatly reduced by relocating development from areas prone to liquefaction. If avoidance is not possible damage from liquefaction can be greatly reduced by careful site preparation if the potential for liquefaction is identified prior to development.
- high or exposed groundwater table: Especially of concern for projects that would not be hooked into a sewer system but would rely on a septic system or leach lines.
- long-term changes to beach profiles possible as a result of the current projections for a rise in sea level.
References


2.2 SAND DUNE SYSTEMS

Sand dunes form when wind transports dry sand inland from the back beach. Small irregularities on the surface — rocks, logs, vegetation, etc. — interrupt air flow and lead to deposition of sand in front of the obstacle.

Eventually sand mounds or ridges form; some develop into ephemeral dunes (foresdunes) that are susceptible to removal by tides or storms; others become permanent dunes (back dunes) that support vegetation.

In general dune slopes will be rather gradual on the face directed into the wind and more steep on the sheltered, leeward face. In an established dune field, the dunes closest to the beach will be rather flat and will be reformed regularly by wind and wave forces. These foresdunes protect the mid and back dunes from direct wind and wave attack and also serve as a source of new material for the more landward dunes. The mid and back dunes are older than the foresdunes; they usually are protected from wind erosion by the active foresdunes and usually have an established vegetative cover which serves to further stabilize the dune. These dunes reform much more slowly than the active beach dunes and have a steeper profile. An exception to this will be established dunes, which have been modified by blowouts or other destabilizing factors. Once disturbed, the older dunes will also restabilize with a flatter slope. Dunes function as a system and not as independent units, so the effects from the disturbance to one dune can ripple through the system. For example, loss of material and deflation of a dune close to the beach can expose all the more landward dunes to greater wind erosion and compound the deflation.

Some of the critical characteristics of a dune system are:
- sufficient supplies of fine to moderate grain size sand to create a dune system
- dominant on-shore winds, sufficient to carry sand particles inland from the beach
- broad, gradual back beach upon which sands can be deposited
- obstacles to interrupt the onshore transport and cause deposition of material
- orientation of the coast with respect to prevailing winds

Often dunes will form at the downcoast edge of a beach, where further transport is blocked and sufficient sand can accumulate to provide a large supply of dry sand for transport by onshore winds. Figure 2-3 shows the 36 major dune systems along the California coast.
- Page reserved for Figure 2-3 Dune systems in California
Benefits from Stable Sand Dunes

- habitat for rare and endangered plants and animals
- resting areas for birds using the Pacific flyway (dune swale wetlands)
- natural stockpile for beach sand
- protection for back beach areas from storms
- information on historic shoreline processes
- indicators of historic sea level and local rates of shoreline uplift
- recreational and educational values
- development leeward of a stable dune system will be protected from wave erosion and winds. If the dunes become unstable, the development may be exposed to high winds, sand blasting, loose sand on buildings and roadways, and potential wave attacks.

Activities which can Destabilize Dune Systems

- loss of material due to sand mining
- deflation from wind and waves
- blowouts
- loss of plant cover from foot traffic, vehicles, plant gathering, or grading
- use of herbicides in or near critical habitat
- suffocation or burial of vegetation from excessive movement of loose sand
- introduction of non-native species
- changes to groundwater system

Protection Options

- prevent removal of dune vegetation — limit or restrict access over dunes, removal of plant cover, or use of herbicides in or near dunes.
- prevent removal of dune material — limit or prohibit sand excavation.
- revegetate disturbed areas that are not actively being used.
- promote dune expansion through dune nourishment — addition of sand, suitable substrate material, and vegetation (both seed material and plants).
- concentrate access on planned and established routes — develop boardwalks, raised access ways and defined paths to prevent extensive loss of vegetative cover.
- orient all shore access paths somewhat perpendicular to prevailing winds to minimize wind disturbance or the creation of a wind tunnel effect; use natural low spots for access.
- develop a dune management and enhancement plan for critical dunes which identifies, among others: threatened and endangered species using the dune system; locations of critical habitat, dune swale wetlands, exposed ground water; direction of prevailing winds; existing access routes and connections to inland access, parking, etc.

References


2.3 POCKET BEACHES

Pocket beaches are small sandy areas contained between two promontories or headlands. There is no upper limit to the length of a pocket beach, but they are rarely more than a mile long. These beaches usually occur along rugged coasts with small indentations between headlands that interrupt longshore transport and provide some protection from wave scour. Pocket beaches may also form at the mouth of a small stream or coastal ravine where the stream or ravine may be the sole source of sediment for the beach. On these beaches, sand accumulation often occurs as linear or convex bars and sand spits.

Pocket beaches can persist in high wave energy areas that seem unfavorable for sandy shorelines. Like any sand beach, they need a source of sediment and some barriers to prevent waves from transporting this sediment offshore or downcoast. The classic form of a pocket beach is in a semi-circle, where the two headlands provide hard points at the ends of the semi-circle that protect the beach from wave attack. The downcoast headland has the effect of trapping accumulated sand, and both up and down coast headlands redirect wave energy away from the contained beach area. It is this reduced wave energy, in conjunction with the orientation of the shoreline, that allows for the formation of pocket beaches.
Pocket beaches form throughout the California coast. Much of the Sonoma and Marin coast is pocket beaches; Big Sur contains numerous pocket beaches; many of the small accessways in western Malibu go to pocket beaches; and, the famed beaches of Laguna are pocket beaches.

The critical components of all these areas are:
- a source of sediment
- resistant headlands to hold sand
- prevailing onshore wind
- refraction of wave energy away from shoreline between headlands

The size of a pocket beach is limited by either the amount of sand or the retaining capacity of the headland features. Once the embayment of a pocket beach is “full,” the retaining features will not be able to hold any more sand and any additional sediment will be quickly carried downcoast or offshore.

In the past century, people have attempted to mimic some of the retentive qualities of headlands by constructing groin fields or offshore retaining structures. In areas that have some sediment but no indentations or resistant features to prevent removal of sediment through longshore transport, it may be possible to install groins that will function like the headlands of pocket beaches. Groins usually cause an accumulation of sand upcoast, with a corresponding deficit of sand downcoast. Any modifications to the offshore area, such as the construction of a groin or artificial headland will also alter wave impacts and may have unexpected effects on the nearby beaches. In areas where there are no natural barriers for sediment transport, thorough study of sediment dynamics, coastal processes, and local ecology would be necessary before actually considering the construction of artificial headland features.
Benefits from Pocket Beaches
- provide beach access and recreational opportunities different from those found on a large expanse of sandy beach
- the stream bed or ravine area which provides sediment to the beach can often be used for “primitive” access
- protection for back beach or bluff area from storms
- potentially good areas for small sand nourishment projects since maintenance efforts may be much less than for exposed, open beach areas
- habitat for rare, threatened and endangered species.

Activities which can Destabilize Pocket Beaches
- interruption of sediment supplies by dams or sand mining
- modification or removal of headlands

Protection Options
- prevent interruption of sediment supplies
- protect headland features
- periodic nourishment

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2.4 COBBLE BEACHES

Cobbles are large rocks or pebbles, usually oval, rounded and smoothed by wave or river action. Another term for cobble is shingle. As a beach type, cobble or shingle can be found on high-energy shorelines. Occasionally it will be a sublayer for a sand beach. Cobble usually rests on top of bedrock or hardpan, and for beaches with an exposed cobble area, the spaces between the cobbles will not be filled with finer material. Cobble beaches can be very stable and have existed for years in some areas. In other locations, cobble beaches are a recent occurrence and are seen as a consequence or by-product of sand beach loss.

Cobble beaches have many of the transport and response mechanisms of sand beaches — but cobble is too heavy for aeolian transport. Most cobble is carried to the coast by river transport and cobble deltas form seaward of these river mouths. The dominant transport mechanism is rolling or sliding as bedload. Small protrusions, such as headlands, can trap cobble and create an upcoast fillet or beach, similar to the way that sand is trapped. Waves and current can lift cobble from the shore bottom, and during extreme storm events, waves can throw cobble onto the back beach or against back beach structures. Cobble will form a very steep beach face — much steeper than sand. It is difficult to walk on for long distances, and has a very distinct “feel” under foot. Some claim cobble gives a musical sound when walked on or when hit by wave uprush.

Little is really known about cobble dynamics and cobble beaches are often assumed to function similarly to sand beaches. Cobble can provide a high degree of protection to back beach areas. A rather narrow cobble beach can absorb large amounts of wave energy and prevent direct wave attack against the back beach, back bluff or structure. Cobble absorbs more wave energy and provides greater back beach protection than a dry sand beach of similar width.

If there is too little cobble to absorb all incoming wave energy, some wave energy will be transmitted to the back beach. The cobble can abrade whatever is directly landward of the cobble and this abrasion can compound the damage from waves. In the same way that sand blasting can wear away a rock surface, “cobble blasting” by waves can wear away the back beach, bluff or
structure adjacent to the cobble. Just as cobble can provide more protection than the same area of sand, small amounts of cobble can do more damage than a similar amount of sand. A quick indicator of whether cobble is damaging the back bluff is the existence of a scour trough. In general, small areas of cobble can be damaging to the back beach area. Unfortunately, there has not yet been enough study focused on cobble beach areas to know either 1) if small areas of cobble are providing unidentified benefits which outweigh the observed abrasive effects, or 2) what is the critical area or volume necessary for a cobble beach to switch from being a detriment to providing protection.

**Potential for Cobble Management**

In recent years, there has been some discussion of using cobble management as a shoreline protection measure. The general idea is to relocate cobbles so that there is either no cobble or else there is adequate cobble to provide beneficial protection of the back beach. Cobble would be moved from sites where small areas of cobble are contributing to erosion and add the cobble to sites where cobble is contributing to bluff protection. Since small areas of cobble can provide significant protection to the back beach, it might be possible to greatly enhance its protective capability through the artificial redistribution of small amounts of cobble.

The BEAR Task Force could not locate any technical studies or reports about cobble management programs, so it would seem that any effort to undertake a cobble management program would be forging new ground. A first step in cobble management might be a modeling effort. Any cobble management would require study and well developed management objectives. Monitoring should be a major element of any cobble redistribution effort; the pre-existing beach and back beach conditions should be carefully recorded, the volumes and locations of “managed” cobble should be documented, and post-management transport and back beach changes should be studied.³

**Benefits from Cobble Beaches**

- wide cobble beaches provide very good back beach protection
- on a narrow dry beach, cobble can give more protection than sand of the same width
- artificial or nourished cobble beaches may be useful for shoreline protection
- in areas with existing cobble beaches, cobble management may enhance protection
- cobble beaches offer different recreational and visual opportunities from sand beaches
- provide hard substrate habitat

**Activities which can Destabilize Cobble Beaches**

- loss of material due to cobble mining
- interruption of upcoast or riverine supplies of cobble

³ Many of the elements of a beach management program could apply to cobble management; however, a management program specific to cobble and the shoreline area should be developed.
- removal of protective headland feature
- periodic burial by artificially placed sediments

**Protective Options**
- development of a cobble management program (experimental at this time)
- prevent interruption of upcoast or riverine supplies of cobble
- protect headland features
- periodic nourishment (experimental at this time)
2.5 NARROW BEACHES BACKED BY BLUFFS

Narrow beaches backed by rather steep, almost vertical coastal bluffs are normal for many portions of the California coast. Usually, the beach will be a thin veneer of sand or cobble overlaying bedrock or a wave-cut platform. Often too, the upper portion of the bluff will be marine terrace deposits — remnants of earlier geologic periods when these bluffs themselves were at ocean level.

Sources of sediment for the beach areas can be the bluffs themselves and material eroded from inland sources and carried to the beach by small coastal streams. Many of these streams are now dammed or controlled and the amount of sediment carried to the coast has diminished greatly. Even before coastal streams were controlled, however, these streams usually only supplied small amounts of sediment to the beach areas since they drained rather small watersheds. Some coastal bluffs areas, like Big Sur, have not had wide sand beaches for at least the past 12,000 years. Other areas, like northern San Diego county, temporarily have wide beaches resulting from disposal of excavation or harbor dredge material, but under natural conditions have narrow beaches seaward of the bluffs.

Bluffs with narrow beaches can be some of the most complex areas along the coast to analyze. The beach is subject to all the normal modifications that occur to a sand or cobble beach. The bluff area will be subject to wave attack when the beach is not wide enough to protect the bluff from waves. The base, mid and upper portions of the bluff are subject to chemical weathering from salt spray in addition to all the normal erosive forces that act on any exposed bluff face. Finally, many of the coastal bluffs have been formed through uplift, and the areas often are seismically active. Faulting, landslides and ground shaking can cause significant, but infrequent, bluff changes.

Beaches seaward of coastal bluffs follow the same seasonal and interannual changes as all other sand beaches, and they can be analyzed using the concept of littoral cells. The beach material is supplied from fluvial sources and from bluff erosion; the material is carried along the coast through longshore processes and seasonal variations in waves that carry material on and offshore. One difference between narrow beaches backed by bluffs and wide sandy beaches is that the narrow beach has a thin veneer of sand overlaying bedrock. It does not have enough material to maintain a dry sand beach area during periods of high wave energy and often the beach will be scoured to bedrock during the winter months.

The bluffs landward of a narrow beach will be partially protected from wave attack by the beach. During periods of mild waves, the beach (typically referred to as a summer beach) may be wide enough that it can protect the bluffs from all wave attack. During periods of high-energy waves and storms, the narrow beach may be removed or the remaining beach may be too small to absorb all the wave energy. Wave impacts on the toe of the bluff can have a number of effects. Very hard bluff material, such as the granite bluffs at Big Sur, may resist wave attack and show little, if any, retreat from decade to decade. Most bluff retreat in Big Sur occurs from landslides.
or failures in less resistant materials. Different rates of erosion can be common along even short sections of bluff if there are varying geologic conditions (i.e. fractures, different material, different amounts of vegetation, etc.)

If a bluff is prone to erosion (this includes most southern California bluffs) it can fail from wave undercutting which may remove several feet of the bluff toe and lead to failure of the upper bluff due to lack of support. Other areas may erode as caves and small openings along fracture lines or seams of weak, less consolidated material. Again, as the caves or openings enlarge, there will not be enough support to hold up the rest of the bluff and upper bluff collapse will result. Finally, the lower bluff material may gradually retreat, leading to an ever increasing steepening in the upper bluff. Eventually the upper bluff will become oversteepened and the upper bluff would effectively erode to a more stable angle.

Many coastlines with narrow beaches backed by coastal bluffs have a long-term balance or equilibrium between the beach area and the back bluff. The beach will enlarge with added sand supplies and shrink with diminished sand supplies. As the beach diminishes, it will expose the back bluff to more frequent wave attack and eventually lead to erosion and retreat of the lower bluff. This will move the back beach position landward and establish a new beach area. Similar beach widths and bluff shapes will occur every few years or decades as the entire shore profile shifts landward.

An unstable lower bluff normally signifies an unstable upper bluff. A stable lower bluff, however, does not signify a stable upper bluff. In situations where the lower bluff is stable, the upper bluff could become unstable from mechanisms independent of the lower bluff. These areas may be subject to possible landslides, subaerial erosion from wind abrasion, groundwater, surface water, septic water, burrowing animals, and others. Attempts to determine stability of a blufftop property protected at the base by a narrow beach must examine the long-term stability of the beach and the lower bluff as well as the long-term stability of the upper bluff.

Benefits from a Stable Narrow Beach backed by Bluff

- provides recreational benefits during periods of low wave energy
- provides lateral access on sand or bedrock throughout the year
- protects back bluff and blufftop development from some wave attack
- offers a different visual experience than a broad sandy beach

Activities which can Destabilize Narrow Beaches backed by Bluffs

- loss of material due to sand mining
- interruption of sediment supplies from fluvial or bluff sources
- interruption of longshore transport (by groins, jetties, etc.)
- interruption of backshore migration (by seawalls, revetments, etc.)
- bluff top alteration and grading
- irrigation, landscaping and building on the bluff face
Protective Measures

- prevent interruption of sand supplies
- periodic nourishment, possibly held by artificial headland features
- prevent interruption of backshore migration
- site all new blufftop development sufficiently far from the edge to avoid need for eventual stabilization
- avoid covering the bluff face with impermeable surfaces

Special Issues for Engineering Geologic Reports for Bluffs with Narrow Beaches

- bluffs with narrow beaches are some of the most hazardous areas along the coast
- site stability must examine erosion to the beach, retreat of the lower bluff and retreat of the upper bluff; and encompass coastal processes as well as site geology
- surface and groundwater can concentrate on coastal bluffs and must be examined when looking at site stability.

References


3.0 OVERVIEW OF THE ENGINEERING AND DESIGN APPROACHES TO PROTECT SHORE FRONT DEVELOPMENT

Numerous techniques are used to protect back beach or coastal bluff property from the natural shoreline processes of erosion and wave action. For new construction, the best protection comes from locating all structures far enough from the waves and active beach area that natural processes of erosion and wave action can occur without threatening the structures.

For existing structures, it may be possible to relocate the structure further from the bluff edge or back beach — and thus further from the area of erosion or high wave energy. Such an approach may be feasible if the existing lot extends far enough landward to allow relocation of the structure to a more safe area. Some of the factors that could be considered in determining whether relocation would be feasible could include, among others, the size of the lot, the age of the structure, and the ease of relocation (considering such factors are building size, building materials, building foundation, constraints from utilities, building access, and others). Also, temporary and ancillary structures, such as gazebos or raised bed gardens, may often be considered for removal or relocation, rather than for protection in place. As an example of planned relocation, some permits have been conditioned to require removal and relocation of a structure when the bluff edge is within 25 feet of the structure (CDP #1-90-142). Also, some subdivisions require structural relocation rather than shoreline protection as part of the Codes, Covenants and Restrictions.

Existing principal structures, with fixed foundations, usually have an established setback and if the setback is inadequate to protect the structure from erosion or storm waves, the property owners attempt either to move the breaking waves further from the structure, or to strengthen a spot between the waves and the structure to slow or halt erosion and protect the structure from wave attack. Some of the options used along the Pacific coast for protecting existing structures from erosion and wave attack have been beach or dune nourishment, nourishment with groins, breakwaters, seawalls, bulkheads, revetments, and bluffs coated with shotcrete or gunnite.

Along a bluff type shoreline, structures at the top of the bluff can be threatened by marine erosion of the lower bluff, since erosion of the lower bluff will lead to the eventual loss of the upper bluff material. Structures on bluffs can also be threatened by terrestrial erosion or failures of the upper bluff that may have no direct association with erosion of the lower bluff. Since there are these two separate erosion mechanisms, structures along bluffs can often be protected by efforts on the lower bluff alone or in combination with upper bluff protection efforts.

This section provides a general discussion of some of the uses for and problems from some of the more common engineering and design approaches to protect shorefront structures. These are:

- beach nourishment
- seawalls and bulkheads
- revetments
- upper bluff stabilization
- surface and groundwater controls
- moving the structure
- shotcrete and gunnite

Often specific sites may combine one or more efforts — seawalls with upper bluff protection, seawalls fronted by rip-rap rock for toe protection, or the use of hybrid structures.

One of the biggest concerns raised about various shoreline protective options is the cost of each. Shoreline protection can be expensive — initial costs for beach nourishment can be $1,000 to $5,000 per linear foot; vertical seawalls can be $2,000 to $4,500 per linear foot; engineered revetments can be $1,000 to $2,000 per linear foot. Project costs are very site specific and may vary greatly from these estimates.

Using initial construction costs for an economic decision on long-term shoreline protection can be misleading. Shoreline protection is not a one-time investment and initial costs do not cover all the costs for any type of shoreline protection. Beach nourishment requires periodic additions of sand that may equal the initial project cost every 5 or 10 years. Seawalls require routine maintenance to fill cracks, patch areas of spalling or replace sections of rusted reinforcing bar. Revetments require routine additions of material and/or the reincorporation of dislodged rock onto the main structure. No estimates of seawall maintenance costs were found. For revetments in the central coast, engineered structures required repairs totaling 20 to 40% of their initial construction costs after a small ten year return period storm, and non-engineered structures required repairs totaling between 50% and 150% of the construction costs after the same event (Fulton–Bennett and Griggs, 1986). Economic decisions for shoreline protection should not be made without an understanding of the long-term maintenance costs.

The following matrix summarizes some of the key concerns about each protective technique and allows a brief comparison between techniques. A more thorough review comes from reading each section. Short reference sections are provided for direction to more detailed discussions.
### 3.1 Major Concerns with Different Shoreline Protective Options

<table>
<thead>
<tr>
<th></th>
<th>Beach Nourishment</th>
<th>Seawall or Bulkhead</th>
<th>Engineered Revetment</th>
<th>Upper Bluff Protection</th>
<th>Gunnite or Shotcrete</th>
<th>Control of Surface or Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial cost</strong></td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate to High</td>
<td>Low</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td><strong>Maintenance costs</strong></td>
<td>Moderate to High</td>
<td>Low to Moderate</td>
<td>Moderate to High</td>
<td>Low to Moderate</td>
<td>Moderate to High</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Long term maintenance</strong></td>
<td>Add sand regularly</td>
<td>Inspect for...</td>
<td>Add rock;...</td>
<td>Inspect for...</td>
<td>Inspect for...</td>
<td>Inspect for...</td>
</tr>
<tr>
<td><strong>Ease of removal</strong></td>
<td>Not applicable</td>
<td>May damage...</td>
<td>Rather easy;...</td>
<td>Difficult;...</td>
<td>Difficult;...</td>
<td>Usually easy</td>
</tr>
<tr>
<td><strong>Modes of failure</strong></td>
<td>Loss of all sand during storms</td>
<td>Catastrophic need regular inspections</td>
<td>Gradual or rapid; loss of rock</td>
<td>Often rapid; need regular inspections</td>
<td>Often rapid; needs routine inspections</td>
<td>Often rapid; need regular inspections</td>
</tr>
<tr>
<td><strong>Suitability for single lot</strong></td>
<td>Suitable as a part of a comprehensive program</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable; better for multiple lots</td>
</tr>
<tr>
<td><strong>Other measures with which it is compatible</strong></td>
<td>Dune vegetation, seawalls or revetments</td>
<td>Nourishment or upper bluff protection</td>
<td>Nourishment or upper bluff protection</td>
<td>Nourishment seawall or revetment</td>
<td>Nourishment</td>
<td>All options</td>
</tr>
</tbody>
</table>
3.2 BEACH NOURISHMENT

Beach nourishment is “the deliberate addition of sand to an eroding beach or the construction of a beach where only a small beach, or no beach, previously existed” (NRC, 1995). Sand is added to create or widen a beach to dissipate wave energy and prevent the destructive wave forces from damaging upland structures. Since beach sand will move throughout the littoral cell, beach nourishment is not considered to be a fixed, permanent feature and is often referred to as “soft” shoreline protection. If developed as long-term protection, periodic renourishment must be an ongoing commitment.

Beach Nourishment in California

Most beach nourishment projects in California have been by-products of other construction efforts — harbor construction and channel deepening, stream channel excavation for flood control or excavation in a dune system, where beaches have been used as convenient locations to dispose of excess dredge or site material. There are some beach areas which have regularly scheduled nourishment efforts by the US Army Corps of Engineers, California Department of Parks and Recreation, local governments or municipal utilities. Most beach nourishment efforts in California have used beach or subaqueous sand sources. The City of Carlsbad has recently expanded the sources of beach material to include “opportunistic sand” which will take advantage of excess sand from inland construction projects.

Many harbor areas have routine sand by-pass programs to keep material from depositing in the harbor. Santa Cruz Harbor owns a dredge and yearly removes about 135,000 cubic yards of sand from the harbor and pumps it onto down coast beaches. Santa Barbara has one of the oldest ongoing operations in California, dredging between 270,000 and 300,000 cubic yards of material annually to both maintain the harbor and replenish the downcoast beaches. At Oceanside Harbor, the Corps of Engineers, in conjunction with the City of Oceanside, ran an experimental sand by-pass system that routed up to 10,000 cubic yards of sand per month from the harbor entrance to the eroded down coast beaches. These projects are normally called nourishment efforts, even
though their function is to only relocate material within the littoral cell rather than add material to the cell.

Figures 3-1 and 3-2 show most of the major nourishment projects which have been undertaken in California since the late 1930’s — the start of significant human intervention along this coast. Where possible, these projects have been categorized as beach placement, nearshore placement or bypassing.

**Differences between Beach Nourishment and other Types of Shoreline Protection**

**Beach nourishment is usually a large-scale effort:** Beach nourishment is only effective if it is used for a broad section of coast or for a compartmentalized section, such as a pocket beach. Beach nourishment is rarely considered as a protection option for a single property (unless the property is a state park holding or other large beachfront property). When property owners construct seawalls or revetments in front of their property, they can reasonably expect that these structures will stay in front of their property. They cannot expect the same protection from beach nourishment. Sand is mobile, and nourishment material will move along the coast as well as on and offshore. Sand placed in front of a 50 or 60-foot wide lot would quickly spread to neighboring properties and protection to the 50 or 60-foot wide lot would diminish quickly. Nourishment of a longer section of beach will spread along shore and be redistributed offshore. If carefully planned, designed, and maintained, nourishment can provide years of protection for the properties fronted by the nourished beach.

**Local governments or communities usually undertake beach nourishment:** Because most beach nourishment projects protect a length of coastline rather than an individual property, they usually are undertaken by a group of property owners or by a local government. This makes beach nourishment more of a public works or regional project, rather than a small private effort.

**Beach nourishment provides recreational and economic benefits in addition to protection:** Beach nourishment, if effective, will create a wider dry beach than was previously available. In contrast, shoreline protection structures normally are constructed on top of an existing beach and remove this area from public use. Beach nourishment can protect the upland areas from wave attack, and also enhance the recreational opportunities of the public beach. An increase in beach visitors, both local residents and tourist, can result in increased revenues for neighboring communities. A major reason that local governments consider involvement in a beach nourishment effort is for this recreational benefit.
Space Held for Figure 3-1
Space Held for pull out Figure 3-2
Beach nourishment can be used to mitigate impacts from other types of shoreline protection: Some California beaches are wide enough to provide some protection to back beach property, but they are not wide enough to provide protection during large storm events. In these situations, beach nourishment can be coupled with other forms of shoreline protection to either help keep the sand on the beach for long periods of time or provide emergency protection in the event the beach width narrows so that it is not adequate protection for the upland area. Most other forms of shore protection protect back shore development by fixing the location of the back of the beach (for example vertical seawall, rip-rap revetment, a shotcrete, a gunnite wall). Beach nourishment moves the seaward edge of the dry beach further seaward. Beach nourishment does not fix the location of the back beach.

Conditions Best Suited for Beach Nourishment

Ideal design conditions: In the ideal beach nourishment project, there would be a free, plentiful source of sand close to an eroding shoreline; the receiver beach would be a fairly straight beach with headland features at each end to contain the nourishment material; the percentages of fine, medium, and coarse sands would be the same for the source material and the receiver beach; and there would be detailed information on the wave climate, longshore and on/off shore transport at the receiver site, and no environmental constraints to adding sand to the receiver beach. While these conditions will never be met for a real-world beach nourishment program, the situation outlines the types of factors that every beach nourishment program should consider.

Proximity of receiver beach to source material: Beach sand is never a free commodity – even for “free” dredge material there is a cost to transport and handle the material. For all modes of transportation there are the initial set-up costs to mobilize and demobilize equipment. For offshore sand supplies these include the costs to move a dredge to the offshore sand source and set up the pipelines and/or barges to carry the material. For inland supplies, it can include the cost of the excavators and of setting up conveyors, trucks and or railcars to carry the material. These costs are often considered fixed and they are the same whether the nourishment volume is 1 cubic yard or 1 million cubic yards. The second set of nourishment costs – the actual transportation costs often depend on the time it takes to move the sand and the distance the sand is moved. These are variable costs and they vary proportionally with the amount of material that is moved and how far it is moved. If the proposed beach nourishment project is to put a given amount of sand on a certain beach, often the only cost that can be modified is the variable transportation cost. The closer the receiver beach is to the sand source, the lower the overall cost for the beach nourishment.

Receiver beach characteristics: Beach nourishment programs are most effective on beaches which have no sediment sinks, such as downcoast harbors, sand mining operations or submarine canyons. Coastlines which have not historically supported a sand beach would be poor areas to consider for beach nourishment since there is good evidence that sand cannot be maintained on that portion of the coast, either because the wave climate is too strong or there are offshore features which retain sediment and prevent the creation of a dry sand beach.
**Grain size similarity:** Nourishment material should approximate the material that occurs naturally at the receiver beach. Grain size analysis is often used to determine material similarity. If the nourishment material is significantly finer than the receiver beach material, it is likely that the nourishment material will be carried offshore quickly, providing little, if any, protection for the backshore, providing only short-term recreational benefits and possibly causing suffocation of sensitive offshore resources. If the nourishment material is significantly coarser than the receiver beach material, it is likely to remain on the receiver beach for a longer period of time, but could steepen the dry beach and nearshore profile, and possibly change nearshore wave conditions. For similarity between the receiver beach and the nourishment source, the US Army Corps of Engineers uses a guideline that the percentage of silt and clays from the source material shall not exceed that of the receiver beach samples by more than 10% (US Army Corps of Engineers, no date).

**Sediment transport conditions at receiver beach:** Information about the wave climate and transport conditions at the receiver beach is needed to predict generally whether nourishment material placed in the nearshore environment will move onshore, how long the material can be expected to remain on the beach, and where it might be expected to go when it leaves the nourishment area. Without a general idea about the future performance of the beach nourishment program, there will be no way to determine whether or not it was successful, whether it should be repeated, or whether there may be better locations for nourishment or placement techniques that should be considered in the future.

**Impacts from Beach Nourishment**

Even though beach nourishment is viewed as a “soft” solution which merely enhances the natural protection and recreational opportunities provided by a beach, there could be environmental problems from beach nourishment. Information on project design, the receiver area, and project vicinity is needed to determine whether the beach nourishment program could affect downcoast areas, nearshore conditions, or sensitive environmental resources. Some of the general Coastal Act concerns associated with beach nourishment are discussed below, including the types of project information necessary for analysts to properly evaluate these concerns. Section 4.1 provides detailed information on filing requirements for all types of shore protection projects. The following information supports the filing requirements and indicates some of the ways the required information can be used.

**Temporary and long-term effects from direct placement of material on the beach:** Material can be placed directly on the beach by pipeline (typically only used if the nourishment material is from subaqueous sources), or by trucks (typically used for dry beach material). Either method of placement will temporarily disrupt routine beach use and often, for safety concerns, access will be limited in the placement area during nourishment. There are possible construction related effects. It is important to know transport routes for the material, the schedule for placement,
expected duration, recreational patterns for the receiver beach, peak use periods and areas, and opportunities to maintain public access to as much of the total beach as safely possible.

When nourishment material is placed directly on the beach, the final product should be a widened beach. This beach will be expected to narrow quickly after initial placement as the offshore profile is reestablished, but should still offer more dry beach than had been available before the project. If the beach is used by grunions or nesting birds, nourishment can smother or suffocate the eggs and nests. Thus, it is important to know if and when non-human species use the beach area. Placement of sand on the beach may cause temporary turbidity as the finer material goes into the surf zone. The project design should estimate the extent and duration of increased turbidity, based on the fines content of the nourishment material, project design profiles, and site specific wave conditions. While turbidity can be expected to be greatest at the time of nourishment, turbidity may remain high until the material reestablishes a new profile.

Temporary and long-term effects from placement of material in the nearshore zone:
Placement in the nearshore area is an inexpensive way to use dredged material for beach nourishment. Material should be placed in an area that is subject to wave action and where the waves may carry much of the material onto the beach. Initially there may be little noticeable change at the dry receiver beach. This area should widen gradually as the offshore material is carried to the beach by wave action. Nearshore placement will not disrupt beach use, but can interrupt nearshore water uses and these interruptions may continue after placement has occurred since there will be new berms or mounds of sand offshore. Nearshore placement requires careful selection of disposal sites, and information on bottom characteristics and water uses. Also, since it is important to know where the material may move once it is placed in the nearshore area, information is needed on transport rates and directions, currents, wave conditions and of any biologically sensitive nearshore areas that are in the general directions of transport.

Effects to offshore resources and lagoons: Beach sand is mobile. A major reason for beach nourishment in California is that the sand has moved from the areas where it is wanted, such as open stretches of coast, and has gone to places, such as harbors, where it is not wanted. Nourishment projects must consider whether there are any resources in the vicinity which could be adversely affected by sand deposition — resources such as lagoons, kelp or eel grass beds, hard bottom habitat, tide pools, reefs, etc. To fully examine effects, the areas must be identified and estimates made for possible deposition levels or quantities.

Monitoring and Measures of Success

Beach nourishment is, by its very nature, a shoreline protection and enhancement effort that will change over time. To provide long-term protection, nourishment must be repeated at regular time intervals. Due to the anticipated changes at a nourished beach and the likelihood that there could be repeated nourishment, it will be appropriate to monitor beach nourishment.
Monitoring is the “systematic collection of physical, environmental, or economic data ... in order to make decisions regarding project operation or to evaluate project performance.” (NRC, 1995) Recognizing that the monitoring should be directed at answering questions about the effectiveness of the nourishment program and helping to improve subsequent nourishment events, some characteristics which can be monitored are listed below. These are in addition to basic project information such as nourishment volume, sediment characteristics, etc.

- wave heights and directions
- longshore transport rate
- on/off shore transport rate
- changes to dry beach width over time
- changes to beach profile over time
- changes to dry beach width of downcoast and upcoast beaches
- volume changes at the receiver beach over time
- number of structures protected by beach, over time
- turbidity levels during construction
- duration of water quality disturbance

Since every beach is slightly different and engineered beach nourishment can offer a variety of benefits, it is likely that specific monitoring plans will be developed for each project. Monitoring should address the critical issues specific to the project and location.

Alternatives to Beach Nourishment

Beach nourishment is one of the few types of shoreline protection that both protects the backshore area and protects the beach itself. Of the various techniques that are reviewed in this report, beach nourishment is the only alternative that protects the beach. Offshore breakwaters, perched beaches, groins and jetties can protect specific beach areas. These options are rarely proposed and thus were not covered in this document. Each would require detailed modeling of sediment transport, thorough site investigation, and careful case-by-case evaluation and analysis. For West Coast conditions, these options are not part of the “common engineering and design approaches to alleviate erosion.”

Dune nourishment can protect both the beach and the backshore and it has been used on the West Coast as shoreline protection. It was not included in this report as a separate protection option, but could be considered as an aspect of overall beach nourishment. Dune nourishment involves both adding sand as a substrate and adding vegetation and planting to help hold the sand in place and prevent major movement of the sand in the dune system by wind or waves. The vegetative top layer provides more stability than unvegetated sand. A well-vegetated dune can provide more protection to the backshore than the same area of unvegetated sand. Dune nourishment can be...
used to provide back shore protection when much of the surrounding area is already vegetated
dunes, or where there may not be adequate supplies of sand to provide full protection with a wide
sand beach. A dune nourishment project would provide vegetated dunes as the new or protected
beach area. This could require careful control or routing of public access and would not provide
the same type of beach area as a full sand nourishment effort.

In situations where beach protection is a critical element of the project, engineering efforts that
only protect the backshore cannot be considered as feasible alternatives. In situations where
protection of the backshore is the main concern, structures such as vertical walls or rip-rap
revetments may be alternatives. As noted previously, these alternatives will not provide any
protection for the beach and will only be an alternative for backshore protection.

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3.3 VERTICAL SEAWALL OR BULKHEAD

**Vertical Seawalls and Bulkheads** are upright structures, parallel to the shoreline, constructed of steel, concrete, or wood, which serve as barriers to or protection from wave attack. In general vertical seawalls are built along the coast to prevent erosion or other wave-related damage. Bulkheads are often built along riverbanks or in harbor areas and serve both as retaining structures and as protection from scour and wave attack. These two structures will be combined in this discussion since they are often outwardly similar and have many of the same impacts and benefits.

**Vertical Seawall and Bulkhead Applications in California**

Vertical seawalls and bulkheads are some of the more common forms of shoreline protection along the California coast. Seawalls have long been used to protect both public and private property. The O’Shaughnessy Seawall, built between 1919 and 1929 by the City of San Francisco to protect the Great Highway from wave attack, was one of the first seawalls in the state. The seaward face is a series of steps or narrow platforms that, when they are not buried in sand, provide vertical access to the beach as well as seats for ocean viewing or picnicking; the landward portion of the seawall connects to an esplanade which is used as a jogging/walking/cycling path parallel to the ocean. While the O’Shaughnessy Seawall is one of the more famous public seawalls in the state, the features of beach access, pedestrian walkways or viewing areas are incorporated into the designs of many of the public seawalls throughout the state. Seawalls to protect private property often incorporate comparable private areas — protected patios or decks, or, occasionally the seawall will be part of the building design. For example, the Monterey Bay Aquarium Research Institute in Moss Landing designed the seaward porch wall as a recurved seawall.
Conditions Best Suited for Vertical Seawalls and Bulkheads

Most existing vertical seawalls and bulkheads have been built along straight sand beaches or low coastal bluffs. Many of the older seawalls and bulkheads were placed seaward of the natural shoreline to extend the buildable land seaward. Fill was placed landward of the seawall or bulkhead and roads, buildings or other development were constructed on the fill. Such structures function as both retaining structures and as protection from wave attack; and many of the ocean front homes and roads in older coastal communities throughout the state were built in this fashion. Recently, seawalls and bulkheads have been built along steep coastal bluffs primarily to provide protection of the lower bluff from wave attack. These walls often incorporate some tiebacks for lower bluff retention, but the primary function of these walls is normally protection from wave erosion and undercutting of the bluff.

On relatively flat beaches or gentle bluffs, seawalls and bulkheads can be installed by construction equipment that is either landward or seaward of the wall. Usually, equipment operators prefer to keep their equipment as far away from wave attack as possible and they will work landward of the installation, but this is often not essential. In situations where the bluffs are steep, the construction equipment must work seaward of the wall or bulkhead. Equipment access and safety from wave attack can seriously limit the opportunities to install vertical walls along the lower portion of a steep bluff. If there is no available access for heavy machinery to get to the beach or if there is no beach area that can serve as a construction platform, it may not be possible to install a vertical structure.

Bulkheads are often used in ports and harbors to create a stable working area or cargo transfer area adjacent to piers and wharves. Often bulkheads are built from the landward side and after the landward portion of the bulkhead and wharf are installed, they are used as construction platforms for further seaward construction. In some situations bulkheads may be built by equipment on construction barges and can be built from the waterside. In protected harbors, wave damage is less of a concern and construction methods depend on cost and ease of access.

Impacts from Vertical Seawalls and Bulkheads

The effects from seawalls and bulkheads depend upon the specific structure and location where it is used. For example, loss of beach area may not be a concern for a project to build a bulkhead in an existing harbor area. Or, fixing of the back beach would be significant on an eroding beach, but might not be a concern if the beach is stable or accreting and the seawall provides protection in the event of extreme, temporary beach loss. \(^5\) The following discussion identifies the more typical impacts from and concerns about vertical seawalls and bulkheads.

\(^5\) Some of these impacts — such as encroachment onto the beach retention of potential beach material or fixing the back of the beach — can be quantified. Section 4.b provides a methodology to quantify these impacts. Other concerns such as scour, end effects or visual degradation can not now be quantified. Nevertheless they are significant concerns and all potential impacts from a shoreline protection option must be recognized and evaluated in any analysis of shoreline protection alternatives.
Encroachment onto Beach: Vertical seawalls and bulkheads encroach onto beach and will physically occupy area that would otherwise be open for use. While smaller seawalls and bulkheads may only encroach two or three feet onto the beach or beyond the line of the natural bluff, massive retaining structures may encroach ten or twenty feet seaward of the original bluff. For non-linear shorelines, it is typical for a seawall or bulkhead design to “smooth out” some of the natural irregularities and even small walls may encroach ten or fifteen feet seaward in such situations. Since one of the original purposes for seawalls was to expand shore lots seaward, it is likely that this type of encroachment occurred routinely in the past. Encroachment onto the beach can be minimized by siting new seawalls and bulkheads as far landward as possible. To analyze thoroughly effects from encroachment, analysts will need the physical dimensions of the proposed seawall or bulkhead, and the shoreward expansion of seawall or bulkhead beyond the back beach or bluff. (See section 4.6 for more information on quantifying this impact.)

Retention of potential beach material: One of the main functions of a seawall is upland stabilization — to keep waves from erosion the lower bluff and causing the landward retreat of the bluff face. Under natural conditions, the back beach or bluff area can often be a significant source of sediment, depending on the type of material that makes up the back beach or bluff. Active sand dunes regularly exchange material with the beach, acting as both a source and sink. Coastal bluffs are often topped by or formed from ancient marine deposits and can contain significant amounts of beach quality sand. Some of bluffs on north San Diego County are thought to contribute up to 50% of all the material in the littoral cell. In his analysis of “Effects of Seawalls on the Beach” (Kraus, 1988), Dr. Kraus found:

At the present time, three mechanisms can be firmly identified by which seawalls may contribute to erosion at the coast. The most obvious is retention of sediment behind the wall that would otherwise be released to the littoral system.

The National Academy of Sciences found that retention of material behind the seawall or bulkhead might be linked to increased loss of material in front of the wall. In Responding to Changes in Sea Level (National Research Council, 1987), it was found that:

A common result of sea wall and bulkhead placement along the open coastline is the loss of the beach fronting the structure. This phenomenon, however, is not well understood. It appears that during a storm the volume of sand eroded at the base of a sea wall is nearly equivalent to the volume of upland erosion prevented by the sea wall. Thus, the offshore profile has a certain “demand” for sand and this is “satisfied” by erosion of the upland on a natural beach or as close as possible to the natural area of erosion on an armored shoreline...

As stated by Dr. Inman, at Scripps Institution of Oceanography (Inman, 1991):

Seawalls usually cause accelerated erosion of the beaches fronting them and an increase in the transport rate of sand along them. While natural sand beaches respond to wave
forces by changing their configuration into a form that dissipates the energy of the waves forming them, seawalls are rigid and fixed, and at best can only be designed for a single wave condition. Thus, seawalls introduce a disequilibrium that usually results in the reflection of wave energy and increased erosion seaward of the wall. The degree of erosion caused by the seawall is mostly a function of its reflectivity, which depends upon its design and location. The likely detrimental effect of the seawall on the beach can usually be determined in advance by competent analysis.

Thus, while a seawall or bulkhead may protect the upland property from continued loss of sediment, on an eroding beach, the sediment loss will cause changes to beach and nearshore, leading to a lower beach profile and greater exposure of the back beach or seawall to wave attack. A technique to estimate the quantity of beach quality material that is kept from nourishment the littoral cell when a seawall or bulkhead is constructed is to examine the anticipated bluff profiles with and without protection. The future bluff profile without a seawall can be estimated from the long-term average annual retreat rate. The bluff profile with the seawall can be estimated from the current profile and the assumption that the seawall will prevent any further landward migration of the lower bluff. The volume of material between these two profiles is the volume of material that would have gone into the littoral cell if the seawall or bulkhead had not been built. The estimated loss of beach quality material is then estimated from the percentage of beach quality material in this total volume. To determine the amount of material that will be retained by a seawall or bulkhead, the analyst will need to know the future bluff profiles with and without the seawall or bulkhead (most likely derived from the long-term average annual retreat rate), the volume difference between these two profiles and the percentage of beach quality material that is in the bluff.

**Location of back beach is fixed:** A major difference between a seawall or bulkhead and a natural back beach is that the seawall or bulkhead is resistant to erosion. This is the primary reason a seawall or bulkhead will be built. Because they are resistant to wave attack and erosion, they will, in effect, fix the location of the back beach. As found by Dr. Everts, (Everts, 1994):

> Seawalls inhibit erosion that naturally occurs and sustains the beach. The two most important aspects of beach behavior are changes in beach width and changes in the position of the beach. On narrow, natural beaches, the retreat of the back beach, and hence the beach itself, is the most important element in sustaining the width of the beach over a long time period. Narrow beaches, typical of most of the California coast, do not provide enough sacrificial sand during storms to provide protection against scour caused

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6 It must be recognized that this technique assumes that the various changes that have happened to the bluff historically will continue into the future. Much of the coast is affected by episodic retreat (that is the bluff will show very little change for a number of years and then there will be significant retreat over a few hours, days or weeks) and episodic events cannot correctly be represented by an average. Since our knowledge of bluff change is based on a few historic photos and surveys and within human time frames, the only changes that will be observed on these bluffs will be landward retreat, a long-term average annual retreat rate is a reasonable surrogate for actual episode change.
by breaking waves at the back beach line. This is the reason the back boundary of our beaches retreats during storms. Armoring in the form of a seawall fixes the back beach line and interrupts this natural process. A beach with a fixed landward boundary is not maintained on a recessional coast because the beach can no longer retreat.

On an eroding shoreline fronted by a beach, the entire shore profile will retreat. The back bluff will retreat landward, the beach will retreat landward and the nearshore zone will retreat landward (See Glossary, and Figure 2 of the Glossary for all terms). A seawall or bulkhead will halt the landward retreat of the back bluff, but will not alter the landward retreat of the rest of the shore profile. The beach and the nearshore will continue to move landward. Eventually, the dry beach will disappear and the seawall or bulkhead will protrude into the ocean. Eventually, the mean high tide line will be fixed at the base of the structure. Geologists term this phenomenon passive erosion. As noted in a paper on shoreline processes, “Beach Response to Coastal Works Gold Coast, Australia” (MacDonald and Patterson, 1985), this passive erosion and loss of beach will occur wherever a seawall is constructed on an eroding shoreline:

On the persistently eroding beaches at North Kirra and Palm Beach, the receding beach line has effectively placed the seawall progressively further and further seaward on the beach profile until no beach exists at all in front of the wall. Clearly the establishment of fixed seawall alignments on persistently eroding section of beach will lead eventually to loss of the beach as a useful recreational amenity.

On an accreting beach, the fixing of the back beach will be of significance only in the early years after installation. As the beach area accreted seaward of the seawall or bulkhead, effects to the beach and the loss of beach will diminish. However, as discussed above, if the coast is eroding, these effects will become more severe as the beach erodes further landward and as the seawall or bulkhead becomes a dominant component of the shoreline system. These effects can be minimized or postponed if the new seawall is sited as far landward as possible.

**Beach Scour:** Scour is the removal of beach material from the base of a cliff, seawall or bulkhead due to wave action. When waves impact on a hard surface, such as a bluff, vertical wall or bulkhead, some of the energy from the wave will be absorbed by the surface, but most of it will be reflected back seaward. If this reflected energy is directed downward, either by wall design or by interaction with incoming waves, the wave energy can disturb the material at the base of the bluff, wall or bulkhead and create erosive or scour trenches in front of and down coast of the hard surface. This phenomenon has been recognized for many years. A 1976 publication entitled, “Shore Protection in California (Department of Navigation and Ocean Development, 1976) stated that:

While seawalls may protect the upland, they do not hold or protect the beach which is the greatest asset of shorefront property. In some cases, the seawall may be detrimental to the beach in that the downward forces of water created by the waves striking the wall rapidly remove sand from the beach.
This observation was stated again more recently by Robert G. Dean in “Coastal Sediment Processes: Toward Engineering Solutions” (Coastal Sediments ‘87):

Armoring can cause localized additional storm scour, both in front of and at the ends of the armoring... Under normal wave and tide conditions, armoring can contribute to the downdrift deficit of sediment through decreasing the supply on an eroding coast and interruption of supply if the armoring projects onto the active littoral zone.

If armoring is deemed warranted to protect a threatened structure and if rational assessment concludes that installation of the armoring would adversely affect the shoreline, mitigation in the form of periodic additions of beach quality sediment should be considered.

If the beach material is sand or cobble, this material can be pulled along by the waves and carried off shore or down coast. It can also be pulled along by waves and driven against the bluff, seawall or bulkhead, causing damage to the vertical surface. If the beach material is soft bedrock, the wave energy can cause breaks and fractures in the bedrock and can lead to a permanent lowering of the bedrock elevation in front of the wall. In addition to the possible impacts to the beach area, this can reduce the stability of the base of the vertical seawall or bulkhead and lead to undermining of the foundation.

The material removed by scour normally remains in the littoral system and following a storm event, scour trenches often fill in with new sand carried shoreward by more gentle waves. Scour is often a temporary problem, and is difficult to quantify since it is so dependent upon specific wave conditions, and type of beach material. A four-year study of seawall impacts along the Central California Coast (Griggs, Tait, and Scott, 1990), found that the beach recovers independently of the seawall when the low-energy wave conditions of summer return. Even though it is not normally quantified, scour can be a serious concern, and walls are often designed with some curvature to reduce the amount of downward energy and with foundations which extend well below the maximum depth of scour. There are no known ways to correct the erosive trenches which can be created by scour, short of either physically refilling them with beach material or waiting for waves to readjust the beach profile and refill the trench naturally. Critical information for examining scour effects from a
seawall or bulkhead is the identified scour depth, foundation design depth, and other proposed measures to minimize scour at the base of the wall.

**End Effects:** End effects are the changes to the beach or bluff up and downcoast of a seawall or bulkhead. One of the more common end effects comes from the reflection of waves off the seawall or bulkhead in such a way that they add to the wave energy impacting the unprotected coastal areas. Wave refraction and diffraction around the end of a seawall or bulkhead also contributes to increases erosion adjacent to the wall or bulkhead. It is often possible to see a small cave or cavity in the bluff face adjacent to a seawall or bulkhead that is caused by this increased wave energy. In a report on the literature on the interaction of seawalls and beaches, entitled “Effects of Seawalls on the Beach” (Kraus, 1988), one of the key conclusions was:

> At the present time, three mechanisms can be firmly identified by which seawalls may contribute to erosion at the coast. ... The third mechanism is flanking i.e. increased local erosion at the ends of walls.

A report of the long-term study of seawalls along the rather sand-rich portions of northern Monterey County, Griggs and Tait found that seawalls could cause a “loss of beach up to 150 m. downcoast from the seawalls due to reflection from end of structure.” (Griggs and Tait, 1988) In a follow-up study, they concluded that the “most prominent example of the lasting impacts of seawalls on the shore is the creation of end scour” which “exposes the back beach, bluff, or dune areas to higher swash energies and wave action” (Griggs, Tait, and Scott, 1990).

A laboratory study by researchers at Oregon State University (McDougal, et al., 1987) found:

> Results to date indicate that erosion at the ends of seawalls increases as the structure length increases. It was observed in both the experimental results and the field data of Walton and Sensabaugh (1978) that the depth of excess erosion is approximately 10% of the structure length. The laboratory data also revealed that the along-coast length of excess erosion at each end of the structure is approximately 70% of the structure length.

Like scour, it is difficult to quantify the exact loss of material due to end effects. The impacts are often temporary and likely to be greatest during and following storm events. Nevertheless, the
impacts can be significant to the neighboring coast properties and efforts should be made to minimize these effects by paying attention to the transitions between the seawall and adjacent properties. Applications for seawalls or bulkheads should identify possible end effects and design efforts to minimize these potential problems. One option for minimizing end effects is to minimize the number of gaps and “ends” for a section of shoreline. This must be carefully weighted against the added loss of natural shoreline and added impacts from armoring. Small gaps should be avoided whenever possible. A second option for minimizing end effects is to site the seawall as far landward as possible.

**Interruption of Longshore Processes:** If a seawall is built on an eroding beach and eventually becomes an isolated promontory or point jutting into the ocean, the seawall or bulkhead can function like a groin or jetty. It will modify or interrupt longshore transport and may cause the upcoast fillet of deposition and downcoast indenture of erosion which is often seen with groins. As noted in “Effects of Seawalls on the Beach” (Kraus, 1988):

> The second mechanism, which could increase local erosion on downdrift beaches, is for the updrift side of the wall to act as groin and impound sand. This effect appears to be primarily theoretical rather than actualized in the field, as the wall would probably fail if isolated in the surf zone.

This effect can be minimized or postponed if the new seawall is sited as far landward as possible.

**Failure Mechanisms**

Seawalls and bulkheads are typically viewed as permanent structures. Nevertheless, there are instances when these structures have failed. A major reason for failure is often loss of foundation support — either loss of material under or in front of the foundation. Normal scour will remove material fronting a wall and should be considered in foundation depth. From Coastal Protection Structures and Their Effectiveness (Fulton–Bennett and Griggs, 1986):
Most concrete walls studied toppled seaward when they failed, due to erosion of sand or bedrock at their toes, and or the active pressures of fill and water behind them. Concrete seawalls have also been poured on bedrock platforms or connected to eroding cliffs. When the bedrock is less resistant than the concrete, which is almost always the case, the support of foundation for the wall has been removed, leading to undermining or outflanking.

Usually such failures occur over several days time and property owners can rush in with emergency rock or sand to refill the lost support. In the central California coast, of the 24 concrete vertical walls or wood bulkheads that were studied by Griggs, only one failed completely.

Other mechanisms that can jeopardize the integrity of a vertical seawall or bulkhead are either the loss of material from behind the wall or the overloading of the material behind the wall with water or a heavy weight. Material can be removed by groundwater piping, burrowing animals or scouring behind the wall by waves. If waves regularly overtop the wall and there is not adequate drainage to remove all this fluid quickly, it can dramatically increase the forces on the wall and cause it to slope seaward. Either situation can expose the wall to forces in excess of those for which it was designed. Care should be taken in all wall designs to insure good drainage of the fill material without piping of loose material out of the fill.

Monitoring and Maintenance

Routine examination of a seawall or bulkhead can often identify small problems or difficulties that, by early detection, may avoid larger problems or possible failure. The project engineer may prepare a detailed monitoring program; a general checklist could include:

- no excessive scour in front of wall following significant storm events
- wall drainage is open and free flowing
- no exposed reinforcing bars
- no apparent tilting or misaligned panels
- adequate foundation coverage, by sand or bedrock

Alternatives

Vertical seawalls and bulkheads are most effective in locations that have an existing beach too narrow to provide full protection for the upland areas. Alternatives to vertical seawalls and bulkheads could include:

- beach nourishment
- engineered rip-rap
- dune vegetation, if back beach is a dune system
References


Everts, Craig – Moffatt & Nichol Engineers (March 14, 1994). “Comments on CCC Methodology to Address Impacts of Seawalls on Beach,” Memorandum to Leslie Ewing and Sherilyn Sarb, California Coastal Commission.

Fulton–Bennett, Kim and Gary B. Griggs, (1986). “Coastal Protection Structures and Their Effectiveness.” Joint publication of the State of California, Department of Boating and Waterways, and the Marine Sciences Institute of the University of California at Santa Cruz.


3.4 RIP RAP REVETMENT

Revetments are facings of stone, rock, or concrete supported on and built to protect a scarp, embankment, or shore structure against erosion by wave action or currents. An engineered revetment will have an outer layer of rock or stone, often referred to as rip-rap. This outer layer must be large enough to withstand anticipated wave forces. Below this layer will be a support layer of smaller material, and, often, a final underlayer of fine gravel or geotextile material that keeps soil in the supporting embankment or scarp from being removed by waves or water flows. Many revetments are not engineered; they consist of whatever large material may have been available and simply dumped on a beach or over a bluff edge. An unengineered revetment is a very inexpensive form of protection but it rarely offers adequate protection for the area and usually requires constant maintenance and resupply of rock or other material to maintain an appearance of utility.

Revetment Applications in California

Revetments are the most common form of shoreline protective device used along the California coast. Revetments are also used along estuaries, lagoons and river banks. Along the coast, revetments have been installed on equilibrium and accretion beaches, on erosive beaches and at the toe of bluffs. On equilibrium or accretion sandy beaches, revetments have been installed with the expectation that they will be buried most of the year and provide protection during those rare storm events when the fronting beach has been removed. Long stretches of coast at Stinson Beach and Pajaro Dunes have such revetments. There is also a somewhat similar revetment at a nourished beach at Surfside which is intended for storm protection during times when the nourished beach is too narrow to provide adequate protection. Most revetments on the California coast are not buried. Revetments are used at the toe of bluffs for scour protection and to retard bluff retreat, along open beach to protect landward development, or to protect roads, buried infrastructure and foundations.
Conditions Best Suited for Revetments

Revetments work fairly well along accretion or equilibrium shorelines where they can be buried during most wave conditions and the beach provides the primary “protection” itself. As a buried structure, the wall will have little, if any, effect on the beach or on coastal access, but can provide existing development with protection from extreme storm events. A potential drawback with this effort is that a buried revetment cannot be easily inspected or checked for stability. It may be buried for several years and then tested by a major storm event. When a revetment is usually buried, it is very important that a qualified professional inspect the revetment soon after the storm. Otherwise, sand may again cover over a damaged revetment and the weakened parts of the revetment will only really be identified in the next major storm event, when the damaged section may be inadequate to protect the backshore property. If the shoreline is eroding, any structure that is built to protect the backshore will eventually be located in the surfzone. Along an eroding shoreline, revetments may be best suited for areas that have limited access along the beach for construction equipment or where encroachment onto the beach is not a significant concern. For all shoreline types, revetments should only be considered if they can be to be safe and stable, and if they can be built so that the toe can be tied together with filter fabric or keyed into a resistant bedrock layer.

Impacts from Revetments

The effects from a proposed revetment depend upon the specific revetment structure and location where it may be used. For example, loss of beach may not be a significant concern if the beach is accreting, but may be very significant along a natural coastal bluff with a narrow, and eroding, sand beach. A report entitled “California’s Coastal Hazards: A Critical Assessment of Existing Land-Use Policies and Practices” (Griggs, Pepper, and Jordan, 1990) concluded “observations and studies to date have not noted a significant difference between the effects of vertical impermeable seawalls and sloping, more permeable rip-rap or revetments.” In general, however, the following discussion identifies the more typical effects from and concerns about revetments.

Encroachment onto Beach: Revetments will encroach onto the beach and will physically occupy area that would otherwise be open for public use. Revetments often look like a triangular wedge of rock or stone, with a face that will have a 1.5:1 or 2:1 slope. For every foot of vertical wall there would be from 1.5 to 2 feet of base support. In front of a bluff face, the revetment base would extend horizontally 1.5 to 2 times the height of the revetment. If the revetment were freestanding (for example, on a coastal dune), the total footprint width would be approximately 3 to 4 times the revetment height.

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7 Some of these impacts — such as encroachment onto the beach, retention of potential beach material or fixing the back of the beach — can be quantified. Section 4.6 provides a methodology to quantify these impacts. Other concerns — such as scour, end effects or visual degradation — cannot now be quantified. Nevertheless, they are significant concerns and all potential impacts from a shoreline protection option must be recognized and evaluated in any analysis of shoreline protection alternatives.
One of the big drawbacks of a revetment is the base width and extent of the footprint. A 15-foot high revetment at the base of a coastal bluff could extend 23 to 30 feet from the base of the bluff. If the revetment is constructed on a narrow equilibrium beach, the revetment could cover most of the sand beach with rock. If the beach is accreting, encroachment will be most significant in the first few years that the revetment is in place and immediately following a major storm that would uncover the revetment. If the beach is eroding, this encroachment will increase in significance over time since the revetment will be encroaching onto an ever diminishing beach.

For analysts to quantify encroachment of a revetment onto public beach, they will need information on the physical dimensions of the revetment — length, width and seaward extent of the toe relative to a fixed reference, such as the toe of the bluff or surveyed property line. On property with no fixed seaward or identifiable public beach boundary, it may not be possible to fully quantify encroachment onto public beach and may be possible only to quantify the amount of beach area displaced. For example, in the City of Santa Barbara, an 800’ long revetment was constructed with a 35’ wide base. The total encroachment was 28,000 square feet (800’ x 35’ =28,000 sq.ft.) If the revetment will be partially buried, it may be important to know both the total dimensions of the revetment and the amount that would be exposed during various beach profile conditions. (See section 4.6 for more information on quantifying this impact.)

**Retention of potential beach material:** One of the main functions of a revetment is upland stabilization — to keep the upland sediments from being carried to the beach by wave action or bluff retreat. Under natural conditions, the back beach or bluff area can often be a significant source of sediment, depending on the type of upland material. Active sand dunes regularly exchange material with the beach, acting as both a source and sink. Coastal bluffs are often topped by or formed from ancient marine deposits and can contain significant quantities of beach quality material. The National Academy of Sciences found that retention of material behind a revetment might be linked to increased loss of material in front of the wall. In Responding to Changes in Sea Level, Engineering Implications (National Research Council, 1987), it was found that:

> A common result of sea wall and bulkhead placement along the open coastline is the loss of the beach fronting the structure. This phenomenon, however, is not well understood. It appears that during a storm the volume of sand eroded at the base of a sea wall is nearly equivalent to the volume of upland erosion prevented by the sea wall. Thus, the offshore profile has a certain “demand” for sand and this is “satisfied” by erosion of the upland on a natural beach or as close as possible to the natural area of erosion on an armored shoreline...

As stated by Dr. Inman, at Scripps Institution of Oceanography (Inman, 1991):

> Seawalls usually cause accelerated erosion of the beaches fronting them and an increase in the transport rate of sand along them. While natural sand beaches respond to wave forcing by changing their configuration into a form that dissipates the energy of the
waves forming them, seawalls are rigid and fixed, and at best can only be designed for a single wave condition. Thus, seawalls introduce a disequilibrium that usually results in the reflection of wave energy and increased erosion seaward of the wall. The degree of erosion caused by the seawall is mostly a function of its reflectivity, which depends upon its design and location. The likely detrimental effect of the seawall on the beach can usually be determined in advance by competent analysis.

Thus, while a revetment may protect the upland property from continued loss of sediment, on an eroding beach, the sediment loss may be transferred to the active beach, leading to a lower beach profile and greater exposure of the back beach or revetment to wave attack. A technique to estimate the quantity of beach quality material that is kept from nourishment the littoral cell when a revetment is constructed adjacent to a bluff is to examine the anticipated bluff profiles with and without protection. The future bluff profile without a revetment can be estimated from the long-term average annual retreat rate. The bluff profile with the revetment can be estimated from the current profile and the assumption that the revetment will prevent any further landward migration of the lower bluff. The volume of material between these two profiles is the volume of material that would have gone into the littoral cell if the revetment had not been built. The estimated loss of beach quality material is then estimated from the percentage of beach quality material in this total volume. To determine the amount of material that will be retained by a revetment, the analyst will need to know the future bluff profiles with and without the revetment (most likely derived from the long-term average annual retreat rate), the volume difference between these two profiles and the percentage of beach quality material that is in the bluff.

**Location of back beach is fixed:** The primary reason a revetment is built will be to resist erosion and protect the more erosive back beach material. Because they are resistant to wave attack and erosion, they will, in effect, fix the location of the back beach. As found by Dr. Everts, (Everts, 1994):

> Seawalls inhibit erosion that naturally occurs and sustains the beach. The two most important aspects of beach behavior are changes in beach width and changes in the position of the beach. On narrow, natural beaches, the retreat of the back beach, and hence the beach itself, is the most important element in sustaining the width of the beach over a long time period. Narrow beaches, typical of most of the California coast, do not provide enough sacrificial sand during storms to provide protection against scour caused by breaking waves at the back beach line. This is the reason the back boundary of our beaches retreats during storms. Armoring in the form of a seawall fixes the back beach.

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8 It must be recognized that this technique assumes that the various changes that have happened to the bluff historically will continue into the future. Much of the coast is affected by episodic retreat (that is the bluff will show very little change for a number of years and then there will be significant retreat over a few hours, days or weeks) and episodic events cannot correctly be represented by an average. Since our knowledge of bluff change is based on a few historic photos and surveys and within human time frames, the only changes that will be observed on these bluffs will be landward retreat, a long-term average annual retreat rate is a reasonable surrogate for actual episode change.
line and interrupts this natural process. A beach with a fixed landward boundary is not maintained on a recessional coast because the beach can no longer retreat.

On an eroding shoreline fronted by a beach, the entire shore profile will retreat. The back bluff will retreat landward, the beach will retreat landward and the nearshore zone will retreat landward (See Glossary, and Figure 2 of the Glossary for all terms). A revetment will halt the landward retreat of the back bluff, but will not alter the landward retreat of the rest of the shore profile. The beach and the nearshore will continue to move landward. Eventually, the dry beach will disappear and the revetment will protrude into the ocean. Eventually, the mean high tide line will be fixed at the base of the structure. Geologists term this phenomenon passive erosion. As noted in a paper on shoreline processes, “Beach Response to Coastal Works Gold Coast, Australia” (MacDonald and Patterson, 1985), this passive erosion and loss of beach will occur wherever a revetment is constructed on an eroding shoreline:

On the persistently eroding beaches at North Kirra and Palm Beach, the receding beach line has effectively placed the seawall progressively further and further seaward on the beach profile until no beach exists at all in front of the wall. Clearly the establishment of fixed seawall alignments on persistently eroding section of beach will lead eventually to loss of the beach as a useful recreational amenity.

On an accreting beach, the fixing of the back beach will be of significance only in the early years after installation. As the beach area accreted seaward of the revetment, effects to the beach and the loss of beach will diminish. However, as discussed above, if the coast is eroding, these effects will become more severe as the beach erodes further landward and as the revetment becomes a dominant component of the shoreline system.

**Beach Scour:** Scour is the removal of beach material from the base of a cliff, seawall or revetment due to wave action. When waves impact on a hard surface, such as a bluff, some of the energy from the wave will be absorbed by the surface, but most of it will be reflected back seaward. If this reflected energy is directed downward, either by wall design or by interaction with incoming waves, the wave energy can disturb the material at the base of the bluff and cause an erosive trench or scour trench in front of and down coast of the hard surface. This phenomenon has been recognized for many years. A 1976 publication entitled, “Shore Protection in California (Department of Navigation and Ocean Development, 1976) stated that:

While seawalls may protect the upland, they do not hold or protect the beach which is the greatest asset of shorefront property. In some cases, the seawall may be detrimental to the beach in that the downward forces of water created by the waves striking the wall rapidly remove sand from the beach.

This observation was stated again more recently by Robert G. Dean in “Coastal Sediment Processes: Toward Engineering Solutions” (Coastal Sediments ‘87):
Armoring can cause localized additional storm scour, both in front of and at the ends of the armoring. Under normal wave and tide conditions, armoring can contribute to the downdrift deficit of sediment through decreasing the supply on an eroding coast and interruption of supply if the armoring projects onto the active littoral zone.

If armoring is deemed warranted to protect a threatened structure and if rational assessment concludes that installation of the armoring would adversely affect the shoreline, mitigation in the form of periodic additions of beach quality sediment should be considered.

The material removed by scour normally remains in the littoral system and following a storm event, scour trenches often fill in with new sand carried shoreward by more gentle waves. Scour is often a temporary problem, and is difficult to quantify since it is so dependent upon specific wave conditions, and type of beach material. Even though it is not normally quantified, scour can be a serious concern. Scour at the toe of revetment can cause individual rocks to detach from the main revetment, fall seaward and expand the seaward encroachment of the wall. Dislodgment of rock will also reduce the overall effectiveness of the main structure.

There are no known ways to correct the erosive trenches which can be created by scour, short of either physically refilling them with beach material or waiting for waves to readjust the beach profile and refill the trench naturally. Critical information for examining scour effects from a revetment is the identified scour depth, toe design depth and other proposed measures to minimize scour at the base of the revetment.

**End Effects:** End effects are the changes to the beach or bluff adjacent to a revetment. One of the more common end effects comes from the reflection of waves off the revetment in such a way that they add to the wave energy that is impacting the unprotected coastal areas. The many angles and small surfaces of the revetment material reflect wave energy in a number of directions, effectively absorbing much of the incoming wave energy rather than reflecting it. Because of the way revetments modify incoming wave energy, there is often less problem with end effects and overtopping than occurs with seawalls and bulkheads. Refraction and diffraction around the ends of the revetment can also contribute to increased erosion adjacent to the revetment. It often is possible to see a small cave or cavity in the bluff face adjacent to a revetment that is caused by this increased wave energy. In a report on the literature on the interaction of seawalls and beaches, entitled “Effects of Seawalls on the Beach” (Kraus, 1988), one of the key conclusions was:

> At the present time, three mechanisms can be firmly identified by which seawalls may contribute to erosion at the coast. ... The third mechanism is flanking i.e. increased local erosion at the ends of walls.

Like scour, it is difficult to quantify the exact loss of material due to end effects. The impacts are often temporary and likely to be greatest during and following storm events. Nevertheless, the
impacts can be significant to the neighboring coast properties and efforts should be made to minimize these effects by attention to the transitions between the wall and adjacent properties. Applications for revetments should identify possible end effects and design efforts to minimize these potential problems. One option for minimizing end effects is to minimize the number of gaps and “ends” there are for a section of shoreline. This must be carefully weighted against the added loss of natural shoreline and added impacts from armoring; however, small gaps should be avoided whenever possible. A second option for minimizing end effects is to site the revetment as far landward as possible.

** Interruption of Longshore Processes:** If a revetment is built on an eroding beach and eventually becomes an isolated island jutting into the ocean, the revetment can function like a breakwater. It may modify or interrupt longshore transport and may cause the upcoast fillet of deposition and downcoast indenture of erosion which is often seen in the wave shadow of breakwaters and around groins. As noted in “Effects of Seawalls on the Beach” (Kraus, 1988):

> The second mechanism, which could increase local erosion on downdrift beaches, is for the updrift side of the wall to act as groin and impound sand. This effect appears to be primarily theoretical rather than actualized in the field, as the wall would probably fail if isolated in the surf zone.

*Isolated Rock in Surf Zone — Faria Beach*
Habitat Modifications and Visual Effects

Any non-toxic hard substrate in the intertidal zone will be colonized by intertidal organisms. To the extent that revetments mimic natural rocky features, they will support a similar diversity of organisms. Many revetments have low species diversity because their exposed surfaces are unlike natural rocky reefs or because they are located high on the beach. Revetments should not be considered as hard substrate habitat without detailed analysis.

Revetments placed on a sand or cobble beach will significantly modify the visual character of the beach. Species, such as sand crabs, use the sand beach as habitat. The large rocks, crevasses and gaps between the rocks change the sand habitat to a new rocky habitat. The rock areas can support rats, squirrels and other burrowing rodents that would not otherwise find habitat on a sandy beach. Also, revetments can collect debris and trash that can help feed these revetment dwellers.

Failure Mechanisms

Revetments are occasionally viewed as temporary structures since they are formed by a number of individually removable rocks. This is especially the case when revetments are installed as emergency protection. Once in place, however, these structures are rarely removed and in most instances, revetments should be viewed as permanent structures. Whether temporary or permanent, these structures have failed — often due to loss of material under the foundation or in front of it. Normal scour will remove material in front of the wall and should be considered in design of toe depth. As noted in Coastal Protection Structures and Their Effectiveness (Fulton–Bennett and Griggs, 1986):

the success rate of riprap walls is marred by relatively high repair and maintenance requirements, and by the fact that significant property damage often occurs when these walls suffer even partial failure. ... Within the study region, at virtually every location where rip rap has been founded on sand, it has settled into that sand over time. A seaward movement of the toe of the structure often accompanies this settlement. .......
Rip rap walls may fail quite rapidly, often leaving behind gaps or arcuate landslide-like scarps of oversteepened rip rap or exposed fill. Because many walls are designed as low as possible to minimize costs, even minor settling can allow significant overtopping, erosion and damage behind the wall.

A second mechanism that can jeopardize the integrity of a revetment is loss of material from behind the revetment. This can cause the revetment to rotate or collapse and expose the upland area to wave attack. Proper underlayer material or filter cloth can often minimize the loss of material from behind the revetment, but filter cloth, according to Fulton–Bennett and Griggs, is not especially effective on slopes steeper than 2:1.
Revetments, to remain effective, require regular maintenance. From examination of rip rap revetments in the central California coast, Fulton–Bennett and Griggs found that a storm event of roughly ten year recurrence required total repairs to engineered revetments of 20 to 40% of their construction costs and non-engineered revetments between 50 and 150% of construction costs.

**Monitoring and Maintenance**

Routine examination of a revetment can often identify small problems or difficulties that, by early detection, may avoid larger problems or possible failure. The project engineer may prepare a detailed monitoring program; a general check list could include:

- no excessive scour in front of revetment following significant storm events
- no dislodged rocks or stones seaward of the wall
- no gaps or exposed underlayer material
- no apparent slumping or rotation of revetment
- settlement of rock into underlying sand

**Alternatives**

Revetments are most effective as storm protection on an equilibrium or accreting beaches. For eroding beaches, they are most effective in locations that prohibit access by construction equipment for a vertical wall or where long-term beach access is not possible and where there is a resistant bedrock layer into which the revetment can be keyed. Alternatives to revetments could include:

- beach nourishment
- vertical seawalls and bulkheads
- dune vegetation, if back beach is a dune system

**References**


Everts, Craig – Moffatt & Nichol Engineers (March 14, 1994). “Comments on CCC Methodology to Address Impacts of Seawalls on Beach,” Memorandum to Leslie Ewing and Sherilyn Sarb, California Coastal Commission.
Fulton–Bennett, Kim and Gary B. Griggs, (1986). “Coastal Protection Structures and Their Effectiveness.” Joint publication of the State of California, Department of Boating and Waterways, and the Marine Sciences Institute of the University of California at Santa Cruz.


3.5 UPPER BLUFF PROTECTION

Upper bluff protection is any type of stabilization or retention that can be used on an upper bluff area to prevent erosion, mass wasting, slumps, spring sapping, slides, or other types of upper bluff loss. Typical structures used for upper bluff stabilization include, but are not limited to: ground anchors; rock anchors; soil nails; piles; gravity, anchored, or cantilever walls; reinforced earth; grouting; and chemical stabilization. If upper bluff structures are threatened by bluff retreat, an additional protective measure may be foundation modifications, such as installing deep-seated piles or tie-backs. Surface and groundwater controls (Section 3.6) should be considered in any effort to stabilize the upper bluff.

Conditions Best Suited for Upper Bluff Protection

Upper bluff protection is most useful for sites which have a steep bluff with a competent bedrock layer or layer of inland material which can be used to support or anchor the upper bluff stabilization. It also is more useful for situations where upper bluff retreat is somewhat independent from lower bluff behavior. There will be little, if any benefit from upper bluff protection if the only cause of upper bluff retreat is failure of the lower bluff. Also, upper bluff protection may not be very effective in protecting areas where the failure mechanism is a deep seated slide or block failure which extends to the base of the bluff face. In most situations the Engineering Geologic Report should identify whether site conditions are conducive to upper bluff protection.

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For detailed information on these techniques, refer to California Coastal Commission (March 1994) Land Form Alteration Policy Guidance, Attachment 3: Overview of Engineering Techniques to Reduce Grading, available from the California Coastal Commission, 45 Fremont Street, Suite 2000, San Francisco, CA 94105.
Impacts from Upper Bluff Protection

The upper bluff stabilization measures should be designed to address specific upper bluff failure mechanisms, and the impacts from upper bluff protection will depend upon the type of protection used. Retaining walls will alter natural bluff land forms and the visual character of the upper bluff; soil nails and rock anchors may have less visual impact than retaining walls, but they may not protect against small slumps and surficial failures. In general the impacts from these methods to the coastal bluff area will be the same as for an inland bluff.\(^\text{10}\) Perhaps the only concern unique to a coastal bluff would be effects to beach and shoreline access if construction activities or equipment required any limits on beach use.

Failure Mechanisms

Upper bluff stabilization efforts can fail if they lose either their base support or the material that holds them in place. For example, if the lower bluff fails there may no longer be any base support for the upper stabilization. Also, if there is no control of surface or ground water along the upper bluff, erosion can continue and remove all the support material for the stabilization. If there are high ground water flows through the bluff and the stabilization effort is a solid, impermeable barrier, ground water may be trapped behind the stabilization and exert sufficient force on the back of the stabilization that it topples or kicks out at the base.

Monitoring and Maintenance

The major effort for monitoring upper bluff stabilization is checking that the stabilization structure is not being undermined or damaged by water. Often this can be accomplished through routine visual inspections, assuming that the seaward portion of the structure can be viewed without damage to the upper bluff. Careful inspection of the seaward face of the structure may be possible using binoculars from the beach or shoreline. An inspection program should check for incipient water damage, such as small gullies or erosion at the edges of the structure; concrete spalling or cracks; exposed re-bar or rust stains on the concrete; loose (untensioned) rock bolts; or changes from the original condition of the structure.

Since the major failure mechanisms for upper bluff stabilization result from uncontrolled surface or groundwater, careful maintenance of all site drainage should be part of any maintenance program for upper bluff stabilization. Other maintenance would be developed from the type of structure and observed problems. Maintenance might include, but not be limited to: repairing or patching concrete, retensioning rock bolts, filling small gullies and redirecting drainage away from structure; redirecting groundwater or allowing it to flow through the structure.

\(^{10}\) Ibid.
Alternatives

Alternatives to upper bluff stabilization could include, but not be limited to:
- control of surface and groundwater
- relocation of the buildings on the site
- possibly lower bluff protection.
3.6 SURFACE AND GROUNDWATER CONTROLS

Effects of Water

Water has been one of the major forces in forming the present California landscape. Earthquakes, plate movement, wind, solar radiation, geothermal energy, and human activity profoundly affect the California landscape. But water, often in concert with some of these other forces, has carried sand and gravel from the mountains to the coast, cut ravines and gullies, deposited fertile soils in the river valleys, and rounding sharp, uplifted peaks. While the force of water can be seen readily in the aftermath of unexpected events such as flash floods or landslides, water’s bigger impact is often from less dramatic, almost imperceptible, ongoing changes — changes that occur from water flowing steadily over a bluff face, or from groundwater flowing through a permeable soil layer or bedding planes.

Water is heavy. It is approximately 62.4 pounds per cubic foot. An inch of water, as precipitation or irrigation, added uniformly to an acre of land increases the weight of that acre by over 100 tons. Moving water is powerful. Flowing water routinely can pick up soil, debris, sand, and pebbles; flood waters can move rocks, boulders, even cars and buses. Finally, water is chemically active. “All chemical weathering reactions (of rock) on this planet involve water either as a reactant or as the carrier of the reaction products.” (Bloom, 1978) Oxidation, carbonation, hydrolysis, and hydration are some of the typical weathering processes that alter rock minerals, normally producing compounds that have greater volume and less strength than the original material. So, whether it is still or moving, water’s effects should never be ignored.

Special Concerns for Blufftop Properties

Water can be critical to the formation and continued erosion of blufftop properties. When blufftop structures have a limited setback, control of surface and groundwater may add years to the useful life of the property. Landscaping irrigation has been estimated to add the equivalent of 40 to 80 inches of additional annual rainfall to blufftop lawns and gardens (Griggs et al., 1990 and Slosson and Larson, 1993)). Gullying, surficial failures, slumping, mass wasting, rotational slides and some cave formation can occur because of surface runoff and groundwater. Surface water flows downhill, and the flow will accelerate as the downhill slope steepens. The energy of flowing water increases as the volume and velocity increase, so water flowing over a steep bluff face has more energy to dislodge and suspend soil particles than water flowing over a relatively flat parcel. Since water flows downhill, and water along the coast flows down to the ocean, coastal bluffs tend to receive a concentration of water flowing from all the upland sources. Blufftop properties tend to have more, and often faster, surface and groundwater flowing over or through them than do properties further inland.
Opportunities to Analyze Surface and Groundwater Concerns

Surface and groundwater should be analyzed for the existing project site and for the proposed shoreline protective option. The analysis of surface and groundwater effects should be done early in the project review. Surface or groundwater controls may be alternatives to the proposed shoreline protective device, or may be able to work with the proposed shoreline protective device to either enhance its performance or support a smaller devise. An analysis of surface and groundwater conditions should be repeated for site conditions with the proposed alternative to determine if the proposed site modification may result in adverse changes to existing surface or groundwater flows. As examples of each, the Self Realization Fellowship in San Diego County has used groundwater pumps, hydraulers and rock anchors in place of a massive seawall or retaining structure to protect their bluff and an access stairway. In neighboring areas, cave filling has been used as an effective protective option, but such projects need to pay close attention to groundwater drainage or else the cave filling could be destroyed by water pressure.

How to Check for Surface or Groundwater Concerns

Surface and groundwater should be discussed in the engineering geologic report that accompanies the application for a shoreline protective device. This discussion should give the analyst a good understanding of the major surface and groundwater concerns, such as level of the groundwater table, groundwater seeps, surface drainage, direction of surface flows, and any existing drainage improvements. The main step in determining if surface or groundwater is a problem on a site is to look at where the water goes. The analyst should be able to understand this through the discussion in the geotechnical report. With information on the sources of water on the site, a control program can begin to take shape.

The first step is to follow the water.

- If water lands on the site, where does it go? (Trace paths from several starting points, remembering that water flows downhill. Trace the path until it leads to a culvert, ravine, stream, beach, or other location where the endpoint is clear. After you know where water travels from one part of the site, check other parts of the site. Don’t forget to check building roofs.)
- If water is added to the site by sprinklers, irrigation lines, etc., where does it go?
- Can water enter the site from adjacent properties and if so, where does it go? (Often street and roadways intercept surface runoff and are used in storm water runoff control. Streets running parallel to the bluff edge may divert much of the upland surface water away from the bluff edge.)

Then, determine if there is any likely connection between where the water is going and where there are problems on the site. For example, is the ravine enlarging, are gullies threatening the stability of the foundation, is bluff soil getting so heavy from all the added water that gravity is pulling it down the bluff face? If there seems to be a connection between surface water and site
problems, look for ways to divert the water from the problem area, such as drainage modifications, vegetation, settling basins, etc.

The same idea applies to groundwater, although it is often more difficult to find the pathways for groundwater than for surface water. Like surface water, groundwater flows downhill (unless, of course, it is under pressure as with an artesian well). Groundwater can only flow through permeable material; it cannot flow through solid rock or metal. Routine pathways for groundwater flow are at the interface of a low permeability soil layer which is overlain by a permeable soil layer; through open cracks and fissures within bedrock or other impermeable material; or on an open, unconfined path in a thick layer of permeable material.

On the coast, it is often possible to identify groundwater paths by finding end points — spots where groundwater free flows out of the side of a bluff, an incongruous spot or line of vegetation on a bluff face; an abrupt transition in bluff vegetation from xeric to hydrophilic. If groundwater is coming out of a bluff face, the water either came from the bluff top property, or came from more inland sites. Groundwater paths may be difficult to trace, but, remember that groundwater exists and must be considered.

Problems from Uncontrolled Surface Water\textsuperscript{11}

- removal of loose surficial soils
- increase weight of ground surface
- slumps
- gullying
- increased turbidity and pollutant loadings

Controls for Surface Water\textsuperscript{12}

- install gutters and downspouts on all buildings
- direct drainage to inland streets and storm drains
- eliminate or reduce irrigation, by using drought-tolerant plants
- ditch and curb all impermeable roads, parking areas, etc.
- direct runoff over the bluff through drain pipes

Problems from Groundwater

- loss of competent subsoil layers
- high pressure against vertical portions of impermeable material in its path (such as seawalls)
- piping or removal of material from behind a retaining structure

\textsuperscript{11} For a more detailed discussion of surface water problems and ways to control runoff, refer to the California Coastal Commission, Procedural Guidance Manual: Addressing Polluted Runoff in the California Coastal Zone, 2nd Edition June 1996; available from the Nonpoint Water Pollution Program, California Coastal Commission, 45 Fremont Street, Suite 2000; San Francisco, CA 94105.

\textsuperscript{12} Ibid.
- "lubrication" of slide planes, helping trigger landslides
- increase weight of soils

Controls for Groundwater
- remove leach lines and septic systems and hook into a regional sewer system
- eliminate or reduce irrigation, by using drought-tolerant plants
- install groundwater pumps to intercept groundwater before it enters property
- hydraugers or other drains to route groundwater off the property

Monitoring and Maintenance

Surface and groundwater controls can be very effective in reducing water related bluff failures. If control measures stop functioning properly, the initial problems may reoccur or new problems may arise. Any devise to control or redirect surface or groundwater must be maintained and requires some level of routine inspection or monitoring to gauge its continued effectiveness. Since much of the problem with water is in its flow, the emphasis of a monitoring program would be on where the controlled water is supposed to go, where it is not supposed to go and to determine whether all the controlled water is continued to be redirected correctly. Most maintenance efforts are actions to maintain the controlled flows — remove blockages in the drains, clean out gutters and downspouts, maintain curbs, etc. If groundwater pumps are being used, it may be necessary to have a trained person check the pumps routinely and insure they are functioning properly. Most other controls can be inspected and maintained by the property owner, provided they understand and accept the responsibility for properly functioning surface and groundwater controls.

References


3.7 SHOTCRETE AND GUNNITE

Shotcrete and Gunnite are terms, often used synonymously, for concrete or mortar that is pneumatically projected, at high velocity, onto a form or surface. Along the coast, shotcrete and gunnite have been used as facings for vertical walls, or as protective covering for erosive soils such as terrace deposits or sandstone. As facing, they often are sculpted and colored to give the appearance of a natural coastal bluff. If placed over an existing bluff, their main purpose is to prevent surface water from eroding the bluff face or creating gullies.

Shotcrete and gunnite can bond strongly with the underlying material, and usually are more brittle than the underlayer. They derive most of their impact resistance from the underlying material. Without solid backing material, shotcrete and gunnite have a tendency to crack and fail under impact.

Conditions Best Suited for Shotcrete or Gunnite

Shotcrete and gunnite are useful for protecting steep, erosive soils from surface water erosion. They have little impact resistance of their own, and have limited application in a high wave energy environment. As such, they are best for upper- and mid-bluff erosion protection. They can be useful in scenic areas as facings for vertical reinforced concrete, since the material can be colored, formed and molded to mimic natural bluff formations; however, the vertical wall itself must be designed to bear most of the energy from wave impacts.

Impacts from Shotcrete and Gunnite

Along the coast, shotcrete and gunnite have been installed on or bonded to existing bluff faces. They result in little seaward encroachment, and in many situations can be made to mimic the visual character of the area. If not carefully designed, shotcrete walls can cause significant visual impacts to scenic coastal areas. Due to the application process — pneumatic projection — shotcrete and gunnite are often very messy. If the construction site is not well controlled, shotcrete and gunnite can wash into nearshore waters, increasing turbidity and sediment. If shotcrete or gunnite structures fail, they may be difficult to remove from the beach and could add to marine debris and pollution. Like other types of shoreline protection, shotcrete and gunnite
will reduce the amount of bluff material that naturally would have been carried from the bluff to the beach, and they prevent the landward retreat of the bluff. If a shotcrete or gunnite face is designed to function like a seawall or bulkhead, it will have the same effects on the shoreline as a seawall or bulkhead and should be analyzed as such.

**Failure Mechanisms**

Shotcrete and gunnite can fail from many of the same mechanisms that cause failure of vertical walls or upper bluff structures. In the coastal environment, water is a major concern and it can damage or destroy shotcrete and gunnite structures. Some of the major concerns include, but are not limited to:
- flanking
- toe scour
- piping of underlayer material, resulting in loss of support
- cracking or abrasion of surface
- puncturing of surface layer
- insufficient drainage to address groundwater pressure
- insufficient bond to loose or non-cohesive underlayer

**Monitoring and Maintenance**

Shotcrete and gunnite need routine patching and maintenance to remain effective. As a facing material, shotcrete and gunnite are occasionally viewed as being a sacrificial, erosive face that can protect the underlayer. They provide this protection until the underlayer is exposed. Then, the underlayer will begin to erode until covered again. Although shotcrete and gunnite area viewed as being short term options for erosion control, some gunnite structures in central California have lasted 10 to 20 years. (Fulton–Bennett and Griggs, 1986)

**Alternatives**

Alternatives to shotcrete and gunnite include, but are not limited to:
- vertical Seawalls and bulkheads
- revetments
- upper bluff stabilization
- landscaping

**References**

Fulton–Bennett, Kim and Gary Griggs (1986) “Coastal Protection Structures and Their Effectiveness,” joint publication of the State of California, Department of Boating and Waterways, and the Marine Sciences Institute of the University of California at Santa Cruz.
4.0 REGULATORY REVIEW OF PERMIT APPLICATIONS FOR SHORELINE PROTECTIVE DEVICES

4.1 INTRODUCTION

Shoreline protective devices, like all other development in the coastal zone, must be reviewed for their effects to coastal resources and their consistency with the California Coastal Act. However, unlike many other types of development, there is often little flexibility about where shoreline protective devices can be located. These devices are constructed in the zone between the coastal water and upland development, on the beach or at the base of a coastal bluff, seaward or the property they are protecting. Shoreline protective devices are often on or adjacent to State tidelands. The regulatory review of shoreline protective devices, thus, must include, among other issues, determining the effects of these structures on public tidelands, beach access, visual quality of coastal areas, natural shoreline processes and sand supply.

This guidance document provides some approaches that can be used in analysis of permit applications for structural devices, such as seawalls, revetments, bluff retaining walls and other such construction which alter natural shoreline processes and are proposed in response to beach erosion. Since most of these projects will be located within the wave uprush area or will be exposed to direct wave attack, they are within the Commission’s original permit jurisdiction. Therefore, the Chapter 3 policies of the Coastal Act are the legal standard of review for shoreline protection projects. It is important for the permit analyst to have a good familiarity with the applicable Coastal Act policies in order to adequately review such projects for their conformance with the Coastal Act (Section 1 provides an overview of the major Coastal Act policies that address shoreline protection. For more thorough coverage, refer to the Coastal Act or the Administrative Regulations).

This section covers the various steps, or elements in reviewing and analyzing a Coastal Development Permit (CDP) application for a shoreline protective device — review of the application for the information necessary to analyze the project, assessment of project need, and a process for developing a staff recommendation. In addition, various special conditions are provided that can be used in conjunction with a recommendation for approval of a shoreline protective device. The overall review process for a shoreline protective device CDP application was shown in Figure 1-1, and is repeated here as Figure 4-1.
Figure 4-1: Flow Chart for Reviewing a CDP Application for Shoreline Protection

Shoreline protection application received

Review for completeness (10- to 30-day review period)
Chapter 3 policies (Section 1)
LCP if applicable (Section 5)
Check adequacy of information for analysis and staff recommendation:
- Regular & special filing requirements (Section 4)
- Shoreline type (Section 2)
- Project description (Section 3)
- Project need & erosion danger (Section 4)
- Alternatives (Section 4)
- Impacts on coastal resources
- Impacts on local sand supplies
- Other information, as needed

Is application complete?

No

Incomplete filing letter

Yes

Accept for filing
- Set for hearing within 49 days and take action within 180 days under Permit Streamlining Act.

Are there existing structures?

No

Not required to approve shoreline protection under Coastal Act 30235.
Review under other Coastal Act policies. Consider alternatives. Go to staff recommendation.

Yes

Are existing structures in danger from erosion? Consider:
- Engineering geologic report
- Coastal process information
- Existing setback
- Past Commission actions

No

(continued on next page)
Figure 4-1: Flow Chart for Reviewing a CDP Application for Shoreline Protection
(continued from previous page)

Is shoreline altering construction required? Consider alternatives which do not alter natural shoreline processes but provide required protection.
- Ground/surface water control
- Landscaping
- Beach nourishment
- Remove/relocate accessory structures
- Past Commission actions

No

Staff recommendation

APPROVAL WITH CONDITIONS
- Identify alternatives to shoreline altering construction to increase stability, reduce risk, and avoid shoreline altering construction in future. (Ref. Section 30253)

Yes

Identify impacts of proposed project on coastal resources.

Identify feasible design alternatives to reduce impact, e.g., width, height, location, type, etc.

Identify mitigation measures for identified impacts, including sand supply.

Staff recommendation

APPROVAL AS PROPOSED
- Identify Coastal Act consistency.
- Identify lack of feasible mitigation measures or alternatives that lessen significant adverse impacts.

APPROVAL WITH CONDITIONS
- Identify mitigation measures and/or design alternatives that lessen significant adverse impacts on coastal resources.

DENIAL
- Identify inconsistencies with Coastal Act.
- Identify alternatives.
4.2 FILING REQUIREMENTS

One of the most important steps in the CDP process is to ensure that a permit application contains all the information needed to evaluate the consistency of the project with the Coastal Act. This should be done before the application is accepted for filing. In general, when the application contains all the information the analyst will need for a thorough review of the proposed project, the remaining process will go smoothly.

The Commission’s permit application form requires that each permit applicant submit certain specific information. However, the form is general and it does not specify the details that must be included in all cases. The purpose of the following list is to specify the details that must be included in the submitted information for a shoreline protection project. The discussion is organized under some general topic headings. When information could logically fit into more than one heading, it is repeated in each. This repetition is for completeness and does not mean that the requested information should be provided more than once. Finally, the provided headings help organize the information, but they are not a “required” organization. The important issue is that the analysts obtain the information that is necessary to properly analyze the project. Table 4-1 is a checklist that can be used to determine if all the necessary information has been provided. This is followed by a discussion of each of the items listed in the checklist.

As noted previously, the initial filing and application review are two of the most important steps in the CDP process. For that reason, the filing information has been provided in this section and is repeated in a less formal question format in Section 4.5. In this section, Section 4.2, the filing information is organized to present what information is needed, why it is needed and how it can be used. Section 4.2 is the more detailed and thorough presentation of the filing information. This organization may not be the best for every project or for every analyst. Therefore, Section 4.5 has been provided to supplement this listing and provide an alternative approach for examining an application to determine whether it has provided sufficient information to accept the application for filing and for detailed project review. Section 4.5 provides a list of questions that an analyst should be able to answer after reviewing a complete application for a shoreline protection project. Section 4.5.1 outlines the various questions for a new shoreline protection project and Section 4.5.2 outlines the various questions for an application for repair and maintenance of an existing shoreline protection device.

There is no single correct way to analyze complex projects such as shoreline protection projects. Every analyst will organize critical project information in a slightly different way. The important aspect is that the analyst has all the critical project information available in the application before undertaking the detailed analysis and evaluation necessary for determining consistency with the Coastal Act.

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13 For coastal bluffs, the analyst should also refer to the Commission’s Adopted Statewide Interpretive Guidelines (Geologic Stability of Blufftop Development—5/3/77)
Table 4-1: Filing information for an application for a shoreline protective device

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<tr>
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<th>Item # (See Attached Discussion for Details)</th>
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<td>• detailed project description</td>
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<td>• general construction schedule and constraints</td>
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<td>• long-term maintenance needs</td>
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<td>Maps, plans and cross-sections (large scale and 8 1/2” x 11” for inclusion in staff reports)</td>
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<td></td>
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1. **Project description**

*Instructions for Use:* The Coastal Act allows the installation of a shoreline protection device if it is needed to protect an existing structure in danger from erosion and if impacts to sand supply are mitigated and there are no other alternatives. An analyst must have enough information on the project site and the proposed project to determine whether it meets the requirements of Coastal Act Section 30235 and is consistent with the other policies of the Act. An analyst must have knowledge of the full scope of proposed project and the manner in which it will be constructed to fully analyze the impacts on coastal resources and to evaluate possible alternatives.

A comprehensive project description should provide details about the proposed temporary and permanent development, including:

- the kind of device that is proposed and where it will be located
- the final dimensions of the proposed project — height, referenced to a vertical datum; length; and, distance from an identifiable back beach feature (such as the bluff, line of vegetation, development, etc.)
- the major components of the proposed protective device (e.g. backfill, filter fabric, toe key, armor layer, etc.)
- the kind and quantities of materials to be used
- the size, shape and source of any rock and backfill to be used
- whether any shoreline protection has been built in the general vicinity of the proposed project and the general condition of this existing protection (this may require a supporting statement from a licensed engineer)
- how the proposed project will fit with the existing protection, if any exists
- how the proposed project will be built — type of construction equipment, access for construction equipment, and staging areas for materials
- how the proposed project will be maintained.

The applicant should provide a comprehensive description of the proposed construction process for all proposed temporary and permanent development. This description should include an identification of any associated development including, but not limited to: access roads, staging areas, dewatering efforts, and proposed construction techniques. Since the construction of shoreline protection projects can often disrupt beach use or habitat for sensitive species, the construction description should include schedule information telling when the work will be performed. Finally, if there are any special construction constraints (for example, work can only be done during extreme low tides or equipment must be less than two tons to use the available access) these constraints should be discussed. If the construction activities will be extensive, it may be preferable to discuss construction activities in a separate section.

Shoreline protection projects often require routine maintenance to remain effective. If any maintenance can be anticipated at the time the project is being developed, these maintenance needs should be included in the project description. If maintenance is clearly a part of the
proposed project, it may be appropriate to develop a separate maintenance plan and possibly tie this plan to routine monitoring (see Item #8)

2. **Maps, Plans and Cross-Sections**

*Instructions for Use:* The analyst needs an accurate site plan to know with certainty where the proposed project will be located and to evaluate how the proposed project may interact with other, known coastal resources. Site cross-sections and beach profiles can be used to evaluate how some impacts to coastal resources may vary seasonally or over time. The analyst also needs engineered plans that are designed to address the existing conditions on the site and in the surrounding area. The analyst can use the site information and engineered plans to evaluate whether the proposed project may have temporary or permanent impacts to public access, recreation, coastal dunes, environmentally sensitive habitat areas, blue line streams, offshore reefs, etc.

The analyst can use information on the project footprint to quantify the area of beach that will be lost due to direct encroachment of the shoreline protective device. The analyst can use information on the long-term retreat rate to estimate the area of beach that would have been created if the back beach location were not “fixed” by a shoreline protective device. Finally, the analyst can use information on the back bluff dimensions, combined with bluff geology and the long-term retreat rates to estimate the amount of beach sand that would be added to the littoral system if the shoreline protection were to not be built and the natural back beach retreat were to continue. This information can be used to determine some of the project’s impacts. For areas that have a Beach Sand Replenishment In-Lieu Fee program, such as San Diego, this information can also be used to determine the mitigation for the proposed project.

**Site Plan:** The applicant should provide site plans of the proposed project showing:

- the project footprint in relation to the applicant's property boundaries and any recorded easements
- locations of provided cross sections
- topographic contours, at 1 to 5 foot intervals, of the entire project site (beach, bluff, and upland area to the landward property boundary) from a recent (normally within the past two years) topographic survey of the property
- the location of any structure that needs protection, relative to the proposed protective device
- the setback of all existing development from either the top of bluff or seaward extent of dune vegetation
- the locations of any public land boundaries in the immediate project vicinity to which the State Lands Commission has agreed
- a permanent surveyed benchmark, referenced to NGVD (National Geodetic Vertical Datum) which can be used for future project maintenance and monitoring.
**Cross Sections:** The applicant should provide cross-sections\(^{14}\), drawn to scale, showing:
- the proposed project in relation to the beach, back bluff or dunes, vegetation and other existing features
- the proposed project, the existing structure(s) that would be protected by the shoreline protective device, and the landward property line
- beach profiles for the range of landward and seaward beach movement that have been observed for this site or the general area, over time.

If the shoreline protective device changes along the shoreline, detailed cross-sections should be provided of each section.

**Engineered Plans:** The applicant should provide engineered plans of the proposed project (both as blueprints and legible 8 1/2 x 11 exhibits). These plans must have been prepared or certified by a registered engineer with expertise in shoreline processes. Normally this means a civil engineer or engineering geologist. On occasion this can be a structural engineer or soils engineer with experience in coastal engineering. Whenever local discretionary approval is required for the project (pursuant to Section 13053 of Title 14 of the California Code of Regulations) there should be evidence that the local government has approved the engineered plans. Also, there should be evidence that the plans that are submitted for the CDP application are the same as the plans that the local government approved.

The plans should show:
- the dimensions of the proposed project, with the vertical dimension referenced to NGVD or another established datum
- plan view of the proposed project, showing its relation to the beach, existing topography and adjacent structures
- detailed drawing of all transition points and edges, such as end walls, keyways, toes, connections to adjacent structures, etc.
- detailed drawings of all joints, tie backs, and drainage
- cross-section of proposed structure in relation to beach and existing topography
- plans and cross-sections of any necessary cut or fill
- other construction details
- construction notes.

If the site poses any special design constraints, they should be noted on the plans and discussed in the engineering notes or in a separate report or letter.

The engineered plans or an attached report should provide detailed information on the engineering design considerations, including, but not limited to:
- design constraints, including constraints posed by up and down coast properties

\(^{14}\) All cross-sections should be referenced to the National Geodetic Vertical Datum NGVD, or other established vertical datum.
- design still water level, included anticipated level over the life of the structure, due to sea level rise and global warming, and methodology used to establish this water level
- design wave height and methodology used to establish this height
- design scour depth
- storm event used in design scenario\(^\text{15}\)
- consequences of overtopping and event (or frequency) which could cause overtopping
- erosion rates with the proposed project, at the back beach and from subaerial processes, if these differ
- design life of proposed project
- maintenance requirements to achieve design life (types of activities and either frequency of maintenance or storm events which could trigger maintenance)
- changes to sand supply and littoral processes from proposed project
- possible end effects and efforts to minimize such effects
- total height of bluff or back beach, and height of protection
- length (or shoreline length) of protection
- seaward encroachment of protection.

**Regional Location Map:** The applicant should provide a regional map that shows the site. Copies of a Thomas Brothers map or USGS Quad sheet can often provide this. In addition, the applicant should provide a map or plan of the general area near the proposed project that shows any existing shoreline protection projects that are near or at the proposed project site and any development stringline. The regional map should also show the proposed project site, in relation to any identified areas of regional significance, public park lands, public beach access, special geologic features, etc.

**Construction Area:** The applicant should provide a map or site plan which shows all the areas, on and off-site, to be affected temporarily or permanently by construction activity, including but not limited to: staging areas, access roads, equipment and materials storage areas, coffer dams, dewatering devices, equipment washout areas, etc.

All of the above mentioned plans, maps and cross-sections should be prepared and provided at scales sufficient to allow staff and the Commission to identify details of the proposal both in map or blueprint format, for use in project review, and in 8-1/2” x 11” format for use in creating exhibits for the staff report. In limited cases, the 8-1/2 x 11” scale may be sufficient to illustrate specific aspects of the proposed project.

\(^{15}\) Normally, permanent shoreline protection is designed to withstand a 100-year storm, or a storm equivalent to the storms that occurred in 1982/83. If a lesser standard is used, the engineer should explain why a lesser standard is proposed and note the design changes that would be necessary to withstand a 100-year storm event. Information on the design conditions is needed to evaluate structural stability, as required by Coastal Act Section 30253.
3. **Project need, risks posed by the no action alternative and alternatives analysis**

*Instructions on Use:* The Coastal Commission is required to approve a shoreline protection device if it is required to serve coastal dependent uses or to protect an existing structure or public beach in danger from erosion and there are no other feasible alternatives, pursuant to Section 30235 of the California Coastal Act. A critical review step for any proposed shoreline protective device is determining why shoreline protection is needed. For most proposed shoreline protection projects the analyst must determine (1) is there an existing structure; (2) is the existing structure in danger from erosion; (3) will the proposed project protect the existing structure; and (4) is the proposed project the least environmentally damaging alternative to protect the existing structure. The “No Project” alternative can often provide information on whether or not there is an existing structure in danger from erosion. Analysis of all feasible alternatives will provide the analyst with information on the different feasible protection options. An analyst can combine and analyze this information with information on the project site and the proposed project to determine whether it meets the requirements of Coastal Act.

In the review of any shoreline protection project, the Coastal Act and the California Environmental Quality Act require that the Commission examine whether there are feasible alternatives to the proposed project that would be less environmentally damaging or that would have less impact on local sand supply. The applicant should be required to submit an environmental analysis of alternatives. This is necessary in the evaluation of consistency with Chapter 3 policies and in formulation of required findings with regard to the California Environmental Quality Act. The analyst must know the impacts that could result from the different alternatives and be able to identify which alternative is the least environmentally damaging.

Applicants should provide a thorough discussion of the need for the project, prepared by a licensed engineer, engineering geologist, geologist or other professional who is familiar with the applicant’s site and who can discuss knowledgeably the need for the proposed project. The discussion on project need should include, but not be limited to, such information as:

- whether the shoreline protection is to protect or enhance a public beach in danger from erosion
- what evidence exists of active erosion at the site or need for shoreline protection
- what is the approximate rate of erosion and/or bluff retreat occurring at the site
- what particular structures, facilities or recreational activities are threatened by the shoreline erosion occurring at the site
- whether the shoreline protection project can be expected to reduce or eliminate the immediate threat.

The coastal development permit application also should provide a written analysis of the environmental impacts of the proposed project and alternatives to the proposed project. The analysis should have sufficient information on the impacts from various feasible options to
demonstrate that the proposed project is the least environmentally damaging feasible alternative. Potential adverse impacts to coastal resources, public access and recreation should be identified. Measures to mitigate these adverse impacts should be proposed.

4. **Engineering Geologic Information and Coastal Process Information**

_Instructions on Use:_ To be effective, the design of a shoreline protective device must take into account a variety of site specific geologic and engineering factors. Shoreline protective devices that have not been engineered for the site conditions are often not the least environmentally damaging option. They also are more likely to fail, require frequent maintenance, or require the placement of more rock or other structural fill along the shoreline to repair the device. All these activities usually result in greater adverse impacts to coastal resources and loss of public access through increased encroachment onto a beach.

The level of information from an engineering geologic report will depend greatly on the specific site conditions. Used in conjunction with information on coastal processes, these reports provide a technical basis for determining project need, identifying feasible alternatives, and determining the risks and possible impacts posed by the proposed project and other alternatives. Engineering geologic reports for shoreline protective devices often provide more information than reports prepared for other kinds of development that the Commission reviews because a great deal of information about the coastal processes affecting the project site must be collected for use in designing the shoreline protective device.

Construction of shoreline protection structures may modify the intensity or nature of wave energy and other shoreline erosive forces affecting property adjoining the site where the protective device is constructed. Therefore, the permit application should provide detailed information on coastal processes which will enable the analyst to determine the impacts the proposed project and the feasible alternatives could have on adjoining public and private properties and on the local sand supply.

Seasonal profiles of the beach are usually needed because beaches can vary greatly between winter and summer, or more specifically between the storm season and the more mild periods of the year. On some beaches, beach width can vary by more than one hundred feet between these two conditions. A proposed project that would seem to be far back from wave attack during the “summer” may be hit routinely by waves during the “winter” period. The different beach profiles (during a period when the beach is wide and during a period when the beach is more narrow) can provide the analyst with important information about seasonal shoreline change, show why shoreline protection may be needed on a wide beach and provide an indication of the boundary between public tidelands and private property.

The applicant should provide an Engineering Geologic Report on the project site. The Report should be prepared by a registered professional geologist or engineering geologist and should
meet the professional standards outlined in the Guidelines for Engineering Geologic Reports, or other comparable standard.

For small shoreline protection projects (such as adding 500 cubic yards of rock to the existing footprint of a riprap revetment) or if a prior professional investigation has been done of the site, a short report and update addressing current site conditions may be acceptable. The Engineering Geologic Report should provide technical information relating to project need, feasible alternatives, the possible physical risks and impacts posed by the proposed project and other alternatives, and any site specific conditions which should be addressed in the engineering project design. For coastal bluffs, the engineering geologic report should also include an analysis of stability of the existing coastal bluff, stability for the proposed project and, stability for all feasible alternatives.

The applicant should provide coastal process information for the proposed project site, or for identified areas close to the project site. The following information should be provided, along with any additional information that helps to describe the site and the existing coastal situation:

- normal and maximum tidal ranges
- storm surge and anticipated long-term changes in sea level
- maximum expected wave height
- "summer" and "winter" beach profiles (discussed in more detail below)
- erosion rates for the existing site, both at the back beach and upper bluff, if available
- type and frequency of storms which have caused shoreline retreat historically
- conditions leading to subaerial erosion historically
- identification of offshore features affecting the site (island sheltering, canyons, etc.)
- identification of the littoral cell, key sand sources and sinks which dominant the cell, and historic contribution of project site to littoral sand supply
- volume of sand required to establish a square foot of beach in the vicinity of the project
- potential for scour and probable scour depth
- end effects from any shoreline protection which exists near the project site
- discussion of how wave energy, the littoral currents, and other coastal forces may be modified by the proposed protection project
- the extent to which the adjoining shoreline areas have been modified by shoreline protection or shoreline protective devices.
- plot showing all historic shoreline surveys, with dates of surveys and references
- site drainage and proposed drainage modifications.

**Seasonal Profiles:** The applicant should provide at least two seasonal profiles of the proposed project site, showing beach conditions during both a mild wave period and during a high wave energy period (often referred to as summer and winter profiles). Profiles should be superimposed
on the cross section for the proposed project (see Item #2). The profiles should be prepared in both blueprint format and 8-1/2” x 11” format for use in creating exhibits for the staff report.

The survey information used to develop the profiles should be noted on the profile, along with any assumptions that were made while developing the profiles. If there is no information on a true “winter” profile, this profile may be extrapolated from available site information, provided the methodology is identified and all assumptions are provided in writing.

Plans and profiles must be prepared or certified by a registered professional engineer with expertise in coastal processes. Normally this means a civil engineer or engineering geologist. On occasion, this can be a structural engineer or soils engineer with experience in coastal engineering.

5. **Written determination from State Lands Commission**

(NOTE: SLC JURISDICTION IS AFFECTED BY RECENT COURT DECISIONS, AND THE COASTAL COMMISSION AND SLC HAVE BEEN MEETING TO DETERMINE THE PROCESS FOR COORDINATION BETWEEN THE TWO AGENCIES WHEN PROPOSED PROJECTS MAY INVOLVE SLC JURISDICTION. THIS GUIDANCE WILL BE REVISED ONCE THIS PROCESS HAS BEEN IDENTIFIED.)

*Instruction on Use:* The State Lands Commission (SLC) has responsibility for all state tidelands, trust lands, and sovereign lands. A proposed project may be in an area subject to SLC jurisdiction if:

- the area is seaward of any surveyed mean high tide line
- the area is near any surveyed mean high tide line
- the area is, or has been, subject to wave uprush or inundation
- the area is delineated on the Commission’s “red line” maps
- there is reason to expect the area will be seaward of the mean high tide line during the life of the structure
- the areas is seaward of a public easement that has been accepted by SLC.

If a proposed project is in an area that may be subject to SLC jurisdiction, the application cannot be filed without evidence that the SLC has made a determination as to its jurisdiction over the project. The SLC may also determine that a lease, permit, or other form of approval is required for the project. Such approval may be necessary before the applicant can begin work. In such cases, staff will need to decide on a case-by-case basis whether to file the CDP application before such approval has been obtained. Among the factors the analyst should consider are (1) the degree of uncertainty with regard to whether the SLC would grant the approval and (2) the preferences of the staff of the SLC. The analyst should coordinate early on with the Commission’s mapping program in the Technical Services Unit, SLC staff and Commission legal staff on this issue.

The State Lands Commission (SLC) has responsibility for all state tidelands, trust lands, and sovereign lands. If a project includes development within the area seaward of the mean high tide line or the area delineated on the post-certification permit and appeals maps as Commission
permit jurisdiction, an application cannot be filed until the applicant provides evidence that the SLC has reviewed its jurisdiction over the proposed project. Normally, the SLC will make one of the following determinations:

- the development encroaches onto sovereign lands and/or lands that are subject to the public easement that inheres in navigable waters and an SLC lease, permit, or other form of approval is required.
- the development does not encroach onto sovereign lands and/or lands subject to the public easement that inheres in navigable waters.
- State Lands chooses not to make a determination at this time as to whether the development encroaches onto sovereign lands and/or lands subject to the public trust easement and does not object to the Coastal Commission acting on the coastal development permit without such a determination from State Lands.

If the SLC determines that a lease, permit and other form of approval is required, the applicant may be required to obtain this approval before the application for the proposed project can be accepted for filing.

The SLC charges a fee for making this determination, not to exceed its actual cost. Applicants should contact:

State Lands Commission
Coastal Development Project Coordinator
100 Howe Avenue, Suite 100 South
Sacramento, CA 95825-8202
(916) 574-1900

6. Other Agency Approvals

Instructions on Use: Projects involving shoreline protective devices often require the approval by a variety of state and federal agencies. Coordination with these other approving agencies on the project will help ensure that the Commission's requirements for the project are as consistent as possible with those of the other reviewing agencies and reduce processing time for the applicant.

The Commission’s regulations do not require that coastal development permit applications include each of the federal permits that are required for the proposed project. This is practical because federal permits for a project that affects the coastal zone cannot be issued until the federal agency has complied with the consistency certification requirements of the Coastal Zone Management Act. On the other hand, the regulations do provide that preliminary approval of state and local agencies that are required to approve the proposed project be included in the coastal development permit application (although there are certain exceptions). However, Commission staff does not have the authority to require an applicant to obtain the approval of another state or local agency if that other agency does not have the authority to issue such an
approval. If that other agency can review and comment on the proposed project, staff can request such comments. It will help in preparing the Commission staff’s recommendation and will avoid redundancy if the analyst can obtain as much information as possible about what specific requirements and findings these other agencies will make.

The applicant should provide, for each of the following agencies: (1) a copy of any application for approval submitted to the agency, (2) information about the status of each required application, (3) written comments resulting from any review which has been completed on the project, and (4) a copy of any permit already obtained:

- US Army Corps of Engineers
- US Fish and Wildlife Service
- National Marine Fisheries Service
- California Department of Fish and Game
- California Department of Parks and Recreation
- State Lands Commission (repeated as Item #5)
- State or Regional Water Quality Control Board.

7. **Effects on Public Access and Recreation**

*Instructions on Use:* The Coastal Act requires that public access to and along the coast be protected and enhanced. If the proposed shoreline protection project will encroach onto or near public beach areas, it could result in the need for temporary or permanent closures, or reduced hours of operation of the beach or any associated public facility. Therefore, information concerning how the project will be constructed will be needed to determine potential adverse impacts to public access and recreation.

The applicant should provide the following information:

- location of nearest vertical access points, up and down coast
- location of any lateral access between nearest up and down coast access points
- graphic depiction of proposed shoreline protection project on a current beach profile(s)
- discussion or evaluation of the effects of the proposed shoreline protection project upon the public's ability to walk the shoreline, as well as impact of the project upon recreational use of the beach and near shore during the entire year.

8. **Monitoring Plan**

In many cases, it may be necessary to monitor the effectiveness of and level of effects from proposed shoreline protection projects. For any given project, staff should work with the applicant to develop the components of a monitoring plan. A special condition may need to be attached to the permit requiring the submittal of a final monitoring plan meeting certain specified standards. In cases where monitoring appears necessary, the applicant should be requested to provide a preliminary plan for monitoring the effectiveness of the proposed shoreline protection and the need for maintenance. This will alert the applicant early to the need

If there is reason to believe that the proposed project, if built, should be monitored, the applicant should provide a preliminary monitoring plan that would include:

- objectives listing the specific aspects or effects of the proposed project to be monitored
- success standards to evaluate the performance of the proposed project
- monitoring techniques and schedule
- reporting techniques and schedule
- expertise and professional qualifications for persons performing the monitoring.

Very often, for shoreline protection projects, monitoring is used to identify when various maintenance activities should occur. This type of monitoring is very useful. If the applicant proposes to include long-term maintenance as part of the proposed project, the applicant must provide the analyst with details of the monitoring plan, triggers for maintenance as well as details about how, where, and when the maintenance will be undertaken.

9. **Other Requested Information — Not necessary for all projects**

Based on the specifics of the proposed project, the analyst may identify special coastal resources that may be affected by the proposed shoreline protection project. The following are some of the special cases that may arise and some general guidance for the types of information that may be useful for determining the effects from these projects. It is not expected that every proposed shoreline protection project will raise these concerns; thus, the following information may not need to be singled out for every project. The analyst should identify whether the proposed project presents the need for any of this information when application is being reviewed for filing.

9.A. **Effects on Sensitive Marine and Shoreline Habitat**

Depending on the location, shoreline protection can destroy environmentally sensitive habitat area such as salt marsh vegetation, riparian habitat, wetlands, and offshore reefs by directly covering over the habitat and disturbing sensitive areas to create construction access roads and staging areas. The Coastal Act requires that sensitive habitat be protected against the impacts of development. To determine the effects of the proposed development on environmentally sensitive habitat areas and evaluate the project’s conformance to the Coastal Act, detailed biological information should be provided when such impacts may be expected to occur.

The applicant should provide a Biological Impact Analysis prepared by a qualified professional, containing the following information:

- a biological survey of the habitats found at the project site and in nearby areas prepared by a biologist that includes a map of habitat areas, a narrative description of the habitat
types, a list of species present, and a quantification of the amount and density of habitat and species types
- a discussion or evaluation of the impacts of the construction and maintenance of the proposed shoreline protection project on the habitat areas identified in the biological survey
- a mitigation plan
- professional qualifications of the biological experts who prepared the plan and who will implement the proposed mitigation.

9.B. Visual Impacts Information

Shoreline protection projects can sometimes dramatically change the appearance of a shoreline area. The Coastal Act requires that new development protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural landforms, and to be visually compatible with the character of surrounding areas. Therefore, to analyze the visual impacts of a proposed project, the applicant should provide a visual impact analysis.

The applicant should provide a visual analysis of the area that includes the following:
- a map showing sight lines to the project site from any nearby public recreation areas and/or vista points/overlooks of high scenic and public interest, which will illustrate the project’s visibility from those locations
- a description of the temporary visual impacts of the project during construction indicating the location and extent of all areas to be cleared or graded for the proposed protective work, construction access roads, staging areas, and coffer dams, and other related improvements, the appearance and relative visibility of any stockpiles, staging areas, etc.
- the construction schedule and anticipated length of time that the temporary visual impacts from construction will occur
- samples that show the color and texture of the permanent shoreline structures and any drainage devices that will visible
- a narrative analysis of the permanent visual impact of the proposed project in light of Coastal Act concerns for protecting public views, minimizing landform alteration, and keeping new development visually compatible with the character of the surrounding area.

9.C. Effects of Shoreline Protection Project on Dunes

A shoreline protection project in or near sand dunes can alter the dynamics of the dune system and cause erosion and/or migration of the dunes. Sand dunes often support rare plants and provide important habitat for various kinds of wildlife. The dunes also provide an important buttress against shoreline erosion and can be a recreational resource. Therefore, in those cases where shoreline protection projects are proposed in or near sand dunes, the applicant should provide an analysis of what impact the proposed shoreline protection project would have on the dynamics of the dune system.
The applicant should provide an analysis of the possible impacts to dunes, including:

- a map of the proposed project in relation to the dune complex around the site
- an analysis of how wave energy, currents, wind and other forces that shape the existing dune complex would be altered and what the resulting effects on the dunes would be
- description of any proposed landscaping and analysis of the interaction of the landscaping plants with native dune vegetation.

9.D. Construction Description, with maps

For large projects, it may be appropriate to provide separate, more detailed information concerning the construction phase. Information on construction would cover the construction techniques, necessary equipment, and locations of all staging areas and access routes, schedules for work, etc. This information is necessary to enable the analyst to determine the temporary and long-term effects of the proposed construction on access, recreation, environmentally sensitive habitat areas, blue line streams, offshore reefs, and other coastal resources. Since many of the potentially adverse effects from shoreline protection projects can occur during construction, details about construction activities are very important for shoreline protection projects. Furthermore, since many adverse effects may be avoided by only working during certain times of year, it is important to know when various activities will occur and whether there is any flexibility in the schedule.

The applicant should provide information on the construction activities, covering all aspects of the proposed project. The discussion should identify:

- types of mechanized equipment which will be on the beach
- anticipated noise levels during different phases of construction
- plans for placing material on the beach or in the near shore, including stockpiling plans
- access plans
- staging areas
- maps or plans showing all areas to be used for construction activities (in blueprint format if available (for project review) and in reduced 8-1/2" x 11" format (for use as exhibits for the staff report))
- maps of any areas which will have temporary or permanent access restrictions
- schedule of all construction activities, including anticipated starting dates, duration and indications if there is any flexibility in each activity
- timing for all activities (e.g. 8 AM to 5 PM work day; 12 hours a day; 24 hours a day; Monday through Friday; just weekends; every day; etc. and indications if there is any flexibility in each activity).

Not all projects will need a separate filing submittal for construction. If few effects are anticipated from construction or if the construction phase of the project will be very brief, information on construction may be provided with the project description, site maps and engineered plans, rather than as a separate construction description submittal.
4.3 ASSESSMENT OF NEED

Using the information submitted as part of the permit application, the analyst should assess the specific site conditions which have led the applicant to request a permit for the proposed form of shoreline protection and determine whether the Coastal Commission is required to approve the proposed protection pursuant to Section 30235 of the Coastal Act which states:

Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fish kills should be phased out or upgraded where feasible.

The policy requires approval of shoreline altering devices when required to serve coastal dependent uses or to protect existing structures or public beaches in danger from erosion. This document provides procedural guidance in review of permit applications for shoreline protective devices to protect existing structures; therefore, reference to coastal dependent uses and public beaches will be omitted in the following discussion.

The analyst should recommend a conditional approval of a shoreline protective device under Section 30235 if:

1) there is an existing structure to be protected;
2) the existing structure is in danger from erosion;
3) shoreline altering construction is required to protect the existing threatened structure;
4) there is no less environmentally damaging feasible alternative; and,
5) the required protection is designed to eliminate or mitigate the adverse impacts on shoreline sand supply.

1. Is There an Existing Structure?

The Coastal Act Section 30235 acknowledges that seawalls, revetments, cliff retaining walls, groins and other such structural or “hard” solutions alter natural shoreline processes. Thus, such devices are required to be approved only when necessary to protect existing structures. The Coastal Act does not require the Commission to approve shoreline altering devices to protect vacant land or in connection with construction of new development. A shoreline protective device proposed in those situations is likely to be inconsistent with various other Coastal Act
policies. For example, Section 30253 addresses new development and requires that it be sited and designed to avoid the need for protective devices that would substantially alter natural landforms along bluffs and cliffs.

Additionally, the Commission has often times interpreted Section 30235 to require the Commission to approve shoreline protection for existing principal structures only. The Commission must always consider the specifics of each individual project but has found, in many instances, that accessory structures such as patios, decks and stairways are not required to be protected under Section 30235. In reaching these conclusions, the Commission has considered whether the accessory structure represents a substantial economic investment. Clearly, the impacts to significant coastal resources and the public beach would typically be far less if accessory structures were relocated or removed from harm’s way, rather than protected in place by a shoreline protective device. Further, relocation or removal of accessory structures is both feasible and less environmentally damaging than constructing a shoreline protective device, and, thus, relocation or removal meets the requirements of the California Environmental Quality Act.

The age of the existing principal structure should also be determined. Age of the structure may be a factor if the applicant wishes to consider the economic feasibility of removing a portion of an older home as an alternative to a seawall, to avoid the alteration of the natural landform and adverse impacts to the beach.

2. **Is the Structure in Danger from Erosion?**

The next step in reviewing and analyzing an application for a shoreline protective device is to determine if there is a reasonable danger from erosion to the structure which would support a need for shoreline altering devices described in Section 30235. A major tool to help analysts determine whether an existing structure is in danger will be information on shoreline processes and potential bluff failure contained in an Engineering Geologic Report. There are many uses for an Engineering Geologic Report, i.e. to help locate a stable site for a new structure; to establish a safe bluff setback; to determine locations for a septic system; to develop foundation criteria; to determine site preparation, etc. The analyst should review the technical submittals prior to filing the permit application to assure the necessary information is provided to determine whether there is a potential threat to the existing structure.

The Engineering Geologic Report should provide a complete analysis of the entire site; not just of the area occupied by the proposed structure. It should also be based on a recent topographic survey of the entire site and the adjacent beach. The Report should provide an objective analysis of the existing site conditions and the need for protection of existing development, including a thorough analysis of both structural and non-structural protection options. There should be an analysis of the potential impacts associated with the proposed design, and alternatives that might be feasible to avoid or reduce the effects of the project. The analyst should refer to the section in this document addressing filing requirements for more detail on information required to file the permit application.
The determination of whether an existing structure is in danger from erosion can be based on a variety of factors including, but not necessarily limited to, the following:

- the existing beach or bluff setback and predicted erosion rate
- the location of the intersection of the projected failure plane and the bluff top
- the angle of repose of the upper bluff and whether there is sufficient distance for the upper bluff to lay back without threatening the existing residence
- the geologist’s estimate of when the residence would be undermined or otherwise damaged
- the foundation of the structure to be protected
- estimated wave run-up.

If there is any question about the adequacy of this information or the determination that the existing structure is in danger from erosion, the submitted information should be reviewed by the Commission’s technical expert prior to filing the application. The analyst should also consider conditions surrounding the site and whether armoring is an established response to erosion along this stretch of shoreline. The analyst should research permit actions on surrounding properties to determine what the Commission has accepted as “in danger” in the past. This will let the analyst determine whether the situation that exists on the subject site is similar to projects that the Commission has approved, or whether a new precedent will be established by approval. Due to the dynamic nature of the shoreline and its potential for hazard, it is necessary for the analyst to know the difference between a dangerous situation, and the inherent risk (but not immediate danger) associated with development along a shoreline.

If there is no evidence that any structure is in danger from erosion or might be threatened in the near future, the Commission is not required to approve a shoreline protective device pursuant to Section 30235. In some cases, the proposed shoreline protective device is intended to prevent continuing erosion even though the existing principal structure is not actually “in danger”.

Again, in those cases, the Commission is not required to approve a shoreline protective device and approval may be inconsistent with other Chapter 3 policies that address visual quality of coastal areas, minimization of landform alteration and protection of public access and recreational opportunities. Also, there may be alternatives available which will reduce the potential future threat without involving structural solutions and their associated landform alteration and beach impacts.

The analyst may find, in consultation with the staff technical experts, that the existing principal structure is not in danger from erosion and it is possible to avoid the significant adverse effects associated with the proposed project. In such cases, staff can recommend denial of the project and identify non-structural alternatives that have less impact to the natural landform and adjacent beach. It would be advantageous for the analyst to identify any alternatives that, if implemented by the property owner, would increase the stability of the site and/or existing structure, minimize risk and avoid the need for armoring in the future. Such alternatives may include, but are not necessarily limited to, groundwater and surface water control, landscaping, removal of accessory
structures or seaward portions of the existing structure, relocation of the structure, underpinning the structure, etc. In some cases, the analyst may recommend approval of such alternatives through conditions of approval of the subject permit, if sufficient information is available to assess the impacts associated with the approvable alternative, and the conditions and alternatives are acceptable to the applicant.

If the analyst, in consultation with the staff technical experts, determines that the existing principal structure is in danger from erosion, the analyst should then question:

3. **Is the Proposed Protective Device Required for Protection from Erosion or can Other Options Protect the Existing Principal Structure?**

   **Is the Proposed Protective Device the Least Environmentally Damaging Alternative to Provide the Necessary Protection?**

If the determination has been made that there is an existing structure in danger from erosion, the Commission is required to approve protection pursuant to Section 30235. However, in review of armoring as the proposed response to shoreline erosion in the area, the analyst should consider whether there are other more preferable alternatives to the armoring that could remove or avoid the risk and provide the necessary protection. For example, alternatives in this instance may include, but are not necessarily limited to, groundwater and surface water control, landscaping, removal of accessory structures, underpinning the structure, etc.

At this point in the review process, the analyst should assess the impacts associated with the project as proposed and consider any alternatives which would avoid the identified significant impacts and provide the required protection. If such alternatives exist, the staff can recommend denial of the project as proposed and identify the feasible alternative which provides protection, is less environmentally damaging and is more consistent with Chapter 3 policies. It may also be possible to approve a feasible alternative through conditions of approval of the subject permit, if sufficient information is available to assess the impacts associated with the approvable alternative, and the conditions and alternative are acceptable to the applicant.

If the analyst determines there are no feasible alternatives to a shoreline altering device described in Section 30235, the analyst should again assess the impacts associated with the project and determine whether any design alternatives would lessen or avoid the identified significant adverse impacts associated with the structural device. Considering all the resources addressed by the Coastal Act, such as visual quality, landform alteration, beach encroachment, effects on shoreline access, impacts to sensitive resources, etc., the analyst should determine whether the proposed project represents the least environmentally damaging feasible alternative. Design elements which could be modified to lessen or avoid the adverse effects on public access or visual quality include, but are not limited to, the height, width, location or type of structure. If beach access is a concern, it is usually important to site the protective structure as far landward as possible. This will minimize current encroachment on to the beach and reduce long-term
beach loss as the shoreline continues to erode. It is also sometimes possible to design the protective device to facilitate lateral access either on top or inland of the structure. Another potential design alternative to reduce impacts to access and sand supply is to redesign the project from a revetment to a vertical seawall to reduce beach encroachment and, thus, impacts to public access and beach use.

Other measures, such as groundwater and/or surface water control, landscaping and removal of accessory structures, when approved in concert with a structural device, can serve to lessen the impacts of the project, reduce future risk, increase stability and potentially avoid additional protective devices in the future. In accordance with Section 30253, when reviewing new development such as a shoreline protective device, the Commission must minimize risk to the development. Section 30253 provides the need to assess the overall site stability to determine whether the device is an effective stable response to ongoing erosion. Section 30253 also requires consideration of whether or not the structure will create or contribute to erosion or destruction of the site or surrounding area and require construction of additional protective measures in the future. Measures such as those mentioned above, when approved in concert with a structural device, could reduce future risk and would also be consistent with Sections 30240, 30251 and the public access and recreation policies of the Coastal Act.

4. Is the Proposed Protection Designed to Eliminate or Mitigate the Adverse Impacts on Shoreline Sand Supply?

Pursuant to Section 30235, if the Commission is required to approve the shoreline altering device, the analyst should require the impacts on shoreline sand supply be eliminated or mitigated through the project design or through conditions of approval. Proposals for shoreline protection must be reviewed for all the concerns and issues addressed in the Coastal Act. However, due to their necessary proximity to the ocean and their potential to alter coastal processes, beach access, recreation and sand supply, much of the analysis of shoreline protection focuses on these concerns.

Section 3 of this document contains a description of some of the impacts to shoreline processes and sand supply associated with various designs of shoreline protection. The impacts include, but are not necessarily limited to, encroachment onto the beach, scour effects, end effects, retention of potential beach material, fixing the back of the beach and landform alteration. Section 3 of this document discusses these effects in detail. Some of the impacts, such as scour and end effects, are short-term effects and can be reduced by design and by appropriate maintenance after storms. The other impacts are cumulative and long-term because they address the effect of the shoreline protective device on the width of the beach seaward of the structure over time. It is these long-term impacts of armoring that are potentially the most harmful to the public’s use of the beach in the future because, while the private property is being protected by armoring, the public beach continues to erode. If protective devices, either directly or cumulatively, result in less sandy beach area available for general public use over the long term, that is an adverse impact on public access and recreation.
Because of the migratory nature of the mean high tide line, it may not be possible to separate impacts to State tidelands (i.e., typically the area seaward of the mean high tide line) from impacts to the beach and shoreline landward of the mean high tide line. Over the long-term, the entire area seaward of the shoreline protective device is likely to be affected. As discussed in the following sections, armoring the shoreline or “fixing the back of the beach” stabilizes the seaward limit of the private property, but does nothing to halt the loss of public property or beach area seaward of the structure if erosion continues through natural shoreline processes. For a greater understanding of the dynamics of the beach and nearshore environment, the analyst should refer to the bibliographic database on coastal erosion/hazards located in the headquarters and district offices.

An analyst should determine whether the proposed structure will be located on State tidelands, and if not, whether it will affect access to State tidelands over the long-term due to its effects on current access patterns or natural shoreline processes that create and maintain sandy beaches. In accordance with the Coastal Act, impacts to public beach access or shoreline sand supplies should be identified and mitigated regardless of whether the beach is in public or private ownership. Section 30240 requires that development adjacent to parks and recreation areas be sited and designed to prevent impacts which would significantly degrade those areas, and be compatible with the continuance of those habitat and recreation areas. Section 30235 requires that any construction that alters natural shoreline processes be designed to eliminate or mitigate adverse effects on shoreline sand supply.

Mitigation measures which may address impacts to sand supply include, but are not limited to:
(1) lateral access dedication where the beach is currently in private ownership and there is no existing prescriptive use or lateral access easement; (2) beach augmentation seaward of the approved protective device; (3) beach nourishment within the same littoral cell at a location which retains sand; (4) installation of public access improvements as part of the proposed project; (5) and/or contribution to public access improvements, beach nourishment and/or beach maintenance through an in-lieu fee or user fee program. The following sections discuss the impacts to public access and sand supply in greater detail and suggest mitigation measures through sample conditions of approval of shoreline protection.

**Emergency Situation**

In some instances, particularly during extreme high tide events and/or storm events, a property owner may request authorization to respond to an imminent threat and to act faster than the regular permit process allows. Section 30624 of the Coastal Act provides for issuance of coastal development permits by the Executive Director of the Coastal Commission (hereafter referred to as the Executive Director), in cases of emergency, which are called emergency permits. Emergency is defined in Section 13009 of the Commission’s code of regulations as a “sudden, unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property or essential public services”. Sections 13136–13144 of the Commission’s
regulations describe the processing of emergency permits, from method of application, to criteria for granting the permit, and report of the Executive Director’s action to the Commission.

The regulations state:

The Executive Director may grant an emergency permit upon reasonable terms and conditions, including an expiration date and the necessity for a regular permit application later, if the Executive Director finds that (a) an emergency exists and requires action more quickly than permitted by the procedures for administrative permits, or for ordinary permits, and the development can and will be completed within 30 days, unless otherwise specified by the terms of the permit; (b) public comment on the proposed emergency action has been reviewed if time allows; and (c) the work proposed would be consistent with the requirements of the Coastal Act.

The Executive Director has approved emergency permits with the condition that the permittee apply for a coastal development permit pursuant to all required procedures once the emergency has been controlled. Thus, development pursuant to an emergency permit is usually considered to be a temporary remedial measure to respond to an unexpected occurrence. In these situations, the emergency actions will reduce or eliminate the potential threat until a regular permit can be obtained for more permanent protective measures in the future.

Section 30611 of the Coastal Act allows the Executive Director to waive the requirement to obtain any permit when immediate action by a person or public agency performing a public service is required to protect life and public property from imminent danger, or to restore, repair, or maintain public works, utilities, or services destroyed, damaged, or interrupted by natural disaster, serious accident, or in other cases of emergency. This process requires notification to the Executive Director of the type and location of the work within three days of the disaster or discovery of the danger, whichever occurs first. Section 30611 does not authorize permanent erection of structures valued at more than twenty-five thousand dollars ($25,000). Section 13144 of the Commission’s regulations requires the Executive Director to report work done without a permit pursuant to Section 30611 to the Commission at the next Commission meeting. The report must include a summary of any work that does not comply with the requirements of Section 30611 and any recommendations for appropriate action.

Therefore, there are controls on the degree of emergency work that can be undertaken without any permit or pursuant to an emergency permit. The Act and regulations suggest that the emergency permit and waiver process is intended to allow for temporary remedial measures and not for major new development.
4.4 CONDITIONS TO MITIGATE UNAVOIDABLE IMPACTS FROM SHORELINE PROTECTIVE DEVICES

The Commission has imposed special conditions on permits for shoreline protective devices to mitigate impacts of such development. These special conditions have addressed impacts on sand supply, visual resources, public access, etc. These conditions have been reviewed by the Commission's legal staff and are available to all staff. If the impacts of a proposed shoreline protective device could be mitigated, the analyst should consult these special conditions.

\[17\] The sample condition language represents potential ways to mitigate impacts and should be utilized on a case by case basis, taking into consideration the site conditions and project specifics. The sample conditions are not meant to be used verbatim or in all cases.
### 4.5 ATTACHMENTS FOR REGULATORY REVIEW OF APPLICATIONS FOR SHORELINE PROTECTIVE DEVICES

#### 4.5.1 Filing Information for Shoreline Protection Projects

<table>
<thead>
<tr>
<th>QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION</th>
<th>NORMAL SUBMITTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is the project?</strong></td>
<td>Project Description&lt;br&gt;Engineered plans&lt;br&gt;Site maps&lt;br&gt;Construction description</td>
</tr>
<tr>
<td><em>(This information should be provided in the standard application submittal. It will help the analyst determine how the proposed project should be analyzed and what may be the significant issues or concerns.)</em></td>
<td></td>
</tr>
<tr>
<td><strong>What will it be?</strong></td>
<td>Project description</td>
</tr>
<tr>
<td><strong>What will it look like (size, height, length, color, texture, materials, etc.)?</strong></td>
<td>Project description&lt;br&gt;Engineered plans</td>
</tr>
<tr>
<td><strong>Where will it be located?</strong></td>
<td>Site maps</td>
</tr>
<tr>
<td><strong>How will it be built?</strong></td>
<td>Engineered plans&lt;br&gt;Construction description</td>
</tr>
<tr>
<td><strong>Will there be any staging areas, access routes, work sites, etc.? If yes, where?</strong></td>
<td>Construction description</td>
</tr>
<tr>
<td><strong>What is the existing site and region like?</strong></td>
<td>Site maps&lt;br&gt;Regional description&lt;br&gt;Engineering Geologic Report&lt;br&gt;*Access maps, and data base&lt;br&gt;*LCP</td>
</tr>
<tr>
<td><em>(This information will help identify any significant resources which either could be affected by the proposed project or which could affect the design and function of the proposed project.)</em></td>
<td></td>
</tr>
<tr>
<td><strong>What is the visual character of the area?</strong></td>
<td>Site maps&lt;br&gt;Regional description</td>
</tr>
<tr>
<td><strong>What is the geologic setting?</strong></td>
<td>Engineering Geologic Report</td>
</tr>
</tbody>
</table>
### QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Normal Submittals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there faults close to the site, and if so which ones and how far away?</td>
<td>Engineering Geologic Report</td>
</tr>
<tr>
<td>Does the site contain, or is it close to dunes, sensitive habitat, offshore reefs, blue line streams, wetlands, etc.?</td>
<td>Site maps Regional description</td>
</tr>
<tr>
<td>Does the site have, or is it close to recreational areas, vertical access and lateral access?</td>
<td>Site maps Regional description *Access maps, and data base</td>
</tr>
<tr>
<td>Is the site in or near any special communities or neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreation?</td>
<td>Regional description Site maps *LCP</td>
</tr>
</tbody>
</table>

**How will the proposed project fit with and/or change the existing site and region?**

*(At the filing stage, this would involve a general review of the proposed project as a preliminary screening. During project review, the analyst would undertake this review in greater detail. The applicant may be able to provide some input on this analysis, particularly for projects that have completed CEQA review.)*

<table>
<thead>
<tr>
<th>Question</th>
<th>Normal Submittals</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the anticipated effects on visual character?</td>
<td>Project description</td>
</tr>
<tr>
<td>What are the anticipated effects on adjacent properties?</td>
<td>Site maps Regional description</td>
</tr>
<tr>
<td>What are the anticipated effects on any identified dunes, sensitive habitat, offshore reefs, blue line streams, wetlands, etc.?</td>
<td>Regional description</td>
</tr>
<tr>
<td>What are the anticipated effects on public access or recreation?</td>
<td>Access maps and data base</td>
</tr>
<tr>
<td>Will the proposed project protect or have adverse effects on any identified special communities or neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreation?</td>
<td></td>
</tr>
<tr>
<td>QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION</td>
<td>NORMAL SUBMITTALS</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
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</tr>
<tr>
<td>Can any of these impacts be reduced or eliminated by project relocation, redesign, rescheduling, project alternatives, etc.?</td>
<td>State Lands Determination</td>
</tr>
<tr>
<td><em>(If a cursory review finds Coastal Act concerns, the analyst may be able to point these out and attempt to identify changes, at the filing stage, which could alleviate or lessen these concerns.)</em></td>
<td><em>Access data base</em></td>
</tr>
<tr>
<td>Who owns the land on which the project will be located?</td>
<td>Title information</td>
</tr>
<tr>
<td><em>(Land ownership is an important issue for projects along the shoreline; however, the boundary between public and private land is often difficult to determine. Applicants may unknowingly plan development for property that they do not own. Reasonable efforts should be made to determine the location of the public/private land boundary for each property.)</em></td>
<td>Site description</td>
</tr>
<tr>
<td></td>
<td>Coastal process information</td>
</tr>
<tr>
<td></td>
<td>Seasonal shore profiles</td>
</tr>
<tr>
<td>Has an offer to dedicate been recorded for this property?</td>
<td><em>Access data base</em></td>
</tr>
<tr>
<td></td>
<td><em>Title Information</em></td>
</tr>
<tr>
<td>Is there a written determination from State Lands Commission that determines that the land is public?</td>
<td>State Lands Determination</td>
</tr>
<tr>
<td>Has the State Lands Commission provided a definite boundary that is seaward of the proposed project?</td>
<td>State Lands Determination</td>
</tr>
<tr>
<td>Has any other public agency provided a defined boundary for this site?</td>
<td><em>Title information</em></td>
</tr>
<tr>
<td>If no boundary has been established, is there reason to believe the land may be public, based on a migratory mean high tide line?</td>
<td>Site description</td>
</tr>
<tr>
<td></td>
<td>Coastal process information</td>
</tr>
<tr>
<td>What are the seasonal profiles for the beach area, and do they show any migration of the mean high tide line landward of the proposed project?</td>
<td>Seasonal shore profiles</td>
</tr>
<tr>
<td>What is the location of the shore platform and if the beach is scoured to the platform, would the mean high tide line be landward of the proposed project?</td>
<td>Seasonal shore profiles</td>
</tr>
<tr>
<td>What is the historic extent of seasonal shoreline change?</td>
<td>Coastal process information</td>
</tr>
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<td>NORMAL SUBMITTALS</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>What other agencies have permit responsibility and have they been notified of the project?</strong></td>
<td>Other agency approvals</td>
</tr>
<tr>
<td>(Knowledge about the other agencies who are reviewing the proposed project will both let the analyst know who they can contact to discuss various resource issues and provide some assurance that the applicant has notified all necessary agencies about the project. Staff can point out possible omissions to the applicant; however, the analyst’s only responsibility is to confirm that the applicant has received all permits which the Commission needs for its review.)</td>
<td></td>
</tr>
<tr>
<td><strong>Why is the proposed project necessary?</strong></td>
<td>Site description</td>
</tr>
<tr>
<td>(Section 30235 establishes important criteria for the review and approval of shoreline protection projects. Information on why the proposed project is needed will help the analyst review the proposed project for consistency with Chapter 3 policies. For more information on this review effort, see Section **)</td>
<td>Project need</td>
</tr>
<tr>
<td>Risks from no action.</td>
<td></td>
</tr>
<tr>
<td>If the proposed project is for “revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes,” is the project required to serve coastal-dependent uses or to protect existing structures or public beach in danger from erosion?</td>
<td></td>
</tr>
<tr>
<td>(This is further elaboration of the Section 30235 criteria.)</td>
<td>Project description</td>
</tr>
<tr>
<td>Is there a coastal dependent use, and is it being served?</td>
<td>Project description</td>
</tr>
<tr>
<td>Is there an existing structure?</td>
<td>Project description</td>
</tr>
<tr>
<td>Is there a public beach?</td>
<td>Project description</td>
</tr>
<tr>
<td>For an existing structure or public beach, is there an identified “danger from erosion”?</td>
<td>Coastal process information</td>
</tr>
<tr>
<td>Engineering geologic report</td>
<td></td>
</tr>
<tr>
<td>How does this area erode?</td>
<td>Project description</td>
</tr>
<tr>
<td>For example: What are the typical erosion events like?</td>
<td>Coastal process information</td>
</tr>
<tr>
<td>What are the shoreline changes that occur?</td>
<td>Engineering geologic report</td>
</tr>
<tr>
<td>Are changes reversible (e.g. sand loss) or irreversible (e.g. bluff retreat)?</td>
<td></td>
</tr>
<tr>
<td>Is there any frequency or recurrent period to these erosion events?</td>
<td></td>
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</tbody>
</table>
## QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION

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<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>What are the historic erosion rates for the area and the site; what are the time frames for these historic rates; and what photos, reports, studies, maps, accounts, etc. were used to develop these erosion rates?</td>
<td>Project description, Coastal process information, Engineering geologic report</td>
</tr>
<tr>
<td>(This is further elaboration of the Section 30235 criteria and will help address Section 30253.)</td>
<td></td>
</tr>
<tr>
<td>Are there any special characteristics of this site that cause it to erode differently than neighboring areas?</td>
<td>Coastal process information, Engineering geologic report</td>
</tr>
<tr>
<td>What is the setback of other homes, structures, etc. in this area and what is the setback of the existing structure that needs protection from erosion?</td>
<td>Coastal process information, Engineering geologic report</td>
</tr>
<tr>
<td>How far from some danger point is the existing structure that needs protection from erosion? (The danger point could be bluff edge, wave uprush, dune edge, etc.; whatever feature is presently providing the existing structure with some protection from erosion.)</td>
<td>Coastal process information, Engineering geologic report</td>
</tr>
<tr>
<td>If no action is taken, approximately how long could the structure survive before being damaged by erosion?</td>
<td>Coastal process information, Engineering geologic report</td>
</tr>
<tr>
<td>If the proposed project is for “revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes,” and is required to serve coastal-dependent uses or to protect existing structures or public beach in danger from erosion, will it eliminate or mitigate adverse impacts on local shoreline sand supply?</td>
<td>Engineering plans, Coastal process information</td>
</tr>
<tr>
<td>(This is further elaboration of the Section 30235 criteria.)</td>
<td></td>
</tr>
<tr>
<td>Will the proposed project remove existing beach area from use by replacing an area of revetment, seawall, etc.? (Quantify the amount if possible.)</td>
<td>Engineering plans, Coastal process information</td>
</tr>
<tr>
<td>Will the proposed project interrupt or impede the long-term landward migration of the shoreline? (Quantify the amount if possible.)</td>
<td>Engineering plans, Coastal process information</td>
</tr>
<tr>
<td>Will the proposed project interrupt or impede the natural patterns of longshore sediment transport either now or in the future? (Quantify the amount if possible.)</td>
<td>Engineering plans, Coastal process information</td>
</tr>
</tbody>
</table>
**QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION**

<table>
<thead>
<tr>
<th>Question</th>
<th>Normal Submittals</th>
</tr>
</thead>
</table>
| Will the proposed project limit or prevent the introduction of backbeach material (from bluffs, dunes, beaches etc.) to the littoral zone, for use as beach material? (Quantify the amount of possible.) | Engineering plans  
Coastal process information |
| Will the proposed project have any adverse effects on nearby properties; will there be any scour or end effects from the project due to its design or location? | Engineering plans  
Coastal process information |
| What design efforts or project modifications will be made to reduce effects to nearby properties; how will the project connect to adjacent property? | Engineering plans  
Coastal process information |
| Is the proposed project new development, as defined in Section 30106 of the Act? (FOR NEW DEVELOPMENT, SECTIONS 30211, 30212 AND 30253 MUST BE CONSIDERED.) | Project description |
| If so, does it:                                                          |                                                       |
| (2) Minimize risks to life and property in areas of high geologic, flood, and fire hazard? |                                                       |
| (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural land forms along bluffs and cliffs? |                                                       |
| (THESE CONCERNS MUST BE ADDRESSED TO DETERMINE CONSISTENCY WITH SECTION 30253.) |                                                       |
| How long is the structure expected to last?                              | Engineered plans                                       |
| Will the seawall, revetment, etc. require maintenance to remain effective? | Engineered plans  
Project description |
| If maintenance will be necessary, what are the long-term actions that will be necessary to maintain the seawall, revetment, etc.? | Engineered plans  
Monitoring program |
| What will be the frequency of maintenance?                               | Engineered plans                                       |
| Are there alternatives to the proposed project which would require less extensive or less frequent maintenance? | Analysis of alternatives }
## 4.5.2 Filing Information for Repair or Maintenance of Shoreline Protection

### QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Normal Submittals</th>
</tr>
</thead>
<tbody>
<tr>
<td>What repair and maintenance is being proposed?</td>
<td>Project description</td>
</tr>
<tr>
<td>(FILING INFORMATION FOR REPAIR AND MAINTENANCE PROJECTS MAY BE AS EXTENSIVE AS FOR NEW PROJECTS, BUT SOME REPAIR AND MAINTENANCE MAY REQUIRE MUCH LESS INFORMATION. THE FINAL DECISION ABOUT FILING, AS IN NEW PROJECTS, RESTS WITH THE ANALYST.)</td>
<td></td>
</tr>
<tr>
<td>What is the project?</td>
<td>Project description</td>
</tr>
<tr>
<td>(FOR REPAIR AND MAINTENANCE THIS WOULD FOCUS ON CONSTRUCTION ACTIVITIES AND CHANGES FROM THE EXISTING STRUCTURE. THIS INFORMATION WOULD BE PROVIDED IN THE STANDARD APPLICATION SUBMITTAL. PROJECT INFORMATION WILL HELP THE ANALYST DETERMINE IF A PERMIT APPLICATION SHOULD BE PREPARED.)</td>
<td></td>
</tr>
<tr>
<td>What is it?</td>
<td>Project description</td>
</tr>
<tr>
<td>What does it look like (size, height, length, color, texture, materials, etc.) and how will it change?</td>
<td>Project description</td>
</tr>
<tr>
<td>Where is it located and will it keep the same footprint?</td>
<td>Site maps</td>
</tr>
<tr>
<td>How will repair and maintenance be undertaken?</td>
<td>Engineered plans</td>
</tr>
<tr>
<td>Will there be any staging areas, access routes, work sites, etc.? If yes, where?</td>
<td>Site maps, Maps of adjacent area, Construction plans</td>
</tr>
</tbody>
</table>

If the proposed project is for repair and maintenance, will it 1) result in an addition to or enlargement or expansion of the object of those repair or maintenance activities, or 2) involve extraordinary methods of repair and maintenance? (COASTAL ACT SECTION 30610(d) ESTABLISHES THESE CRITERIA FOR DETERMINING THE NEED FOR A COASTAL DEVELOPMENT PERMIT FOR REPAIR AND MAINTENANCE. IF THE PROPOSED PROJECT WILL NEED A PERMIT, THE ANALYST WILL NEED SUFFICIENT INFORMATION ON THE PROPOSED PROJECT TO PREPARE PRELIMINARY FINDINGS ON CONSISTENCY WITH THE COASTAL ACT. REFER TO CALIFORNIA CODE OF REGULATIONS SECTION 13252 FOR THE LIST OF EXTRAORDINARY METHODS OF REPAIR AND MAINTENANCE.)
### QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Normal Submittals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will there be substantial alteration of the foundation?</td>
<td>Project description</td>
</tr>
<tr>
<td>Will riprap, artificial berms of sand or other materials, or any other forms of solid materials be placed on the beach or in coastal waters?</td>
<td>Engineered plans</td>
</tr>
<tr>
<td>Will more than 20% of the material be replaced by material of a different kind?</td>
<td>Project description</td>
</tr>
<tr>
<td>Will there be mechanized equipment or construction materials, temporarily or permanently, on any sand area; within 50 feet of a coastal bluff; in or within 50 feet of environmentally sensitive area; or, within 20 feet of coastal waters or streams?</td>
<td>Project description, Site map, Construction plans</td>
</tr>
<tr>
<td>Will 50% or more of the structure be replaced?</td>
<td>Project description</td>
</tr>
<tr>
<td>Is the repair work for protecting transportation roadways and being undertaken by local governments, state agencies, public utilities (railroads), etc.?</td>
<td>Project description</td>
</tr>
<tr>
<td>Why is the proposed repair and maintenance activity necessary?</td>
<td>Project need</td>
</tr>
<tr>
<td>(This is a concern more for the initial construction of a seawall, revetment, etc.; however, at a general level, the analyst should have information on the continued existence of a back beach or bluff top structure and of the continued concern for danger from erosion.)</td>
<td></td>
</tr>
<tr>
<td>Was a permit issued for the initial construction or for earlier repair and maintenance?</td>
<td>Project description, * Permit Tracking Data Base</td>
</tr>
<tr>
<td>(The earlier permit action may provide a significant portion of the needed information.)</td>
<td></td>
</tr>
<tr>
<td>When was the initial development constructed?</td>
<td>Project description</td>
</tr>
<tr>
<td>Has there been previous repair and maintenance activity and if so, when?</td>
<td>Project description, * Permit Tracking Data Base</td>
</tr>
<tr>
<td>What is the existing site and region like?</td>
<td>Site map, Regional description, * Permit Tracking Data Base</td>
</tr>
<tr>
<td>(In particular, the analyst should consider whether repair and maintenance will perpetuate reliance on a type of shoreline protection which is used commonly in the region, or will perpetuate reliance on protection which has become obsolete, or found to be ineffective.)</td>
<td></td>
</tr>
</tbody>
</table>
**QUESTIONS THAT SHOULD BE ADDRESSED BY INFORMATION IN THE APPLICATION**

<table>
<thead>
<tr>
<th></th>
<th>NORMAL SUBMITTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What types of protection, if any, are used on the adjacent properties?</td>
<td>Site map</td>
</tr>
<tr>
<td>What types of protection, if any, are used throughout the region?</td>
<td>Regional description</td>
</tr>
<tr>
<td>What types of protection, in general, have been built in the region recently?</td>
<td>*Permit tracking Database</td>
</tr>
</tbody>
</table>
| If the existing protection requiring repair and maintenance activity is different than the protection in the region or on the adjacent properties, why is it preferable to continue relying on this protection rather than changing to the regional design? | Project description  
Regional description |
| Are there significant resource impacts from the existing protection that could be mitigated by changing to the regional design? | Site description |

If proposed repair and maintenance activities may have significant resource impacts during construction, are there ways to reduce the impacts from or frequency of repair and maintenance activities, while maintaining the integrity of the protection structure?

*(IF A CURSORY REVIEW FINDS COASTAL ACT CONCERNS, THE ANALYST MAY BE ABLE TO POINT THESE OUT AND ATTEMPT TO IDENTIFY CHANGES, AT THE FILING STAGE, WHICH COULD ALLEVIATE OR LESSEN THESE CONCERNS.)*

What is the expected need for and frequency of future repair and maintenance activities? | Project description |

Do any other agencies have permit responsibilities? If so, what agencies, and have they been notified of the project? | Other agency approvals |

*(KNOWLEDGE ABOUT THE OTHER AGENCIES WHO ARE REVIEWING THE PROPOSED PROJECT WILL BOTH LET THE ANALYST KNOW WHO THEY CAN CONTACT TO DISCUSS VARIOUS RESOURCE ISSUES AND PROVIDE SOME ASSURANCE THAT THE APPLICANT HAS NOTIFIED ALL NECESSARY AGENCIES ABOUT THE PROJECT. STAFF CAN POINT OUT POSSIBLE OMISSIONS TO THE APPLICANT; HOWEVER, THE ANALYST’S ONLY RESPONSIBILITY IS TO CONFIRM THAT THE APPLICANT HAS RECEIVED ALL PERMITS WHICH THE COMMISSION NEEDS FOR ITS REVIEW.)*

* All items highlighted by an * are items which should be available at the Commission offices, or the information which the analysts should be able to obtain independently from the filing submittal.
4.6 METHODOLOGY FOR QUANTIFYING SOME IMPACTS FROM SHORELINE PROTECTIVE DEVICES

The following methodology can be used to quantify impacts from revetments and vertical sea walls on encroachment, retention of potential beach material, and fixing the location of the back of the beach. This can be used in the staff analyses to compare impacts of various project options, or to establish a project specific mitigation fee in areas where an in-lieu fee beach sand mitigation program has been established.

\[ A_e = W \times E \]

\[ A_e = W \times E \]

\[ W = \text{Width of property to be armored (ft.).} \]

\[ E = \text{Encroachment by seawall, measured from the toe of the bluff or back beach to the seaward limit of the protection (ft.).} \]

\[ A_w = R \times L \times W \]

\[ A_w = R \times L \times W \]

\[ R = \text{The retreat rate which must be based on historic erosion, erosion trends, aerial photographs, land surveys, or other accepted techniques and documented by the applicant. The retreat rate should be the same as the predicted retreat rate used to estimate the need for shoreline armoring.} \]

\[ L = \text{The length of time the back beach or bluff will be fixed or the design life of armoring without maintenance (yr.) For repair and maintenance projects, the design life should be an estimate of the additional length of time the proposed maintenance will allow the seawall to remain without further repair or replacement.} \]
\[ V_b = \] Volume of sand denied the beach by the protective device is equal to the percentage of sand in the bluff material (S) times the total width of the protected property (W) times the years the structure will be in place (L) times the area between the solid and dotted lines in Figure 4-4 directly landward of the device \([R \times h_s]\), plus the area between the solid and dotted area above the device \([1/2h_u \times (R + (R_{cu} - R_{cs}))]\). Since the dimensions and retreat rates are usually given in units of feet and volume of sand is usually given in cubic yards, the total volume of sand must be divided by 27 to provide this volume in cubic yards, rather than cubic feet. This can be expressed by the following equation:

\[ V_b = (S \times W \times L) \times \left[ (R \times h_s) + \left( 1/2h_u \times (R + (R_{cu} - R_{cs})) \right) \right]/27 \]

\[ S = \] Fraction of beach quality material in the bluff material, based on analysis of bluff material to be provided by the applicant.

\[ h_s = \] Height of the seawall from the base to the top (ft).

\[ h_u = \] Height of the unprotected upper bluff, from the top of the seawall to the crest of the bluff (ft).

\[ R_{CU} = \] Predicted rate of retreat of the crest of the bluff, during the period that the seawall would be in place, assuming no seawall were installed (ft/yr). This value can be assumed to be the same as \( R \) unless the applicant provides site specific geotechnical information supporting a different value.

\[ R_{CS} = \] Predicted rate of retreat of the crest of the bluff, during the period that the seawall would be in place, assuming the seawall has been installed (ft/yr). This value will be assumed to be zero unless the applicant provides site specific geotechnical information supporting a different value.

\[ V_t = \] Total volume of sand required to replace losses due to the structure, through reduction in material from the bluff, and conversion of the reduction in nearshore area and loss of available beach area to the volume of sand necessary to replace this area (cubic yards).
\[ V_t = V_b + V_e + V_w \]

\[ V_e = \text{Volume of sand to rebuild the area of beach lost due to encroachment by the seawall; based on the seawall design and beach and nearshore profiles (cubic yards).} \]

\[ V_e = A_e x v \]

\[ v = \text{Volume of material required, per unit width of beach, to replace or reestablish one foot of beach seaward of the seawall; based on the vertical distance from the top of the beach berm to the seaward limit of reversible sediment movement (cubic yards/ft of width and ft. of retreat). The value of } v \text{ is often taken to be 1 cubic yard per square foot of beach. If a vertical distance of 40 feet is used for the range of reversible sediment movement, } v \text{ would have a value of 1.5 cubic yards/square foot (40 feet x 1 foot x 1 foot / 27 cubic feet per cubic yard). If the vertical distance for reversible sand movement is less than 40 feet, the value of } v \text{ would be less than 1.5 cubic yards per square foot. The value of } v \text{ will vary from one coastal region to another, but should not vary from lot to lot.}^{18} \]

\[ V_w = \text{Volume of sand to rebuild the area of beach lost due to long-term erosion (Vw) of the beach and near-shore, resulting from stabilization of the bluff face and prevention of landward migration of the beach profile; based on the long-term regional bluff retreat rate, and beach and nearshore profiles (cubic yards).} \]

\[ V_w = A_w x v \]

\[ M = V_t x C \]

\[ C = \text{Cost, per cubic yard of sand, of purchasing and transporting beach quality material to the project vicinity ($ per cubic yard). Derived from the average of three written estimates from sand supply companies within the project vicinity that would be capable of transporting beach quality material to the subject beach, and placing it on the beach or in the near shore area.} \]

\(^{18}\text{A value of 0.9 cubic yards per square foot has been suggested for the Oceanside Littoral Cell (Oceanside Littoral Cell Preliminary Sediment Budget Report, December 1997, prepared as part of the Coast of California Storm and Tide Wave Study); a value of 0.4 cubic yards per square foot has been suggested for the Mission Bay Cell (State of the Coast Report: San Diego Region, September 1991).} \]
5.0 PLANNING APPROACHES FOR RESPONDING TO BEACH EROSION

This chapter provides guidance on how Local Coastal Programs (LCPs) can plan for new development in a way that reduces the need for shoreline protection, minimizes adverse impacts of shoreline protection that is allowed and facilitates alternative forms of shoreline protection that do not involve armoring. This guidance will be useful to Commission staff who are evaluating LCPs for consistency with the Coastal Act and to local governments that are developing LCP policies that deal with shoreline hazards, shoreline protective devices, beach erosion, and responses to beach erosion other than shoreline armoring. LCPs also provide an opportunity to take a comprehensive approach to shoreline erosion, identifying areas that are not suitable for new development, types of development inappropriate for placement near or on coastal bluffs (e.g., private stairways). The LCP process allows the opportunity to assess the cumulative effects of projected shoreline protection, based on allowed development, developing active beach management programs (e.g., beach nourishment coordinated with flood control maintenance) and providing incentives for locating development away from hazardous coastal areas.

Most LCP hazards policies dealing with shoreline hazards and shoreline protective devices incorporate the relevant Coastal Act policies. In addition to the Coastal Act policies, LCPs should set forth policies that are tailored to the particular circumstances and needs of that portion of the coastal zone. The LCP policies should illustrate how the Coastal Act policies will be carried out in the relevant area of the coastal zone. This requires an understanding of the unique features and needs of the area, which most local government staff have. With this information, the local government can actively plan for how new development will be accommodated consistent with the Coastal Act policies.

The Coastal Act policies discourage the use of shoreline armoring. Policies 30210, 30211, 30221, 30251, and 30253 all place high priority on preserving the ocean and recreational value of beaches. Shoreline armoring interferes with such preservation because it may interfere with lateral access, and it tends to cause loss of beach sand, loss of beach area, visual degradation, etc. One of the most problematic elements of dealing with coastal development is adequately assessing and addressing the hazards associated with bluff top and beach front development and coordinating that with the possible effect on beach erosion from structural measures. Coastal Act section 30235, in part, states that shoreline protective devices

…shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply” (emphasis added).

Thus the Coastal Act requires first a determination that the protective device is needed and second, if it is needed, that it must be designed to avoid or mitigate adverse impacts on the local shoreline sand supply. (See Section 4 for further discussion on the required analysis.) Individually, each shoreline protective structure may have small impacts on local shoreline sand
supply. When evaluated on a regional and cumulative basis, these structures may have a great impact not only on local shoreline sand supply, but also on regional sand supplies. According to the Coastal Commission’s Regional Cumulative Assessment Project (ReCAP)\(^\text{19}\):

A regional overview for individual shoreline activity would provide coastal planners and analysts a perspective on how an individual project would fit into the overall cumulative approach to shoreline management. Without a regional overview, the piecemeal approach to shoreline protective devices will continue to impact shoreline processes and resources.

Gary Griggs, James Pepper and Martha Jordan, in California’s Coastal Hazards: A Critical Assessment of Existing Land-Use Policies and Practices, found that since decisions to approve shoreline protective devices:

\[\ldots\]
\[\ldots\]
\[\ldots\]

Thus it is imperative that LCPs incorporate policies that take into account the unique features and coastal processes of the local area while integrating local action on shoreline protective devices into a regional framework in order to ensure that development is consistent with Coastal Act policies. Local governments may have the information needed to create such policies and achieve these objectives. Also, the US Army Corps of Engineers may be able to conduct studies to provide information, or university students and faculty may also contribute additional information and expertise.

The policies of the Coastal Act relative to beaches, coastal bluff erosion, and shoreline protective devices are oriented toward preservation of beaches for public recreation and public coastal access, continuation of natural shoreline processes including bluff erosion and maintenance of sand supply, and toward preservation of the scenic nature of coastal bluffs from public viewpoints. Shoreline protective devices can interfere with and/or degrade all of these.

LCP policies are needed which not only carry out the policies of the Coastal Act, but which do so in a manner that best suits local shoreline features and processes while incorporating a regional perspective on shoreline development.

5.1 POLICY GUIDANCE FOR PLANNERS DEVELOPING, AMENDING OR REVIEWING LCP POLICIES ON SHORELINE PROTECTIVE STRUCTURES, HAZARDS, AND BEACH EROSION

Numerous studies of California’s coastline and shoreline processes (some of which are cited in Sections 2 and 3 of this document) demonstrate that shoreline protective structures can have deleterious effects on beaches at their base and on more distant beaches due to interruption of sand supplies. As discussed in earlier sections, there are also beach types that behave differently from one another in terms of erosion and accretion and different methods of shoreline protection that may have more or less applicability in any given situation.

The following policy guidance is intended to provide planners who are working on LCP policies relating to hazards, beach erosion, and shoreline protective devices (seawalls, rip rap revetments, etc.), with a quick and easy way to make sure that all the major issues about those topics are addressed by the LCP. The policy guidance is arranged in three parts that address new development, existing development, and long-range planning. The first two stem directly from Coastal Act sections 30253 and 30235, respectively. The third part has as its basis Coastal Act section 30235 and the Commission’s ReCAP effort. The policy guidance set forth below (the text in the bold font) is intended to be used as guidance as to how LCPs could carry out the Chapter 3 policies of the Coastal Act. The guidance is in the form of direction to readers, not simply policy language. The guidance can be modified to be used as policy text, but it should be customized for the particular situation. The discussion text following each policy guidance is explanatory only and should not be used for policy text.

The policy guidance, in some instances, may be is more protective than existing Coastal Act policies. The policy guidance, in many instances, arises from previous Coastal Commission experiences with shoreline protective devices and beach erosion.

Policy Guidance for New Development

Once built, ‘new’ development may become an ‘existing structure’ within the meaning of Coastal Act section 30235, which allows for shoreline protection when necessary to protect an existing structure in danger from erosion. Therefore, to reduce construction of shoreline protective devices, new development must be sited so that it will not be subject to future hazards from erosion.

1. Policy Guidance: Ensure that new development will not need a shoreline protective device for the duration of its economic life.

Discussion: Coastal Act section 30253(2) says new development may not “in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.” Shoreline protective devices can and do
substantially alter natural landforms by greatly reducing erosion of the bluffs
behind the device and accelerating erosion of the beach seaward of the device and
of the bluffs on either side of the device. In addition, construction of shoreline
protective devices can involve substantial grading of the bluff.

New development should be sited far enough from the bluff edge, or top of bluff,
that it will not require a seawall, revetment or any other bluff alteration for the full
life of the development. This is a two step effort — determining a safe distance
from the bluff edge for development, and determining the location and
configuration of the bluff edge at some time in the future, often taken to be the
life of the development.

2. Policy Guidance: Define the economic lifetime of structures as a minimum of 75 years
(100 years is preferable).

Discussion: While the Coastal Act does not define the economic lifetime of a structure, the
Commission’s ReCAP effort has shown that most structures last at least 75 years.
Economic life may be developed from the general neighborhood character.
However, structures will generally remain in good condition with regular repair
and maintenance for at least 75 years after construction.

3. Policy Guidance: Require all applications for a permit for new blufftop development to
include a geologic report of the entire site with special attention to the area of demonstra-
tion, i.e., that area which lies 50 feet inland from the edge of the bluff or that area which
lies between the top of the bluff and the point at which a line from the toe of the bluff in-
clined 20 degrees above horizontal intersects the surface, whichever is greater. The geologic
report should be required to include a predicted erosion rate and a setback that will ensure
the development will not require shoreline protection during its economic life, based on ei-
ther a or b, below.

a. Develop a long-term annual average erosion rate, multiply this by the economic life of
the structure and either multiply that by a safety factor or add a safety factor as a set dis-
tance. For example, if the rate of erosion is determined to be 3 inches per year, the eco-
nomic life of the structure is 100 years, and the safety factor is 1.2, then the minimum set-
back is 30 feet (3 in. x 100 yrs. = 300 in., 300 in. = 25 feet, 25 feet x 1.2 = 30 feet). If the
safety factor were a set distance of, say, 10 feet, and the rate of erosion and economic life of
the structure were the same as in the preceding example, then the setback would be 35 feet.
The safety factor may vary regionally, based on the quality of the shoreline change data
and the size or magnitude of extreme erosion events.

b. Require the geologist to provide 75-year and 100-year setback lines and give the meth-
odology for determining the setback.
Discussion: The erosion rate and setback recommended by the geologist will enable the local government to ensure that new development on bluff tops and cliffs is safe from erosion and will not require shoreline protection during its useful life. The local government and coastal analysts will need information on the methodology both to check the thoroughness of the analysis and to compare it with other projects in the vicinity.

4. Policy Guidance: In-fill development, i.e., new development between adjacent developed parcels, should be allowed no closer to the bluff edge than as indicated by the geologic report.

Discussion: In areas where a vacant lot lies between two adjacent developed lots, the applicant will often propose a setback distance comparable to that of the adjoining developed properties. This has been found to be appropriate if:

1) the bluff edge is essentially a straight line and not concave at the location of the vacant lot and,

2) the existing structures are currently set back a distance that would equal the erosion rate appropriate to the economic lifetime of the proposed structure.

However, the required geologic report should still determine the full setback that would be necessary for the life of the development and this should be used in site design if it indicates a greater setback is needed.

5. Policy Guidance: Define the bluff edge as the upper termination of a bluff, cliff, or sea cliff. In cases where the top edge of the cliff is rounded away from the face of the cliff as a result of erosion processes related to the presence of the steep cliff face, the bluff line or edge is that point nearest the cliff beyond which the downward gradient of the surface increases more or less continuously until it reaches the general gradient of the cliff. In a case where there is a step-like feature at the top of the cliff face, the landward edge of the uppermost riser is taken to be the cliff edge.

Discussion: There are many instances where the edge of the blufftop is not a clear and there is not a dramatic change from a horizontal to a vertical surface. Often parcels are not horizontal but slope toward the sea, or there may be a stair-stepped configuration, or there may be gullies present which have cut landward back into the bluff top. Because erosion features, such as gullies, may be evidence of weaker, less stable areas, they must be considered when determining the blufftop setback. Where there may be confusion about the location of the blufftop, it may be appropriate to map the blufftop and include the map in the LCP, clearly identifying the date of the determination as a tool of comparison for future references.
6. **Policy Guidance**: Require that blufftop landscaping use drought tolerant, native species.

Discussion: Drought tolerant species do not need as much watering as other species. Adding water to the top of a bluff or bluff face can lead to accelerated bluff failure. Native species are adapted to the harsh conditions of bluff tops (wind, salt spray, etc.)

7. **Policy Guidance**: Define an “area of high geologic hazard” as fault zones and land subject to dangers from liquefaction and other severe seismic impacts, unstable slopes regardless of slope angle, landslides, areas of coastal cliff instability, tsunamis, and slopes steeper than 30%.

Discussion: Coastal Act section 30253(1) states that “new development shall minimize risks to life and property in areas of high geologic hazard.” These areas should be identified in the LCP and on adopted maps to enable minimization of risk. Depending on the local geologic structure, the appropriate slope percentage that constitutes an area of geologic hazard may be greater or less than 30 percent.

8. **Policy Guidance**: Accessory structures (e.g. patios, gazebos, etc.), if allowed, should be constructed in such a manner as to be easily relocated landward should they become threatened by shoreline erosion. CDPs authorizing accessory structures should be conditioned with the requirement that the permittee (and all successors in interest) shall remove the accessory structure(s) if threatened by shoreline erosion and that no shoreline protection device shall be allowed for the sole purpose of protecting the accessory structure(s). Accessory structures should not be considered structures for the purposes of shoreline protection as provided in Section 30235 of the Coastal Act.

Discussion: In certain circumstances such as a small parcel it may be appropriate to allow some accessory structures in the setback area. However, unless there is no other developable area large enough for the minimum development consistent with the zone district, this development should only be allowed if conditionally authorized such that, once threatened, it is relocated or removed. There could also be a situation where a permanent structure is proposed to be located significantly landward of the required bluff setback and a temporary structure is proposed between the permanent structure and the bluff setback area. Again, the temporary structure should only be allowed if it can be relocated if threatened by erosion. Armoring should not be used to protect temporary structures.

9. **Policy Guidance**: Ensure that land divisions of coastal fronting property will result in new parcels that can be developed with structures that will not require shoreline protection during a 75 or 100 year economic life. Prohibit land divisions that will result in parcels that are unbuildable, e.g., exclusively areas of high geologic hazard; and that each new parcel has at least the minimum developable area, consistent with the zone district, outside of any high geologic hazard area.
Discussion: Coastal Act section 30106 defines land divisions and lot splits as development. Such divisions should not be authorized if the increase in parcel numbers will increase the demand for shoreline protection. Land divisions should not create unbuildable lots, e.g., entirely on a bluff face, or lots too small to allow for a single-family residence landward of the bluff setback.

10. Policy Guidance: Allow new development on sand dunes only when required to avoid a “taking” of property. Establish a sand dune preservation zone district in the zoning ordinance to provide standards for development on sand dunes when such development must be allowed. Site new development on sand dunes 1) landward of the most seaward line of vegetation, 2) in a way that avoids or minimizes adverse impacts to natural dune formation, and 3) in a way that does not adversely affect sandy beach habitat. Require a geologic report to substantiate the stability and integrity of the dune and a biologic report to identify potential biologic impacts and mitigation therefore. Where there is no vegetation, require a geologic report to establish a line seaward of which no new development will be allowed. Ensure that no new development is allowed seaward of the inland extent of the estimated wave runup from the 100-year design storm. Where existing subdivided lots lie entirely seaward of the most seaward line of vegetation or seaward of the inland extent of the estimated 100 year storm wave runup, allow only minimum development, and limit site cover and site disturbance to the extent necessary for the minimum development.

Discussion: The existence of vegetation on dunes is evidence that some amount of stability exists and that the area is not subject to regular wave runup, although this needs to be substantiated by a geologic report, and a biologic report is needed to identify impacts to flora and/or fauna and to identify mitigation. If there is no vegetation, it is more difficult to intuitively discern the area of stability; in those cases it is imperative that a geologic report determine the inland extent of the wave runup from the 100-year storm. Alternatively, this could already be mapped on the land use plan and zoning maps. There are subdivisions that include lots well onto the beach. If these are in fact legal lots of record, then some development must be allowed. In those cases, the amount of development should be limited to reduce impacts to coastal resources and to limit the amount of loss when the inevitable destructive storm occurs.

Policy Guidance for Existing Development

1. Policy Guidance: Allow shoreline protective devices only in the following instances: a. when required to serve coastal-dependent uses, or b. when required to protect existing principal structures in danger from erosion, or c. when required to protect public beaches in danger from erosion, AND, d. when impacts to shoreline sand supply are mitigated.
Discussion: Coastal Act Section 30235 sets up several tests to determine if shoreline protection is an appropriate response to erosion. First, is the subject property a coastal dependent use, existing structure or public beach? If yes, is there a documented danger from erosion. And, third, if yes, does the proposed protection minimize or eliminate impacts to sand supply. Almost every shore protection structure will have some unavoidable impacts on sand supply, as well as the visual character of the shoreline. For areas where there are accessory buildings seaward of the principal structure, the local government may want to consider adding the language to the LCP to prohibit the use of armoring to protect accessory structures. The Coastal Commission has found that relocating ancillary facilities may be a feasible, less environmentally damaging alternative than constructing a shoreline protective device. In general, accessory structures can usually be relocated, while it is more problematic to relocate the principal residence or building. Shoreline protective devices should only be authorized when necessary and only to protect those structures that cannot feasibly be protected in any other manner and that are or contain the principal use of the site, and when impacts to shoreline sand supply are mitigated. For all situations, the applicant should consider alternatives to shoreline protective devices; for accessory structures relocation should be thoroughly reviewed.

2. Policy Guidance: Define principal structures as any primary living quarters, main commercial buildings, and functionally necessary appurtenances to those structures such as septic systems and infrastructure. Facilities such as privately owned, non-coastal dependent pipelines, roads, utilities and accessory structures (e.g. storage sheds, decks, patios, gazebos, walkways, landscaping, etc.) are not considered to be principal structures.

Discussion: The Coastal Act simply uses the words “existing structures” without any qualifications or definitions in Section 30235. By limiting development for which shoreline protective devices may be constructed, coastal armoring and consequent beach erosion may be slowed. The Coastal Commission has found that it is generally feasible to relocate ancillary structures while it is more problematic, although not necessarily infeasible, when considering the principal residence or building. Relocation of ancillary facilities may be environmentally less damaging than a seawall and more protective of coastal resources. Coastal Act section 30235 states that seawalls shall be permitted when required to protect existing structures. If it is feasible to relocate structures, then a seawall is not required for protection.

3. Policy Guidance: Require applications to include an analysis of alternatives that are capable of protecting the existing structure from erosion including, but not limited to: a) no action; b) involvement in regional beach nourishment; and/or c) the relocation of the threatened structure. Require the following information also: amount of beach that will be covered by the shoreline protective device; the amount of beach that will be lost over time,
through passive erosion; total lineal feet of shoreline protective devices within the littoral cell where the device is proposed; and, the cumulative impact of added shoreline protective devices for the littoral cell within which the proposed device will be located.

Discussion: See Section 4 of this document for a comprehensive discussion on filing applications for shoreline protection. LCPs should establish similar filing requirements that take into account local and regional shoreline situations. This will allow an analysis of cumulative impacts within the littoral cell and allow the impacts of the individual project to be considered in a regional context. This in turn can provide the basis for non-armored responses to coastal bluff erosion.

4. Policy Guidance: Define the replacement of residences destroyed by storm waves or bluff failure as “minor development,” or require submittal of plans but waive the requirement for actually obtaining a permit if the replacement residence conforms to applicable existing zoning requirements, is for the same use as the destroyed structure, does not exceed either the floor area, height, or bulk of the destroyed structure by more than 10 percent, and if the replacement residence is setback on the parcel at least 60 percent of the minimum bluff edge setback for new structures in the same area with the same geologic structure. Do not allow a structure to be relocated to a wetland, stream, or other sensitive habitat.

Discussion: The Coastal Act states that structures destroyed by a disaster may be replaced without need for a coastal development permit if the structure conforms to applicable existing zoning requirements, is for the same use, does not exceed the floor area, height, or bulk of the destroyed structure by more than 10 percent and if the structure is sited at the same location as the destroyed structure. However, it may be physically impossible, or at least infeasible, to locate the replacement structure in the same location as the destroyed structure because, for example, bluff failure may result in the physical loss of the original location. This means that a coastal development permit would be necessary to relocate the structure away from the original location to a safer location. However, in some cases, a landowner may seek to locate a replacement residence in its original location simply to avoid permit requirements. This could result in the residence not being placed in the safest area on the site. If the relocation is defined as a “minor development,” then, while a permit would be required, there would no requirement for a public hearing. Alternatively, the requirement for actually obtaining a permit could be waived. In that case, the applicant would submit plans for review, but no permit would be issued or necessary. Under either of these alternatives, the owner would have an incentive to relocate the structure to a safer location where shoreline protection would not be necessary. This would further the goals of protecting existing structures, reducing the need for shoreline protective structures, and reducing beach erosion. The proposed policy guidance reduces the immediate and future need for shorelines protective structures without
causing beach erosion and its relocation provisions may be more economically feasible than reconstructing in the same location with armoring.

5. Policy Guidance: Encourage the relocation of threatened structures, rather than constructing shoreline protective devices, by waiving permit filing fees for applications to relocate structures or providing variances from zoning requirements such as side or front yard setbacks, etc.

Discussion: Relocation of a structure away from an eroding bluff or out of the reach of storm waves may provide the applicant with many years of future site use without the costs and effects of long term shoreline protection.

6. Policy Guidance: Annually notify in writing all blufftop property owners that the placement of emergency shoreline protective devices shall be allowed only when the need for such protection was in fact caused by a sudden, unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property, or essential public services. Emergency permits will become void and the structure authorized by them considered a public nuisance unless the property owner makes an application for a regular coastal development permit within 30 days of the issuance of the emergency authorization.

Discussion: Emergency permits are available as a possible response to a sudden, unexpected occurrence. It is not an emergency if a condition has been known for a long time, but no action is taken to address the condition until it becomes critical. Unfortunately, emergency shoreline protection is often installed during difficult conditions and often cannot be designed or constructed with the same level of care as shoreline protection that is designed and constructed in a timely manner. Annual notices will encourage coastal property owners to plan ahead and should suggest that coastal property owners retain an engineering geologist to assess whether the property is stable or in need of some form of stabilization. Also all emergency permits must be followed up by regular permit applications to ensure that the standards for shoreline protective structures are met and to verify that the emergency device is still needed. It can be quite costly to remedy poorly designed or constructed emergency structures, so proper planning and design initially is important.

7. Policy Guidance: Prohibit new shoreline protective structures from extending onto a beach farther than a straight line connecting the nearest corners of adjacent shoreline protective structures, if any. Require new shoreline protective devices to cover the least amount of beach area as is necessary to provide adequate protection for the existing principal structure.

Discussion: If a new shoreline protective structure is designed to fill in between two existing shoreline protective structures, the “in-fill” should only be allowed for one or two
urban lots, at a maximum. Since shoreline protection will interfere with shoreline access and sediment transport during some conditions, shore protection structures should be sited as far landward as possible to minimize these effects.

8. **Policy Guidance**: Send notices of shoreline protective device permit applications to all local governments with shoreline within the same littoral cell.

Discussion: The littoral cell is the natural boundary for dealing with beach sand supply and movement. Without knowing the range of shore developments that is proposed for a littoral cell regardless of political jurisdiction, other jurisdictions cannot take any sort of coordinated action to preserve and/or restore beaches.

9. **Policy Guidance**: Prohibit additional permanent structures on bluff faces, except for engineered public beach access where no feasible alternative means of public access exists.

Discussion: New structures such as stairways added to bluff faces could become existing structures eligible for a shoreline protective device when threatened by erosion. This in turn adds to shoreline armoring. Among other things, the Coastal Act protects and encourages public access to beaches. Therefore, local governments should consider prohibiting all new stairways on bluff faces unless no feasible alternative means of public access to a beach exists.

10. **Policy Guidance**: Require that blufftop landscaping use drought tolerant native species whenever possible.

Discussion: Drought tolerant native species do not need as much watering as other species. Adding water to the top of a bluff can lead to accelerated bluff failure. Blufftop landscaping should be designed to minimize irrigation and avoid artificial soil saturation. Native species are adapted to the harsh conditions of bluff tops (wind, salt spray, etc.).

11. **Policy Guidance**: Require all existing, non-permitted shoreline protective structures constructed after January 1, 1973 to obtain a coastal development permit. Declare non-permitted shoreline protective structures a public nuisance. Require the property owner to apply for a coastal development permit for such structures no later than one year from the date of certification of this policy by the Coastal Commission. Failure to meet the deadline may result in the local government posting the property with a notice of violation and recording it against the property.

Discussion: Shoreline protective devices that were built after January 1, 1973, without coastal permits, are illegal. Many of these devices were not built according to standard engineering practices and so may pose a hazard to the public or to the property owner through premature failure. To require these unpermitted structures to
obtain a permit would allow for review and possible correction of substandard structures.

12. Policy Guidance: If an in lieu fee mitigation program exists, require payment of an in lieu fee to support beach nourishment efforts in a manner proportionate to the quantifiable effects of the shoreline protective device on the amount of sand that would have been nourishing the beach in the absence of the shoreline protective device.

Discussion: The Commission has designed and implemented a methodology for making such a calculation (see Section 4). In many areas with shoreline erosion problems, it may be appropriate to incorporate this methodology into the LCP. Other methodologies may also be appropriate.

Policy Guidance For Long-Range Planning

1. Policy Guidance: Inventory available studies on local and regional coastal processes and beach resources; participate in studies to fill in information gaps about regional effects of shoreline protective structures on beach erosion and methods to counteract beach erosion. Establish an Overlay or Geologic Hazard Assessment District (include tsunamis) and designate areas of coastal resource significance (e.g., sand dunes and areas of high geologic hazard) on the LUP and zoning maps, to limit in-filling for relatively undeveloped areas and to limit seaward encroachment of development.

Discussion: This type of information, whether compiled from existing sources or undertaken by the local government itself, will provide a basis for implementing long range solutions, other than armoring, to the hazards associated with shoreline erosion.

2. Policy Guidance: Create and maintain a database/file of geotechnical reports from individual projects for use in analysis of regional effects of shoreline protective structures, including documentation of interference with sand transport, loss of sand from the beach, the amount of beach area already covered by shoreline protection devices, location of such encroachments, and the cumulative impacts of those devices on recreational use.

Discussion: Such a data base can serve both the local government and applicants by allowed rapid recall of past project information.

3. Policy Guidance: Develop an in-lieu fee mitigation program to allow for mitigation of seawall impacts through payment of an in-lieu fee that is used to replenish beaches in the same littoral cell as the seawall.

Discussion: In natural areas and/or areas not already stabilized by shoreline protective devices, armoring halts erosion of the area behind the protective device and hence eliminates a source of future beach material, causes increased erosion of the beach
seaward of the device, and can interfere with longshore transport of sand within the littoral cell. This type of policy encourages local governments to develop programs for collecting in-lieu fees that can be used to mitigate some of the permanent and adverse effects of armoring on public resources. Such a policy would enable the creation of a fund with which the relevant local government could fund beach nourishment. Utilize information and expertise from the SANDAG (San Diego Association of Governments) and BEACON (Beach Erosion Authority for Control and Nourishment) experiences as appropriate (Contact the Coastal Commission’s San Diego or Ventura office for further information).

4. **Policy Guidance**: Monitor and comment on other jurisdiction’s activities which may affect natural sand movement and supply on the local governments beaches.

Discussion: Ideally there would be a multi-jurisdictional entity that would study shoreline processes, shoreline change and long-term trends and provide a forum to discuss projects that could affect other jurisdictions within the littoral cell. In any event, local tracking of projects will help to keep all jurisdictions aware of activities and provide them an opportunity to comment on projects that may result in adverse effects on their beaches.

5. **Policy Guidance**: Develop a comprehensive shoreline protection program that includes regular shoreline surveys to develop short and long-term shoreline trends, identifying priorities for types of shoreline protection, and developing programs for opportunistic beach nourishment using clean dredge material, clean material from flood control structures, clean excavation material and other innovative sources. Identify which beaches have priority for nourishment.

Discussion: The littoral cell is the most reasonable geographic division for studying shoreline processes and shoreline trends. Since jurisdictional boundaries were not established with concern for littoral cell boundaries, a regional, multi-jurisdictional entity would be the ideal forum for a comprehensive shoreline program. If no such program exists, local jurisdictions can undertake a great deal of useful study and examination of shoreline processes on a smaller and more manageable section of shoreline within their local boundaries. Such program should identify the major factors that influence coastal processes within the cell and concentrate on those factors over which the local jurisdiction has control.

6. **Policy Guidance**: Rank the types of permissible shoreline protective devices in order of least to most potential coastal impact and set forth technical criteria and standards for the structural design of shoreline protective devices.

Discussion: This will depend on the local shoreline characteristics and access considerations.
7. *Policy Guidance*: Encourage voluntary consolidation or purchase of property, or development of a transfer of development credit program as a means to reduce development potential of coastal fronting land.

8. *Policy Guidance*: Seek federal and state funds to conduct the following types of studies: source of harbor deposition material, the impact of beach erosion on beach access, the effect harbor deposition has on beach replenishment downcoast of the harbor; the impact of harbor dredging on potential tsunami hazard, and the direct and indirect costs of harbor dredging to the local government or Harbor District.
## 5.2 LCP TABLE

Local Coastal Program Policies and Ordinances Relating to Shoreline Protective Devices

(Note: Specific language of each reference (excepting BEACON) is provided following this chart and can be located using the alpha-numeric identifier of the reference. For example, the identifier of San Luis Obispo County Hazards Policy 6 and Coastal Zone Land Use Ordinance §23.04.118 is 1a. The language of that policy and the ordinance section is found at 1a in the Specific Language Table that follows this table. Unless otherwise identified, all references are to Land Use Plans. Where both Land Use Plan policy and Implementation Plan ordinance sections are listed, as in 1a, the Land Use Plan policies are listed first.)

<table>
<thead>
<tr>
<th>Type of Policy</th>
<th>a</th>
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<tr>
<td>1 Setbacks for Development on Blufftops and Sand Dunes</td>
<td>San Luis Obispo County Hazards Policy 6 Coastal Zone Land Use Ordinance Section 23.04.118.</td>
<td>Malibu/ Santa Monica Mountains Policies 163 and 164</td>
<td>Marin County Natural Dune &amp; Sandy Beach Protection Policy 20</td>
<td>City of Pismo Beach Bluff Erosion/Instability Section, Bluff Top Setbacks Policy S-3</td>
<td>Humboldt County North Coast Area Plan Definitions: &quot;Bluff Edge&quot; or &quot;Cliff Edge&quot;</td>
<td>Mendocino County Coastal Element Hazards Policy 3.4-7</td>
<td>City of Encinitas Hazard Policy 1.6f</td>
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<td>2 Long Range Planning</td>
<td>City of Ventura 15.9 BEACON Program</td>
<td>City of Imperial Beach Policy S-11</td>
<td>City of Newport Beach Visitor Serving Facility section Policy 1</td>
<td>Marin County Policies 7 and 8 Shoreline Protection and Hazards</td>
<td>City of Encinitas Hazard Policy 1.7</td>
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<td>3 Public Access</td>
<td>City of Carpinteria Policy D.1.6 A.1.1</td>
<td>Carmel Area of Monterey County Specific Policies 2.7.4.10</td>
<td>City of Santa Barbara Marine Resources Policy 6.5</td>
<td>Marin County Policy 4 Marine Protection and Hazards</td>
<td>Del Monte County LCP, Zoning Ordinance c.1.</td>
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<td>4 Existing Development</td>
<td>Santa Barbara County Seawall and Shoreline Structures Policy 3.1</td>
<td>City of Santa Barbara Policy 6.3</td>
<td>San Mateo County Hazards Component Policy 9.12</td>
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<td>5 Historical Background/Basis for Limiting Shoreline Structures</td>
<td>San Luis Obispo County Hazards Policy 7 Coastal Zone Land Use Ordinance Section 23.07.080</td>
<td>City of Sand City Natural Hazards Policies 4.3.10, 4.3.11</td>
<td>San Mateo County Hazards Component Policies 9.1, 9.2, 9.3, 9.10</td>
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<tr>
<td>6 Hazard Area</td>
<td>San Luis Obispo County Hazards Policy 7 Coastal Zone Land Use Ordinance Section 23.07.080</td>
<td>City of Sand City Natural Hazards Policies 4.3.10, 4.3.11</td>
<td>San Mateo County Hazards Component Policies 9.1, 9.2, 9.3, 9.10</td>
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<td>7 New Development</td>
<td>Carmel Area of Monterey County General and Specific Policy 2.7.3.3</td>
<td>San Mateo County Hazards Component Policy 9.11.</td>
<td>City of Grover Beach Marine Resource Areas Recommendation, Sand Dunes Policy No. 1</td>
<td>Marin County Unit 1, Dune Policies 20 and 21</td>
<td>Malibu/Santa Monica Mtns. Bluff and Beach Erosion Policy</td>
<td>City of Encinitas Hazards Policy 1.6f.</td>
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<td>8 Emergency</td>
<td>Marin City Policy 7 Shoreline Protection and Hazards Section</td>
<td>City of Encinitas Zoning Ordinance Section 30.34.020, Coastal Bluff Overlay Zone, Subsection E, Temporary Emergency Protection Devices</td>
<td>San Luis Obispo County Coastal Zone Land Use Ordinance, Section 23.03.045, Emergency Permits</td>
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<td>9 Regional</td>
<td>BEACON (Beach Erosion Authority for Control Operations and Nourishment), a Joint Powers Authority. Please contact Commission’s Ventura office for further information about BEACON.</td>
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City of Santa Barbara: Water & Marine Resources section re: Dredging Activities and Seawalls, pg. 3–67 ff.
5.3 LANGUAGE OF POLICIES IDENTIFIED IN LCP TABLE (PAGES 5–12 AND 5–13)

EXAMPLES OF USEFUL POLICIES RELATING TO SHORELINE HAZARDS, SHORELINE PROTECTIVE DEVICES, & BEACH EROSION
(Current as of August 1996)

This is Not Meant to be a Comprehensive List of All Useful LCP Policies.

The examples are meant to give Commission and local governments LCP planners a starting point for developing new policies. State-of-the-art information should be used in developing new LCP policies. As new LCP policies are developed they can be added to this list.

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<tr>
<th>TYPE OF POLICY</th>
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<tr>
<td>Setbacks for Development on Blufftops and Sand Dunes</td>
<td><strong>San Luis Obispo County, Hazards Policy 6</strong>: New development or expansion of existing uses on blufftops shall be designed and set back adequately to assure stability and structural integrity and to withstand bluff erosion and wave action for a period of 75 years without construction of shoreline protection structures which would require substantial alterations to the natural landforms along bluffs and cliffs. A site stability evaluation report shall be prepared and submitted by a certified engineering geologist based upon an on-site evaluation that indicates that the bluff setback is adequate to allow for bluff erosion over the 75-year period. Specific standards for the content of geologic reports are contained in the Coastal Zone Land Use Ordinance. [THIS POLICY SHALL BE IMPLEMENTED PURSUANT TO SECTION 23.04.118 OF THE CZLUO]</td>
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**CCC Staff comment**: This policy is straightforward and, like many of the County’s policies, specifically calls out the section of the Implementation Plan (zoning ordinance) which implements the policy, making it very easy to move from the policy directly to the particular requirements of the implementing ordinance.

**San Luis Obispo County Coastal Zone Land Use Ordinance (CZLUO), Section 23.04.118, Blufftop Setbacks**: …The required setback shall be the larger of the two required by subsections a. and b. of this section.

a. **Stringline setback method**: Where 50 percent of the lots adjacent to the coastline within 300 feet of the site are developed at the time of application, no part of a proposed new structure, including decks, shall be located closer to the seaward property line of the site that the greatest distance determined by either of the following:

   (1) A line between the most seaward portions of the structures on the adjacent lots; or

   (2) Where there is substantial variation of land from between adjacent lots, the average setback of structures o the adjoining lots shall be used.

b. **Bluff retreat setback method**: New development or expansion of existing uses on blufftops shall be designed and set back from the bluff edge a distance sufficient to assure stability and structural integrity and to withstand bluff
erosion and wave action for a period of 75 years without construction of shoreline protection structures that would in the opinion of the Planning Director require substantial alterations to the natural landforms along bluffs and cliffs. A site stability evaluation report shall be prepared and submitted by a certified engineering geologist based upon an on-site evaluation that indicates that the bluff setback is adequate to allow for bluff erosion over the 75-year period. The report shall accompany the land use permit application, and shall contain the following information:

1. Historic, current and foreseeable cliff erosion, including investigation of recorded land surveys and tax assessment records in addition to the use of historic maps and photographs, where available, and possible changes in shore configuration and sand transport.
2. Cliff geometry and site topography, extending the surveying work beyond the site as needed to depict unusual geomorphic conditions that might affect the site and the proposed development.
3. Geologic conditions, including soil, sediment and rock types and characteristics in addition to structural features such as bedding, joints, and faults.
4. Evidence of past or potential landslide conditions, the implications of such conditions for the proposed development, and the potential effects of the development on landslide activity.
5. Wave and tidal action, including effects of marine erosion on seaciffs.
6. Ground and surface water conditions and variations, including hydrologic changes caused by the development (e.g., introduction of sewage effluent and irrigation water to the groundwater system; alterations in surface drainage).
7. Potential effects of seismic forces resulting from a maximum credible earthquake.
8. Effects of the proposed development including sighting and design of structures, septic system, landscaping, drainage, and grading, and impacts of construction activity on the stability of the site and adjacent area.
9. Potential erodibility of the site and mitigation measures proposed to minimize erosion problems during and after construction. Such measures may include but are not limited to landscaping and drainage design.
10. The area of demonstration of stability shall include the base, face, and top of all bluffs and cliffs. The extent of the bluff top considered should include the area between the face of the bluff and a line described on the bluff top by the intersection of a plane inclined a 20-1/4 degree angle from the horizontal passing through the toe of the bluff or cliff, or 50 feet inland from the edge of the cliff or bluff, whichever is greater.
11. Any other factors that may affect slope stability.

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<tr>
<th>Setbacks for Development on Blufftops and Sand Dunes</th>
<th>Malibu/Santa Monica Mountains</th>
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<tr>
<td><strong>Policy 163:</strong> Continue to require an engineering report on all proposed bluff-top development to insure geologic stability, adequate structural setback and appropriate mitigation of on-site runoff.</td>
<td><strong>Policy 164:</strong> On blufftops, new development shall be set back a minimum of 25 feet from the top of the bluff or at a stringline drawn between the nearest corners of adjacent structures, whichever distance is greater, but in no case less than would allow a 75-year useful life for the structure.</td>
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<td>TYPE OF POLICY</td>
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<tr>
<td>Setbacks for Development on Blufftops and Sand Dunes 1c</td>
<td>Marin County, Natural Dune &amp; Sandy Beach Protection Policy 20: Development of other shorefront lots within the Stinson Beach and Seadrift areas shall assure preservation of the natural sand dune formation in order to protect environmentally sensitive dune habitat and vegetation and to maintain the natural protection from wave runup that such natural dunes provide. Where no dunes are evident, any new development on shorefront lots shall be set back behind the first line of terrestrial vegetation to the maximum extent feasible, in order to minimize the need for protective works, to protect sandy beach habitat, and to provide a buffer area between private and public use areas in order to protect both the scenic and visual character of the beach, and the public right to access the use and enjoyment of dry sand areas.</td>
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<tr>
<td>Setbacks for Development on Blufftops and Sand Dunes 1d</td>
<td>City of Pismo Beach, Bluff Erosion/Instability Section, Bluff Top Setbacks Policy S-3: All structures shall be set back a safe distance from the top of the bluff in order to retain the structures for a minimum of 100 years, and to neither create nor contribute significantly to erosion, geologic instability or destruction of the site or require construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.</td>
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<tr>
<td>Setbacks for Development on Blufftops and Sand Dunes 1e</td>
<td>Humboldt County North Coast Area Plan Definitions, “Bluff Edge” or “Cliff Edge:” is the upper termination of a bluff, cliff or seaciff. When the top edge of the cliff is rounded away from the face of the cliff as a result of erosional processes related to the presence of the steep cliff face, the edge shall be defined as that point nearest the cliff beyond which the downward gradient of the land surface increases more or less continuously until it reaches the general gradient of the cliff. In a case where there is a step like feature at the top of the cliff face, the landward edge of the topmost riser shall be taken to be the cliff edge.</td>
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| Setbacks for Development on Blufftops and Sand Dunes 1f | Mendocino County Coastal Element Hazards Policy 3.4-7 The County shall require that new structures be set back a sufficient distance from the edges of bluffs to ensure their safety from bluff erosion and cliff retreat during their economic life spans (75 years). Setbacks shall be of sufficient distance to eliminate the need for shoreline protective works. Adequate setback distance will be determined from information derived from the required geologic investigation and from the following setback formula:  
Setback (meters) = Structure life (years) x retreat rate (meters/year)  
The retreat rate shall be determined from historical observation (e.g., aerial photographs) and/or from a complete geotechnical investigation. |
| Setbacks for Development on Blufftops and Sand Dunes 1g | City of Encinitas Hazard Policy 1.6f: The City shall provide for the reduction of unnatural causes of bluff erosion, as detailed in the Zoning Code, by:…  
Requiring new structures and improvements to existing structures to be set back…40 feet from coastal blufftop edge with exceptions to allow a minimum coastal blufftop setback of no less than 25 feet. For all development proposed on coastal blufftops, a site-specific geotechnical report shall be required. The report shall indicate that the coastal |
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| **Setbacks for Development on Blufftops and Sand Dunes**                     | blufftop setback will not result in risk of foundation damage resulting from bluff erosion or retreat to the principal structure within its economic life and with other engineering evidence to justify the coastal blufftop setback.  
| 1g (cont’d)                                                                  | On coastal bluffs, exceptions to allow a minimum setback of not less than 25 feet shall be limited to additions or expansions to existing principal structures which are already located seaward of the 40 foot coastal blufftop setback, provided the proposed addition or expansion is located no further seaward than the existing principal structure, is set back a minimum of 25 feet from the coastal blufftop edge, and the applicant agrees to remove the proposed addition or expansion, either in part or entirely, should it become threatened in the future.  
|                                                                              | In all cases, all new construction shall be specifically designed and constructed such that it could be removed in the event of endangerment and the applicant shall agree to participate in any comprehensive plan adopted by the City to address coastal bluff recession and shoreline erosion problems in the City  
|                                                                              | This does not apply to minor structures that do not require a building permit, except that no structures, including walkways, patios, patio covers, cabanas, windscreens, sundecks, lighting standards, walls, temporary accessory building not exceeding 200 square feet in area, and similar structures shall be allowed within five feet from the bluff top edge… |

| Long Range Planning 2a                                                        | **City of Ventura, 15.9, BEACON Programs:** Continue to support the educational, legislative and research programs of the Beach Erosion Authority for Control Operations and Nourishment (BEACON).  
|                                                                              | **15.9.1:** Provide City support and/or sponsor new legislation to mitigate regional sand transport and supply impacts.  
|                                                                              | **15.9.2:** Provide City support for the acquisition of grant funds to conduct regional sand resource studies.  
|                                                                              | **15.9.3:** Provide City support for sand supply research programs, such as the California Storm and Tidal Wave Study conducted in San Diego County by the U.S. Army Corps of Engineers. |

| Long Range Planning 2b                                                        | **City of Imperial Beach, Policy S-11** The City should protect property by:  
|                                                                              | a) Creating artificial dunes pursuant to SANDAG technical specifications.  
|                                                                              | b) Developing a coastal shoreline protection device ordinance for the design and construction of seawalls and revetments.  
|                                                                              | c) Developing erosion management measures such as irrigation controls, landscaping ordinances, and other measures suitable to the changing nature of the Imperial Beach shoreline.  
<p>|                                                                              | d) Working in coordination with SANDAG and other coastal cities in developing a regional beach replenishment program and continuing to implement the adopted “Shoreline Preservation Strategy for the San Diego Region.” |</p>
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<tr>
<td>Long Range Planning 2c</td>
<td><strong>City of Newport Beach LUP (1/9/90 version, p. 33) Visitor Serving Facilities section, Policy No. 1</strong>: Proposals for the construction of anti-erosion structures, offshore breakwaters, or future marinas shall be examined in light of their potential ability to conflict with the City’s mandate to preserve in its natural state the ocean beaches, water, surf action, and coastal shoreline in a manner that will ensure their availability for continued public use and enjoyment.</td>
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| Long Range Planning 2d | **Marin County Policies 7 and 8, Shoreline Protection and Hazards**  
7. Because revetments, seawalls or other shoreline protective works can be detrimental to maintenance of natural shoreline processes and can interfere with visual enjoyment and coastal access, such works are discouraged. The County of Marin through the LCP and other documentation has identified those coastal areas potentially subject to significant wave and run-up erosion.  
8. It shall be County policy to encourage property owners subject to ocean-front erosion hazards to develop responses to such hazards prior to emergency conditions. Where contiguous properties are subject to generally similar erosion hazards, joint program development should occur. |
| Long Range Planning 2e | **City of Encinitas Hazard Policy 1.7** The City shall develop and adopt a comprehensive plan, based on the Beach Bluff Erosion Technical Report prepared by Zeiser Kling Consultants Inc., (dated January 24, 1994), to address the coastal bluff recession and shoreline erosion problems in the City. Said plan shall include, at minimum, components that deal with all the factors affecting the bluffs in Encinitas. These include, but are not limited to, minimum blufftop setback requirements for new development/redevelopment; alternatives to shore/bluff protection such as beach sand replenishment; removal of threatened portions of a residence or the entire residence or underpinning of existing structures: addressing bluff stability and the need for protective measures over the entire bluff (lower, mid and upper); impacts of shoreline structures on beach and sand areas as well as mitigation for such impacts; impacts of groundwater and irrigation on bluff stability; and, visual impacts of necessary/required protective structures.  
If a comprehensive plan is not submitted to, reviewed and approved by the Coastal Commission as an amendment to this land use plan by November 17, 1995, then no additions or expansions to existing structures shall be permitted on coastal blufftop lots except for minor additions or expansions that comprise no greater than a 10 percent increase above the existing gross floor area or 250 square feet whichever is greater, provided such additions/expansions are located at least 40 feet from the coastal blufftop edge, the addition/expansion is constructed in a manner so that it could be removed in its entirety, and the applicant agrees, in writing, to participate in any comprehensive plan adopted by the City to address coastal bluff recession and shoreline erosion problems in the City. In addition, until such a comprehensive plan is approved by the City of Encinitas and the Coastal Commission as an amendment to the LCP, the City shall not permit the construction of seawalls, revetments, breakwaters, cribbing, or similar structures for coastal erosion except under circumstances where an existing principal structure is imminently threatened and, based on a thorough alternatives analysis, an emergency coastal development permit is issued and all emergency measures authorized by the emergency coastal development permit are designed to eliminate or mitigate adverse impacts on local shoreline sand supply. |
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<tr>
<td>Public Access</td>
<td>City of Carpinteria, Policy D. 1.6: A bluff top hiking/biking trail corridor at least 20 feet in width, or wider if necessary to accommodate separated bikeway and pedestrian lanes or to accommodate constraints (such as existing vegetation, uneven terrain or ESHA buffers) shall be located so as to ensure that continuous trail access can be maintained over a period of time equivalent to the design life of proposed adjacent development (100 years). The necessary width of the corridor shall be based on the bluff retreat determined on a site-specific basis, pursuant to Policy A.1.1.</td>
</tr>
<tr>
<td>3a</td>
<td><strong>A. 1.1:</strong> As part of any development proposed on the Bluffs that may be affected by coastal bluff retreat during the design life span (100 years) of the development and, or which, by virtue of its proposed location may constrain potential relocation of public access or existing development including the railroad tracks subject to coastal rate of bluff retreat, the project applicant(s) will be required to submit geotechnical studies assessing the site-specific rate of bluff retreat. Geotechnical studies shall include the relevant geologic cross-section and shall calculate the bluff recession rate based on the most erodible portion of the bluff (generally, the marine terrace) and shall be performed by a qualified engineering geologist experienced in coastal process analysis. Structures shall be set back a sufficient distance so as to protect the structure from bluff retreat during its anticipated life span (100 years) and so as to protect bluff top coastal access amenities and existing development including any future need to relocate the railroad tracks located between the proposed development and the bluff edge for an equivalent life span (100 years), to the maximum extent feasible and to avoid the installation of shoreline protective devices on the beach and bluff. Open space and/or active and passive recreational uses (e.g., trails) are the only acceptable uses located within this setback with the exception of existing development, such as railway transportation.</td>
</tr>
<tr>
<td>Public Access</td>
<td>Carmel Area of Monterey County Specific Policies 2.7.4.10, pg. 38 Revetments, groins, seawalls, or retaining walls, and other such construction that alters natural shoreline processes shall be permitted only where required for the protection of existing development. These structures shall not impede lateral beach access and shall respect, to the greatest degree possible, natural landform and visual appearance.</td>
</tr>
<tr>
<td>3b</td>
<td><strong>City of Santa Barbara Marine Resources Policy 6.5</strong> seawalls, revetments, bulkheads and all other permitted structures shall not encroach upon any beach area to a degree which impedes lateral access along the beach at any tide condition.</td>
</tr>
<tr>
<td>Public Access</td>
<td>Marin County LUP, Policy 4 Construction of shoreline protection measures otherwise permitted by LCP policies shall accommodate previously existing shoreline access.</td>
</tr>
<tr>
<td>3c</td>
<td>Del Monte County LCP/Zoning Ordinance C. 1 and LCP Policy 11 C. Lateral Access 1. New development along the immediate shoreline shall provide lateral access by access easements along the shoreline, inland of the mean high tide to the first line of vegetation or to the crest of the paralleling bluff in areas of coastal bluffs.</td>
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<tr>
<td>Public Access</td>
<td>No permit shall be issued for a project which obstructs lateral access on the immediate shoreline, inland of the mean high tide to the first line of vegetation, or the crest of the paralleling bluff. Exceptions to these requirements would be for the placement of navigational aids or shoreline protective devices to protect existing structures (i.e., Section 21.35.040(B) (2)).</td>
</tr>
<tr>
<td>Existing Development</td>
<td><strong>Santa Barbara County, Seawall and Shoreline Structures, Policy 3.1:</strong> Seawalls shall not be permitted unless the County has determined that there are no other less environmentally damaging alternatives reasonably available for protection of existing principal structures. The County prefers and encourages non-structural solutions to shoreline erosion problems, including beach replenishment, removal of endangered structures and prevention of land divisions on Shorefront property subject to erosion; and, will seek solutions to shoreline hazards on a larger geographic basis than a single lot circumstance. Where permitted, seawall design and construction shall respect to the degree possible natural landforms. Adequate provision for lateral beach access shall be made and the project shall be designed to minimize visual impacts by the use of appropriate colors and materials.</td>
</tr>
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</table>
| Existing Development | **City of Santa Barbara, Policy 6.3**  
**Policy 6.3:** Seawalls, revetments and bulkheads shall not be permitted unless the City has determined that they are necessary to, and will accomplish the intent of protecting existing principal structures, and that there are not less environmentally or aesthetically damaging alternatives such as relocation of structures, sand augmentation, groins, drainage improvements, etc. Determinations permitting such structures shall be based upon the findings and recommendations of geology, soils and engineering reports prepared by licensed and registered professionals in those fields. |
| Existing Development | **San Mateo County, Hazards Component, Policy 9.12:**  
**Limited Protective Shoreline Structures:**  
a) Permit construction of shoreline structures such as retaining walls, groins, revetments, and breakwaters only in accordance with the following conditions when: (1) necessary to serve coastal-dependent uses, to protect existing development, or to protect public beaches in danger of erosion, (2) designated to eliminate or mitigate adverse impacts on local shoreline sand supply, and (3) non-structural methods (e.g., artificial nourishment) have been proved to be infeasible or impracticable.  
b) Protect existing roadway facilities which provide public access to beaches and recreational facilities when alternatives routes are not feasible and when protective devices are designed in accordance with the requirements of this Component and other LCP policies. |
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| **Historical Background/ Basis for Limiting Shoreline Structures** 5 | **City of Santa Barbara**: Water and Marine Resources section re: Dredging Activities and Seawalls, pg. 3–67 ff.  
Dredging activities are of major significance for the City’s shoreline. Development of the Harbor beginning in the late 1920s, while providing facilities for the commercial fishing industry and recreational opportunities for generations of local citizens and visitors, was achieved not without environmental costs. Serious problems associated with sand accretion and beach erosion occurred from the outset. The littoral transport of beach sand was arrested by emplacement of the Breakwater. Sand impoundment occurs within the Harbor for the same reason. The sand that deposits at the Harbor site would, if not removed, accumulate to the point of filling in the Harbor. Downcoast beaches have never fully recovered from the initial blockage of easterly sand-movement.  
Replenishment of sand for beaches to the east is dependent upon Harbor dredging efforts. Without this artificial nourishment, downcoast beaches are exposed to wave attack and shoreline erosion ensues. Sand is normally transported downcoast by the longshore current and deposited by the energy-generating forces of wave refraction. This phenomenon of littoral drift is limited to the breaker and near-breaker zones. Thus, when shoreline structures, such as breakwaters and groins, intercept the littoral drift and curtail sand supply, artificial nourishment becomes imperative… |
| **Hazard Area 6a** | **San Luis Obispo County, Hazards Policy 7**: The GSA combining designation in coastal areas of the county is amended to include all coastal bluffs and cliffs greater than 10 feet in vertical relief and that are identified in the Assessment and Atlas of Shoreline Erosion (DNOD, 1977) as being critical to future or present development. Maps clearly distinguish the different geologic and seismic hazards which the county covers by the GSA combining designation. These hazards shall include steep slopes, unstable slopes, expansive soils, coastal cliff and bluff instability, active faults, liquefaction and tsunami. [THIS POLICY SHALL BE IMPLEMENTED BY DESIGNATING GSA AREAS ON THE COMBINING DESIGNATION MAPS AND PURSUANT TO SECTION 23.07.080 OF THE CZLUO.]  
**San Luis Obispo County Coastal Zone Land Use Ordinance (CZLUO), Section 23.07.080, Geologic Study Area (GSA)**: A Geologic Study Area combining designation is applied by the Official Maps (Part III) of the Land Use Element, to areas where geologic and soil conditions could present new developments and their users with potential hazards to life and property. These standards are applied where the following conditions exist:  
…  
**d. Erosion and stability hazard — coastal bluffs.** Areas along the coast with coastal bluffs and cliffs greater than 10 feet in vertical relief that are identified in the Coastal Erosion Atlas, prepared by the California State Department of Navigation and Ocean Development (1977), in accordance with Hazards Policy No. 7 of the Local Coastal Plan. |
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<tr>
<td>Hazard Area</td>
<td>City of Sand City, Natural Hazards Policies,</td>
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<td>6b</td>
<td>4.3.10: Encourage the clustering of developments away from potentially hazardous areas and condition project permits based upon recommendations presented in the geologic report.</td>
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<td>a) South of Bay Avenue, in no event shall the setback be less than 200 feet from the mean high water line. The mean high water line shall be established and adopted by the City as a part of the Implementation Plan for this area.</td>
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<td>b) An active recreation beach zone and public amenity zone shall be established between the mean high water line and the building envelope. Uses allowed in the active beach and public amenity zones are described in Policy 6.4.1 of this Plan.</td>
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<td>4.3.11: No development will be allowed in the tsunami runup zone, unless adequately mitigated. The tsunami run-up zone and appropriate mitigation, if necessary, will be determined by the required site-specific geological investigation.</td>
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<td>Coastal Commission Staff Comment: These policies apply to a shoreline composed largely of sand dunes with little in the way of “typical” vertical coastal bluffs. Thus the 200 foot setback mentioned in a) should not be construed as applying to development on top of a “typical” vertical coastal bluff.</td>
</tr>
<tr>
<td>Hazard Area</td>
<td>San Mateo County, Hazards Component Policies:</td>
</tr>
<tr>
<td>6c</td>
<td>9.1 Definition of Hazard Areas: Define hazardous areas as fault zones and land subject to dangers from liquefaction and other severe seismic impacts, unstable slopes, landslides, coastal cliff instability, flooding, tsunamis, fire, and steep slopes (over 30%)</td>
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<td>9.2 Designation of Hazard Areas: Designate hazardous areas in the Coastal Zone as those delineated on the Geotechnical Hazards Synthesis Map, the Floodway Boundary and Floodway Maps and Flood Insurance, Rate Maps adopted under Chapter 35.5 of the San Mateo County Zoning Regulations, and the Natural Hazards Map in the Natural Hazards Chapter of the General Plan.</td>
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<td>9.3 Regulation of Geologic Hazard Areas: Apply the following regulations of the Resource Management (RM) Zoning Ordinance to designated geologic hazard areas:</td>
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<td>a. Section 6324.6 - Hazards to Public Safety Criteria</td>
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<td>b. Section 6326.2 - Tsunami Inundation Area Criteria</td>
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<td>c. Section 6326.3 - Seismic Fault/Fracture Area Criteria. Require geologic reports prepared by a certified engineering geologist consistent with “Guidelines for Geologic/Seismic Reports” (CDMG Notes #370 for all proposed development.</td>
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<td>d. Section 6326.4 - Slope Instability Area Criteria.</td>
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<tr>
<td>Hazard Area</td>
<td><strong>9.10 Geological Investigation of Building Sites</strong>: Require the County Geologist or an independent consulting certified engineering geologist to review all building and grading permits in designated hazardous areas for evaluation of potential geotechnical problems and to review and approve all required investigations for adequacy. As appropriate and where not already specifically required, require site specific geotechnical investigations to determine mitigation measures for the remedy of such hazards as may exist for structures of human occupancy and/or employment other than those considered accessory to agriculture as defined in Policy 5.6. “Hazards areas” and “hazards” are defined as those geotechnical hazards shown on the current Geotechnical Hazards Synthesis Maps of the General Plan and the LCP Hazards Maps. A copy of the report of all geologic investigations required by the California Division of Mines and Geology shall be forwarded to that agency.</td>
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| 6c (cont’d)    | **Carmel Area of Monterey County, General and Specific Policies**
|               | **2.7.3.3**: New land divisions which create commitment to new or intensified development shall be approved only where it can be demonstrated that development of each proposed parcel and construction of the proposed access roads will neither create nor significantly contribute to erosion, geologic instability, flooding, or fire hazard, not require construction of new protective devices which would substantially alter natural landforms. |
| New Development | **San Mateo County, Hazards Component, Policy 9.11**: Locate new development (with the exception of coastal dependent uses or public safety recreational facilities) in areas where beach erosion hazards are minimal and where no additional shoreline protection is needed. |
| 7b             | **City of Grover Beach, Marine Resource Areas, Sand Dunes, Policy 1**: No development shall be allowed in the vegetated dune areas; development adjacent to vegetated dunes shall be sited and designed to prevent impacts which would significantly degrade the vegetated dunes. Retaining fences, walls, or other structures or earth moving activities shall be allowed only to protect existing structures. |
| New Development | **Marin County, Unit 1, LCP Policies on Natural Dune and Sandy Beach Protection**
| 7c             | **Policy 20**: Development of other shorefront lots within the Stinson Beach and Seadrift areas shall assure preservation of the natural sand dune formations in order to protect environmentally sensitive dune habitat and vegetation and to maintain the natural protection from wave runup that such natural dunes provide. Where no dunes are evident, any new development on oceanfront lots shall be set back behind the first line of terrestrial vegetation to the maximum extent feasible, in order to minimize the need for protective works, to protect sandy beach habitat, and to provide a buffer area between private and public use areas in order to protect both the scenic and visual character of the beach, and the public right of access to the use and enjoyment of dry sand areas. **Policy 21**: No additional subdivision of beachfront lots shall be permitted in recognition of the cumulative negative impacts such divisions would have on both public and private use of the beach, except if a finding is made that such a
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<td>New Development 7d (cont’d)</td>
<td>subdivision will be consistent with the above policy. Similarly, the erection of fences, signs, or other structures seaward of any existing or proposed development and the modification of any dune or sandy beach area shall not be permitted except as provided in Chapter III of the LCP in order to protect natural shoreline processes, the scenic and visual character of the beach, and the public and private use of dry sand areas in accordance with Section 30211 of the Coastal Act.</td>
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<tr>
<td>New Development 7e</td>
<td>Malibu/Santa Monica Mountains, Bluff and Beach Erosion Policy 165: No further permanent structures shall be permitted on a bluff face, except for engineered stairways or accessways to provide beach access where no feasible alternative means of public access exists.</td>
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| New Development 7f | City of Encinitas Hazards Policy 1.6f: The City shall provide for the reduction of unnatural causes of bluff erosion, as detailed in the Zoning Code, by:…  
Requiring new structures and improvements to existing structures to be set back…40 feet from coastal blufftop edge with exceptions to allow a minimum coastal blufftop setback of no less than 25 feet. For all development proposed on coastal blufftops, a site-specific geotechnical report shall be required. The report shall indicate that the coastal blufftop setback will not result in risk of foundation damage resulting from bluff erosion or retreat to the principal structure within its economic life and with other engineering evidence to justify the coastal blufftop setback.  
On coastal bluffs, exceptions to allow a minimum setback of not less than 25 feet shall be limited to additions or expansions to existing principal structures which are already located seaward of the 40 foot coastal blufftop setback, provided the proposed addition or expansion is located no further seaward than the existing principal structure, is set back a minimum of 25 feet from the coastal blufftop edge, and the applicant agrees to remove the proposed addition or expansion, either in part or entirely, should it become threatened in the future.  
In all cases, all new construction shall be specifically designed and constructed such that it could be removed in the event of endangerment and the applicant shall agree to participate in any comprehensive plan adopted by the City to address coastal bluff recession and shoreline erosion problems in the City  
This does not apply to minor structures that do not require a building permit, except that no structures, including walkways, patios, patio covers, cabanas, windscreens, sundecks, lighting standards, walls, temporary accessory building not exceeding 200 square feet in area, and similar structures shall be allowed within five feet from the bluff top edge…. |
| Emergency 8a | Marin County Policies 7 and 8, Shoreline Protection and Hazards  
7. The County of Marin through the LCP and other documentation has identified those coastal areas potentially subject to significant wave and run-up erosion.  
8. It shall be County policy to encourage property owners subject to ocean-front erosion hazards to develop responses to such hazards prior to emergency conditions. Where contiguous properties are subject to generally similar erosion hazards, joint program development should occur. |
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| Emergency 8b   | **City of Encinitas, Section 30.34.020, Coastal Bluff Overlay Zone, Subsection E, Temporary Emergency Protection Devices**: Notwithstanding other regulations of the City, the City Manager or his/her designee may permit the installation of temporary emergency protection/retention facilities (such as riprap, walls, erosion control devices, etc.) on or at the base of a coastal bluff if:  
1. Enclosed or principal buildings at the top of an ocean bluff are threatened by a potential bluff failure/collapse.  
2. The threat is imminent. A statement of a State-licensed engineer or engineering geologist establishing an imminent threat may be required if the City Engineer is not able to determine the imminent threat.  
3. Documentation shall be provided that the proposed temporary protection is the minimum necessary to address the emergency and to assure minimal encroachment onto sandy beach area. In addition, construction access and staging plans shall be submitted which document that no public beach parking areas will be utilized for the interim storage of materials or equipment and that overnight storage of equipment or materials will not be permitted on the sandy beach. |
| Emergency 8c   | **San Luis Obispo County, Section 23.03.045, Emergency Permits, Coastal Zone Land Use Ordinance**: The purpose of this section is to establish procedures for the issuance of emergency permits in situations that constitute an emergency as defined by this section. Emergency permits may be granted by the Planning Director as provided by this section, in accordance with Section 30624 of the Coastal Act and Sections 13329 of Title 14 of the California Administrative Code.  
a. Emergency defined. For the purposes of this section, an emergency is a sudden, unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property or essential public services.  
b. Permit procedure. In cases of such emergency, the Planning Director may issue an emergency permit in accordance with the following provisions:  
(1) Applications in cases of emergencies shall be made to the Planning Director in writing if time allows, or by telephone or in person if time does not allow.  
   ...  
(6) Within 30 days of the notification required in subsection b(1) of this section, the property owner shall apply for a land use permit as required by this title and any construction permits required by Title 19 of this code. Failure to file the applications and obtain the required permits shall result in enforcement action pursuant to Chapter 23.10 of this code.  
(7) The Planning Director shall not issue an emergency permit for any work to be undertaken on any tidelands, submerged lands, or on public trust lands, whether filled or unfilled; requests for emergency work in these areas shall be referred to the California Coastal Commission. |
| Regional 9     | **BEACON (Beach Erosion Authority for Control Operations and Nourishment)**, a Joint Powers Authority among the cities of Carpinteria, Oxnard, Port Hueneme, Santa Barbara, and San Buenaventura (Ventura), and the counties of Santa Barbara and Ventura; please contact the Commission’s Ventura office for further information. |
APPENDIX A: GLOSSARY OF COASTAL PROCESS TERMS

Accrete: to add new material gradually to pre-existing material; opposite of erode.

Accretion: enlargement of a beach area caused by either natural or artificial means. Natural accretion on a beach is the build-up or deposition of sand or sediments by water or wind. Artificial accretion is a similar build-up due to human activity, such as the accretion due to the construction of a groin or breakwater, or beach fill deposited by mechanical means.

Aeolian Transport: movement of sediment by the wind. Aeolian sediments have a greater angularity of the grains, compared with waterborne particle.

Alluvium: soil (sand, mud, or similar eroded material) deposited by streams. This deposit may be a stratigraphic (layered) deposit beneath the surface.

Aquifer: an underground layer of porous rock, sand, or other earth material containing water, into which wells may be sunk.

Arcuate: A curved somewhat semi-circular feature; used to describe a rounded, concave shoreline.

Armor: to fortify a topographical feature to protect it from erosion (e.g., constructing a wall to armor the base of a sea cliff).

Armor rock: (armor stone) natural or man-made rock or rock-like structures that are used for shoreline protection. Commonly, armor rock is used as the outermost layer of a groin or revetment. Many forms of these rocks are utilized; their overall stability depends largely on the type of mechanical interlock between the units, and in-place fitting (Figure 1).

Artificial headland: A hard structure extending from the shore and turning parallel to it; built to stabilize the shoreline locally as a natural headland would.

Artificial nourishment: the process of enlarging a beach with material (usually sand) obtained from another location.

Backbeach (dry beach): the sand area inundated only by storm tides or extreme high tides. These areas supply sands to the dune system.

Backshore: the region of the shore or beach lying between the foreshore and the coastline and acted upon by waves only during severe storms (Figure 2).

Bar: an elongated sand ridge found offshore, composed of sand or gravel eroded from the beach.
Figure 1: Manufactured units of armor rock used in breakwaters, jetties, groins, and revetments. Shown are various views of some of the different styles; the tetrapod, quadripod, tribar, and dolos armor units. These structures are commonly about 3–5 meters wide and each weighs more than three tons.

**Barchans:** the crescent shaped sand mounds that form when there is one dominant wind direction but a limited supply of sand.

**Bathymetry:** related to submarine contours or topography; also refers to depth measurements.

**Beach:** the expanse of sand, gravel, cobble or other loose material that extends landward from the low water line to the place where there is distinguishable change in physiographic form, or to the line of permanent vegetation. The seaward limit of a beach (unless specified otherwise) is the mean low water line (Figure 2).
Beachfill: sand or other material used to artificially replenish a beach. Dedicated beachfill is that which has been obtained specifically for beach replenishment. Opportunistic beachfill is that which has been excavated for other purposes then made available for beach replenishment.

Beach nourishment project: placement of sand on a beach to form a designed structure in which an appropriate level of protection from storms is provided and an additional amount of sand (advanced fill) is installed to provide for erosion of the shore prior to the anticipated initiation of a subsequent project. The project may include dunes and/or hard structures as part of the design.

**Figure 2**: Cross section of a typical local shore profile.

Beach nourishment program plan for conducting a series of beach nourishment projects at a specific location, typically over a period of 50 years. The program would be based on establishing the technical and financial feasibility of beach nourishment for the site and would include plans for obtaining funding and sources of sand for its duration.

Beachgrass: any of the genus Ammophila of deeply rooted, tough, perennial grasses that grow on sandy beaches and are often planted to combat beach erosion.

Bedrock solid rock underlying soil and younger rock layers; generally the oldest exposed geological unit.
**Berm**: a nearly horizontal portion of the beach or backshore formed by the deposit of material by wave action. Some beaches have no berms and others may have one or several (Figure 2).

**Bight**: a bay caused by a bend in the coastline.

**Block fall**: a type of landslide; specifically used to describe failure of a vertical cliff.

**Blowouts**: are circular rims or depressions formed where sand has been removed by wind; often caused by removal of vegetation.

**Bluff (or cliff)**: a scarp or steep face of rock, weathered rock, sediment or soil resulting from erosion, faulting, folding or excavation of the land mass (Figure 2). The cliff or bluff may be simple planar or curved surface or it may be steplike in section. For purposes of (the Statewide Interpretive Guidelines), “cliff” or “bluff” is limited to those features having vertical relief of ten feet or more and “seacliff” is a cliff whose toe is or may be subject to marine erosion.

**Bluff edge (or cliff edge)**: the upper termination of a bluff, cliff or seacliff. When the top edge of the cliff is rounded away from the face of the cliff as a result of erosional processes related to the presence of the steep cliff face, the edge shall be defined as that point nearest the cliff beyond which the downward gradient of the land surface increases more or less continuously until it reaches the general gradient of the cliff. In a case where there is a steplike feature at the top of the cliff face, the landward edge of the topmost riser shall be taken to be the cliff edge. The termini of the bluff line, or edge along the seaward face of the bluff, shall be defined as a point reached by bisecting the angle formed by a line coinciding with the general trend of the bluff line along the seaward face of the bluff, and a line coinciding with the general trend of the bluff line along the inland facing portion of the bluff. Five hundred feet shall be the minimum length of bluff line or edge to be used in making these determinations (from Public Resources Code Section 13577).

**Bluff top retreat (or cliff top retreat)**: the landward migration of the bluff or cliff edge, caused by marine erosion of the bluff or cliff toe and subaerial erosion of the bluff or cliff face.

**Bore**: to make a hole in or through with a drill or other device. Used commonly for determining stratigraphic (sedimentary) history, to reveal information on past site conditions and provide some guidance on future site stability or erosive potential.

**Borrow area**: an area from which construction or beach replenishment material is mined for use in a different area.

**Breach**: a breakthrough of part, or all, of a protective wall, beach sand barrier, beach berm, or the like by ocean waves, river or stream flow, mechanical equipment, or a combination of these forces. Breaching is sometimes purposefully done to protect a region from river overflow.
**Breaker**: a wave breaking on a shore, over a reef, etc. Breakers may be classified into four types; spilling, plunging, collapsing, and surging.

**Breakwater**: a structure or barrier protecting a shore area, harbor, anchorage, or basin from waves, usually constructed as a concrete or riprap (rock wall) structure (Figure 3).

**Breccia**: a type of sedimentary rock containing course, angular fragments.

**Bulkhead**: a structure or partition used to retain or prevent landslides and mass land movement. A secondary purpose is to protect the upland against damage from wave action.

**Figure 3**: A **breakwater** will lessen or null the forces of incoming waves, providing some shoreline protection. (Dashed arrows indicate general wave direction). Often, a breakwater will be located at the mouth of a harbor bounded by jetties. Jetties are used to hold open a tidal inlet, calm wave forces, and slow beach erosion on its periphery by trapping sediments. (Top view)
Caisson: A supporting piling constructed by drilling a casing hole into a geologic formation and filling it with reinforcing bar and concrete; using for foundations.

California Least Tern: an endangered bird species that nests on beaches and in salt marshes along California; smallest of the terns.

Cantilever walls: vertical walls that use a deep foundation to resist horizontal wave forces. Walls are often constructed of pre-fabricated panels that are jetted or driven into the sand. Typically for every foot of exposed wall there should be at least half a foot of buried foundation wall to prevent overturning. (Engineered designs may vary, based on site-specific conditions.)

Cementation: the process by which loose sediment is bound together into rock.

Clast: rock composed of fragments.

Cobble: generally describes well-rounded rocks along the shore and in river channels. Cobble size particles are between pebbles and boulders, generally larger than coarse gravel (76 mm). California has numerous cobble beaches, with cobble exposed year-round or covered by sand during mild wave periods and exposed during and after storm conditions.

Continental shelf: The zone bordering a continent and extending from the low water line to depth (usually about 180 meters) where there is a marked or rather steep descent toward a greater depth.

Contour: a line on a topographic map or bathymetric (depth) chart representing points of equal elevation with relation to a datum (point or set of points). Contour lines are usually spaced into intervals for easier comprehension and utilization.

Cretaceous: a period of geologic time spanning 136–64 million years ago.

Current: a flow of water in a particular direction. Such flows can be driven by wind, temperature or density differences, tidal forces, and wave energy. Currents are often classified by location, such as longshore current, surface current, or deep ocean currents. Different currents can occur in the same general area, resulting in different water flows, for example, a rip current can flow perpendicular to the shore through the surf zone, a long shore current may flow southerly, parallel to the coast and a seasonal deep water current may flow to the north.

Delta: an area of loose deposit of silt, sand, and gravel, roughly triangular in shape, formed at the mouth of a river or rivers.

Diffraction (of water waves): The phenomenon by which energy is transmitted laterally along a wave crest. When a barrier, such as a breakwater interrupts part of a train of waves, the effect of
diffraction is manifested by propagation of waves into the sheltered region within the barrier’s geometric shadow.

**Dissipate**: to break up, scatter, dispel, or dispense energy. The many forms of breakwaters and revetments act as dissipaters of wave energy.

**Distributary**: The branching channels of marine deltas generated as a result of the reduction of the channel gradient and consequent deposition within the channel.

**Downcoast**: in the United States usage, it is the coastal direction generally trending toward the south; also the way in which current flows.

**Downdrift**: the direction of predominant movement of littoral (shore) materials.

**Dune**: ridges or mounds of loose, wind-blown material usually sand. A dune structure often has a back and foredune area. Stable dunes are often colonized by vegetation. (Figure 4)

**Dynamic equilibrium**: a beach or coastline condition where neither erosion nor accretion is occurring, but where the beach is continuously being reshaped by wave action.

**Ebb tide**: the period of tide between high water and the succeeding low water; a falling tide. (opposite = flood tide)

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**Figure 4**: Cross section of a beach with dunes showing a foredune and backdune. Sand is transported in a landward direction from the shoreline creating a slightly steeper face on the seaward side of the dune.
Eocene: a period of geologic time spanning 54–38 million years ago.

Equilibrium beach width: the mean distance between the shoreline and backbeach line at which sand contributions and losses are balanced.

Erode: the gradual wearing away and removal of land surface by various agents such as waves; opposite of accrete.

Erosion: the wearing away of land by natural forces. On a beach, the carrying away of beach material by wave action, currents or the wind.

Escarpment: a more or less continuous line of cliffs or steep slopes facing in one general direction, caused by erosion or faulting (Figure 2).

Estuary: the region near a river mouth in which the fresh water of the river mixes with the salt water of the sea.

Eustatic: refers to worldwide changes in sea level.

Evaluation: process by which a project’s performance is determined relative to criteria developed for this purpose.

Fault: a rock fracture accompanied by displacement.

Feeder beach: an artificially widened beach serving to nourish downdrift beaches by natural littoral currents or forces.

Fetch: the area in which sea waves are generated by a wind having a fairly constant speed and direction. Commonly associated with waves over the deep portion of the ocean that exhibit fairly stable speed and direction.

Fillet: the concave accumulation of sand upcoast of a natural or artificial structure.

Filter cloth: a type of strong permeable plastic cloth that is used landward of seawalls or revetments to reduce or minimize scour behind the wall.

Flood tide: the period of tide between low water and the succeeding high water; a rising tide. (opposite = ebb tide)

Forebeach (wet beach): the sand area affected regularly by tides and wave action.
Foreshore (or beach face): region of the coast extending from the berm crest (or the highest point of wave wash at high tide) to the low-water mark which is measured at low tide (Figure 2).

**Formation**: a unit of rock that is distinctive and persistent over a large area.

**Fossiliferous**: rock units containing fossils.

**Gabions**: a mesh box or enclosure filled with rocks, cobbles, stones, etc. and used as building units for dams, dikes, or shoreline protection.

**Geohazard**: a risk associated with geologic processes or events.

**Gravity walls**: massive, self-supporting walls which resist horizontal wave forces through their sheer mass. (For example, the O’Shaughnessy Seawall in San Francisco weighs approximately 12 tons per linear foot.)

**Groin**: a shoreline protection structure built (usually perpendicular to the shoreline) to trap nearshore sediment or retard erosion of the shore (Figure 5). A series of groins acting together to protect a section of beach is known as a groin system or groin field.

**Groundwater**: subsurface water occupying the zone of saturation usually found in porous rock strata and soils.

**Gunnite**: slurry concrete that is sprayed onto forms or structures; often used as a facing material for structural seawalls or retaining walls. Almost all strength comes from the supporting material or forms.

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**Figure 5: Types of groins** — a form of shoreline protection. (Arrows show predominant longshore current direction; dashed area shows typical accretion zone). (Top view)
**Headland**: (Head) a high, steep-faced projection extending into the sea, usually marking an area of fairly stable and rigid landform.

**Holocene**: in geologic time, less than 11,000 years ago; also called *Recent*.

**Jetty**: on open seacoasts, a structure extending away from the shore, which is designed to prevent shoaling of a channel and to direct and confine the stream or tidal flow. Jetties are built at the mouths of rivers, harbors, or tidal inlets to help deepen and stabilize the access channel (Figure 3).

**Lagoon**: a shallow body of water, such as a pond or lake, usually located near or connected to the sea.

**Leeward**: The direction toward which the wind is blowing.

**Liquefaction**: the process of becoming liquid, especially applied to sand that loses its bearing strength due to strong shaking.

**Littoral**: of or pertaining to a shore, especially of the sea.

**Littoral cell**: a region that encompasses most features affecting sediment transport. The boundaries of the cell are usually delineated by river drainage areas, promontory headlands, or submarine canyons on the periphery, the continental shelf-continental slope boundary on the seaward side and by inland ridges and river inlets on the landward side. Sediment within these cells generally travel seaward by river drainage, southward (downcoast) by longshore currents, and are eventually lost to the continental slope area or submarine canyon (Figure 6).

**Littoral drift**: the sedimentary material moved in the littoral zone under the influence of waves and currents; consisting of silt, sand, gravel, cobbles, and other beach material.

**Littoral transport**: the movement of sediment in the littoral zone by waves, currents, and tides. This includes movement parallel (longshore transport) and perpendicular (on-offshore transport) to the shore.

**Littoral zone**: the region where waves, currents, and winds interact with the land and its sediments. This region comprises a backshore, foreshore, inshore, and offshore and is broken down into littoral cells (Figure 6).

**Longshore**: parallel to and near the shoreline.

**Longshore current**: a flow of water in the breaker zone, moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline.
**Figure 6: Littoral drift** occurs within a littoral cell which is often bordered by river drainage areas, submarine canyons, and/or projecting headlands. (This sample taken from the Santa Cruz and Monterey Counties.) (Top view)

**Marine terrace**: a flat or gentle seaward sloping wave-cut bench, which is a remnant of an old coastline. Marine terraces are conspicuous along most of the California coast where uplift has occurred.

**Mean high water**: See Tides

**Mean higher high water**: See Tides

**Mean low water**: See Tides

**Mean lower low water**: See Tides

**Mean sea level**: See Tides
**Mesa:** an isolated, relatively flat geographical feature, often demarcated by canyons (from Spanish *mesa,* “table”).

**Midden** refuse heap or other deposit left by ancient humans.

**Miocene:** a period of geologic time spanning 27–26 million years ago.

**Monitoring:** systematic collection of physical, biological, or economic data or a combination of these data on a beach nourishment project in order to make decisions regarding project operation or to evaluate project performance.

**National Geodetic Vertical Datum of 1929 (NGVD):** a fixed reference for elevations, equivalent to the 1929 Mean Sea Level Datum. The geodetic datum is fixed and does not take into account the changing stands of sea level. NGVD should not be confused with mean sea level. (see *tides: mean sea level*)

**Nearshore zone:** an indefinite zone extending seaward from the shoreline well beyond the breaker zone; it defines the area of nearshore currents.

**Nourishment:** the process of replenishing or enlarging a beach. It may be brought about naturally by longshore transport or artificially by the deposition of dredged materials.

**Offshore:** off or away from the shore. This area extends from beyond the breaker zone to the outer limit of the littoral zone and beyond (Figure 2).

**Onshore:** (inshore) The region between the seaward edge of the foreshore and the seaward edge of the breakers or waves (Figure 2).

**Overwash:** the process by which severe storm waves sweep over a dune, beach, or shore structures, often causing flooding.

**Perimeter foundation:** a foundation type that supports a building on a low wall or footing extending around the outer edge of the building.

**Perched beach:** a sill that retains sand (sediment) behind or landward of it. The sill can be placed offshore or above the high tide line to hold and protect a fill and eliminate the need for offshore sand to form a stable beach (Figure 7).

**Pile:** a long, heavy timber or section of concrete or metal driven or drilled into the earth or seabed to serve as a support or protection.

**Pleistocene:** a period of geologic time spanning 2 million — 11,000 years ago.
Pliocene: a period of geologic time spanning 7–2 million years ago.

Pocket beach: a small beach formed between two points or headlands, often at the mouth of a coastal stream. Pocket beaches are common throughout the California coastline.

**Figure 7:** Cross section of a *perched beach*.

Public Trust Lands: Public Trust lands shall be defined as all lands subject to the Common Law Public Trust for commerce, navigation, fisheries, recreation, and other public purposes. Public Trust Lands include tidelands, submerged lands, the beds of navigable lakes and rivers, and historic tidelands and submerged lands that are presently filled or reclaimed and which were subject to the Public Trust at any time. (From Public Resources Code 13577; see tidelands and submerged lands.)

Quaternary: a period of geologic time comprising the past 2 million years; includes the Pleistocene and Holocene ages.

Receiver beach: for beach nourishment, the area where beach material is placed.

Recurved or concave-faced walls: vertical concrete walls with either a seaward facing curve at the top of the wall or along the entire height of the wall. The purpose of the curved face is to reflect the wave energy seaward and prevent overtopping or toe scour.

Reflection: Redirection of a wave when it impinges on a steep beach, cliff or other barrier;

Refraction: (1) process which changes the direction of a wave moving into shallow water at an angle to the contours: the part of the wave advancing in shallower water moves more slowly than
the part in deeper water, causing the wave crest to bend toward alignment with the underwater contours. (2) bending of wave crests by currents.

**Retaining wall**: low wall used to support or retain an earth embankment or area of fill.

**Revetment**: a sloped retaining wall; a facing of stone, concrete, blocks, rip-rap, etc. built to protect an embankment, bluff, or development against erosion by wave action and currents.

**Rill**: the channel of a small stream or gully.

**Rip current**: a strong surface current flowing seaward from the shore. It usually appears as a visible band of agitated water and is the return movement of water piled up on the shore by incoming waves and wind. With the seaward movement concentrated in a limited band its velocity is accentuated. Rip currents can be used by swimmers, divers, and surfers to get through the surf zone relatively easily. On the other hand, "rips" can also pull inexperienced swimmers and waders into deeper water away from the shore (Figure 8a). Since a rip current is usually quite narrow, the most effective way to get out of it is to swim perpendicular to the direction of the flow (in most cases, parallel to the beach). Rip currents can often develop adjacent to a jetty or groin (Figure 8b).

**Riprap**: a protective layer or facing of rock, concrete blocks or quarrystone, placed to prevent erosion, scour, or sloughing of an embankment or bluff.

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**Figure 8a**: Rip current along a straight coastline (Top view)  
**Figure 8b**: Rip current along a jetty. (Top view)
**Sand by-pass**: deliberate transfer of sand along the shore around a barrier such as a jettied harbor entrance or inlet. In the case where sand accumulates preferentially on one side of an inlet, this action may result in nourishment of the beach on the eroding (receiving) side.

**Sand source**: resource of sand that can be economically used for beach nourishment. The sand must meet the requirements for size distribution and cleanliness and its removal and transfer must not create unacceptable environmental effects. The source may be on land, offshore, in a nearby inlet, or in a navigational channel, a shoal, or other area in which sand accumulates.

**Sandstone**: a rock composed predominantly of sand grains that have undergone cementation.

**Scarp**: (beach scarp) an almost vertical slope along the beach caused by wave erosion. It may vary in height from a few centimeters to a meter or more, depending on wave action and the nature and composition of the beach (Figure 2).

**Scour**: removal of material by waves and currents, especially at the back, base, toe or edges of a shore structure.

**Sea level**: the height of the ocean relative to land; tides, wind, atmospheric pressure changes, heating, cooling, and other factors cause sea-level changes.

**Seawall**: a structure separating land and water areas, primarily designed to prevent erosion and other damage due to wave action. It is usually a vertical wood or concrete wall as opposed to a sloped revetment.

**Seas (waves)**: waves caused by wind at the place and time of observation. (see **swell**).

**Sediment**: grains of soil, sand, or rock that have been transported from one location and deposited at another.

**Sediment budget**: an account of the sand and sediment along a particular stretch of coast; the sources, sinks, rates of movement, or the supply and loss of sediment.

**Seiche**: a standing wave oscillation in an enclosed waterbody that continues (in a pendulum fashion) after the cessation of the originating force. Seiches can be caused by tidal action or an offshore seismic event.

**Shale**: a rock composed predominantly of clay minerals.

**Shoal**: a shallowing of the depth of water, often a navigational channel. This shallowing may be caused by the deposition of river sediments or littoral materials and often becomes a hazard to navigation. Incoming ocean waves will heighten and may break as they approach the shallowing shoreline. Dredging and channel modification is often utilized to reduce deposition.
Shore: narrow strip of land in immediate contact with the sea, including the zone between high and low water. A shore of unconsolidated material is usually called a beach (Figure 2).

Shoreline: intersection of the ocean or sea with land; the line delineation the shoreline on National Ocean Service nautical charts and surveys approximates the mean low water line from the time the chart was prepared.

Shore protection: structures or sand placed at or on the shore to reduce or eliminate upland damage from wave action or flooding during storms.

Slab foundation: a foundation type that supports a building in a thin layer of steel reinforces concrete.

Slough: to erode the uppermost layer of soil, or to crumble and fall away from the face of a cliff.

Soldier pile wall: vertical pilings or steel H-beams deeply embedded into the sand or bedrock, with horizontal planks or beams landward of the vertical supports.

Spit: a small, naturally formed point of land or a narrow shoal projecting into a body of water from the shore (Figure 9).

Still water level: The elevation that the surface of the water would assume if all wave action were absent.

Storm surge: A rise above normal water level on the open coast due to the action of wind stress on the water surface. Storm surge resulting from a hurricane also includes the rise in level due to atmospheric pressure reduction as well as that due to wind stress.

Subaerial: formed, existing, or taking place on the land surface; contrasted with subaqueous or underwater.

Subaerial erosion: erosion that occurs on the land surface due to removal of surface material by wind, water, weathering, and gravity. (see erosion).

Submarine Canyon: a steep-sided underwater valley commonly crossing the continental shelf and slope.

Submerged Lands: Submerged lands shall be defined as lands which lie below the line of mean low tide (from Public Resources Code 13577; see Public Trust Lands).
Surf zone: area between the outermost breaking waves and the limit of wave uprush.

Surficial: relating to the earth’s surface.

Talus: a pile of rock debris at the base of a cliff.

Tectonic: related to the earth’s surface.

Terrace: a gently sloping platform cut by wave action.

Tidal epoch: (National Tidal Datum Epoch) the specific 19 year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and averaged to form tidal datums. This period occurs when the new and full moon would recur on the same day of the year. The present tidal epoch used is 1960 through 1978.

Tidal prism: the total amount of water that flows into a harbor or estuary or out again with movement of the tide, excluding any freshwater flow.

Tide: the periodic rising and falling of the water that results from gravitational attraction of the moon and sun, and other astronomical bodies, acting upon the rotating earth. The California coast has a "mixed" tidal occurrence, with two daily high tides of different elevations and two daily low tides, also of different elevations. Other tidal regimes are diurnal tides, with only one high and one low tide daily, and semidiurnal, with two high and two low tides daily, with comparatively little daily inequality between each high or each low tide level.

National Ocean Service (NOAA) maintains a network of tide and water level stations and provides basic tidal data for various coastal uses. These data are average heights of water developed from a 19-year record, and include: mean high water (MHW), mean higher high water (MHHW), mean low water (MLW), mean lower low water (MLLW), mean sea level (MSL). For shorter periods of observations, corrections are applied to eliminate known variations and develop the equivalent of a mean 19-year value. The most recent 19-year period used for obtaining average water heights, referred to as the National Tidal Datum Epoch, was 1960 through 1978.

- **mean high water**: is the 19-year average of all high water heights (if the tide is either semidiurnal or mixed) or the higher high water heights if the tide is diurnal. For diurnal tides high water and higher high water are the same.

- **mean higher high water**: is the 19-year average of only the higher high water heights

- **mean low water**: is the 19-year average of all low water heights (if the tide is either semidiurnal or mixed) or the lower low water heights if the tide is diurnal. For diurnal tides low water and lower low water are the same.
**mean lower low water**: is the 19-year average of only the lower low water heights

**mean sea level**: is the 19-year average height of the surface of the sea for all stages of the tide, usually determined from hourly height readings (see NGVD of 1929).

**Tidal range**: difference between consecutive high and low (of higher high and lower low) waters. (see tides).

**Tidal wave**: wave movement of the tides. Often improperly used for tsunamis (see tsunami).

**Tidelands**: Tidelands shall be defined as lands which are located between the lines of mean high tide and mean low tide (from Public Resources Code section 13577; see Public Trust Lands).

**Figure 9**: Spits are usually formed over a long time by the accretion, or build up, of sand or other sediment. They may grow to form a beach barrier similar to this example. (Top view)

**Tie-back walls**: vertical walls that are braced into the material behind them by tie rods or cables connecting to anchors or “deaden”.

**Tombolo**: bar or spit that connects or “ties” an island to the mainland or to another island.

**Transverse dunes**: the ridges and sand mounds that form essentially perpendicular to the prevailing wind direction. These form when there is one dominant wind direction and a large supply of sand.
Tsunami: a long period wave, or seismic sea wave, caused by an underwater disturbance such as a volcanic eruption or earthquake. Commonly misnamed a "Tidal Wave."

Undertow: a seaward current near the bottom on a sloping inshore zone, caused by the return, under the action of gravity, of the water carried up on the shore by waves. Commonly misnamed a Rip Current.

Upcoast: in the United States usage, the coastal direction, generally trending toward the north, from which a current comes. Sediment will often deposit on the upcoast side of a jetty, groin, or headland, reducing the amount of sediment that is available for transport further downcoast.

Updrift: the direction opposite that of the predominant movement of littoral materials.

Wakefield bulkhead: vertical boards imbedded in sand using a tongue and groove arrangement, with horizontal planks reinforcing the seaward face.

Watershed: the geographical area drained by a river and its connecting tributaries into a common source. A watershed may, and often does, cover a very large geographical region.

Wave: a ridge, deformation, or undulation of the surface of a liquid. On the ocean, most waves are generated by wind and are often referred to as wind waves.

Wave climate: the range if wave parameters (Height, period and direction) characteristic of a coastal location.

Figure 10: Wave characteristics including wavelength, wave height, crest, and trough. Wave motion is periodic; it is repetitive through fixed periods of time.
Wave-cut platform: the near-horizontal plane cut by wave action into a bedrock formation at the shoreline.

Wave height: the vertical distance from a wave trough to crest (Figure 10).

Wave length (wavelength): the horizontal distance between successive crests or between successive troughs of waves (Figure 10).

Wave period: the time for a wave crest to traverse a distance equal to one wavelength, which is the time for two successive wave crests to pass a fixed point.

Wave run-up: the distance or extent that water from a breaking wave will extend up a beach or structure.

Windward: The direction from which the wind is blowing.

SOURCES: Many of these definitions were extracted from:


APPENDIX B: CALIFORNIA’S LITTORAL CELLS:

Smith River to Spanish Flat
California’s Littoral Cells:
Ten Mile River to Drakes Bay
California’s Littoral Cells:
Point Reyes to Point Big Sur
California’s Littoral Cells:
Morro Bay to Santa Barbara
California’s Littoral Cells:
Santa Barbara to San Pedro
California’s Littoral Cells:
Santa Monica to Silver Strand
APPENDIX C: SAMPLE STAFF FINDINGS FOR SHORELINE PROTECTION PROJECTS

<table>
<thead>
<tr>
<th>Permit Number/Name</th>
<th>Type of Project</th>
<th>Commission Action</th>
<th>Comments</th>
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<tbody>
<tr>
<td>A-3-PSB-96-100</td>
<td>Rip-rap revetment</td>
<td>Denial</td>
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<tr>
<td>Tokyo Masuiwaya</td>
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<tr>
<td>6-96-138</td>
<td>Vertical seawall</td>
<td>Denial</td>
<td>Denial based on insufficient demonstration of need. Third application, 6-98-39, was approved on a seawall and was constructed.</td>
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<td>Denver &amp; Cantor</td>
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<td>6-96-116</td>
<td>Beach nourishment</td>
<td>Approval with conditions</td>
<td>Contains monitoring for beach nourishment.</td>
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<td>La Paz Co. Landfill</td>
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<tr>
<td>6-96-102</td>
<td>Sea cave filling</td>
<td>Approval with conditions</td>
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<td>Solana Beach &amp; Tennis Club</td>
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<tr>
<td>A-6-OCB-96-104 / 6-96-89</td>
<td>Revetment and upper bluff shotcrete</td>
<td>Approval with conditions</td>
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<td>Casa de la Playa</td>
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<tr>
<td>5-90-839</td>
<td>Revetment to protect proposed road, septic system, and new homes</td>
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<td>Lechuza Villas West</td>
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<td>A-1-97-46</td>
<td>New single family residence on a bluff top</td>
<td>Approved with conditions</td>
<td>Denial of any future shoreline protection and requirement to remove any beach debris from slope failure.</td>
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<td>Riley</td>
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20 These findings have been taken from recent staff reports; they are not the only available findings. These findings provide a range of the findings which have been written recently. Inclusion or exclusion from this table does not reflect any evaluation on quality of work.
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<thead>
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<tbody>
<tr>
<td>6-99-100 Presnell et al.</td>
<td>Vertical seawall</td>
<td>Approval with conditions</td>
<td>Requirement that all future maintenance stay within project footprint, and not extend seaward</td>
</tr>
<tr>
<td>A-3-PSB-99-04</td>
<td>Single family home demolition and reconstruction</td>
<td>Approval with conditions</td>
<td>Required a greater setback than approved by local government, required the applicant to record a deed restriction denying any future shoreline protection, and an assumption of risk.</td>
</tr>
<tr>
<td>A-3-CAP-99-023</td>
<td>New bluff-top single family home</td>
<td>Approval with conditions</td>
<td>Required a greater setback than approved by the local government, an open space deed restriction over the area seaward of the approved home, and an assumption of risk.</td>
</tr>
</tbody>
</table>
APPENDIX D: TECHNICAL SERVICES UNIT WORK REQUEST FORM