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Title: Ocean Shore Protection Policy and Practices in Oregon: An Evaluation of Implementation Success

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Oregon's beaches were designated public recreation areas by the 1967 Beach Law. These beaches and adjacent shorelands experience erosion and other hazards due to winter storm waves, weathering, and geologic instability. Sea cliff recession threatens older development and inadequate construction setbacks create hazards for new buildings. The typical hazard response is to install a hard shore protection structure (SPS).

An evaluation of shore protection and land use policy implementation, factoring in recent advances in our understanding of coastal processes and engineering, suggests that policies designed to mitigate hazards and protect the beach are not working well.

Five state laws that make up the "shore protection management regime" were examined using an oceanfront tax-lot-based geographic information system (GIS) for the 16-mile long Siletz littoral cell on the central coast. Policy objectives were determined, measures of achievement and related data needs were identified, and the GIS designed accordingly.

Seven principal shore protection policy objectives and twenty-five measures of achievement were identified. GIS queries related to these measures revealed that 49% of the Siletz cell beachfront has been hardened with SPSs—69% of it since the 1967 Beach Law. Because of jurisdictional gaps, 31% of the post-1967 SPSs were not regulated. For those that were regulated and approved, no clear need could be determined in 35% of the cases. Also, 28% of the SPSs were installed on vacant lots, often because local officials required a SPS before owners could obtain a building permit. This and other findings, such as inadequate construction setbacks, suggest that *land use decisions, more than erosion hazards, are driving the demand for beachfront SPSs.*

In the SPS permit process, alternatives to hard SPSs are not thoroughly evaluated, SPSs are typically over-designed, and many encroach on the public beach, affecting access. Cumulative SPS impacts are significant, especially the blocking of 39% of the sand supply from eroding sea cliffs. Given expected future erosion and relative sea level rise along the central Oregon coast, some beaches may gradually disappear.

Based on this analysis, Oregon's ocean shore protection management regime needs an overhaul. Addressing these policy issues now will help preserve Oregon's beaches for future generations.

Ocean Shore Protection Policy and Practices in Oregon: An Evaluation of Implementation Success

by

James W. Good

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For Jon and Sandy,

to lifelong learning,

and in memory of Sally Jacobsen.

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PREFACE

The English system of measurement is used throughout this thesis. There were several reasons for this. First, most of the historical, map, permit record, and other data collected for the study were already in English units. Second, and more important, the principal audiences for the study and potential users of the GIS/database are local governments and state coastal management agencies, all of whom use the English system. When needed for other applications, the data and results of analysis can be easily transformed to the metric system.

OCEAN SHORE PROTECTION POLICY AND PRACTICES IN OREGON: AN EVALUATION OF IMPLEMENTATION SUCCESS

CHAPTER 1

INTRODUCTION

> In the administration of this God-given trust, a broad protective policy should be declared and maintained. No local selfish interest should be permitted, through politics or otherwise, to destroy or even impair this great birthright of our people. (former Governor Oswald West, speaking of Oregon's beaches, 1949—quoted in Straton 1977)

The Oregon coast is world-renowned for its rocky shores, rugged beauty, and accessible, uncrowded beaches. Oregon's beaches offer great variety. Long, gently sloping beaches backed by sea cliffs front much of the coast, interrupted only by rocky basalt headlands that extend into the sea. Steep-faced pocket beaches nestle within short stretches of rocky coastline. Barrier sand spits with dune complexes enclose the estuaries of more than a dozen coastal rivers. Other beaches form the trailing edge of landward-migrating dune sheets.

These ocean beaches are also public recreation areas by virtue of customary public use, far-sighted legislation early in the century, and a subsequent series of laws that culminated in the historic 1967 "Beach Bill." But the path that led to preservation of what former Governor Oswald West termed a "birthright" was not an easy one. It was marked with controversy—numerous legislative battles, landmark court cases, public initiative petitions, media blitzes, and charges of influence-peddling. Though the outcome of these battles was often in doubt, today we enjoy free use of both the wet and dry sand portions of Oregon's beaches. With an unparalleled system of state parks, waysides and other access points along the shore, these beaches are among the most accessible in the country.

The Oregon coastline is also one of the most dynamic in the world. Severe winter storms, large waves, strong tides and nearshore currents, and rain and high winds cut into beaches and dunes; undermine and batter sea cliffs, causing slumping and slides; and flood low-lying coastal lands. In recent years, the vulnerability of the coast to large, locally-generated earthquakes and tsunamis has become widely accepted in the scientific community, adding the threat of catastrophic hazards to the reality of the chronic ones we experience.

As coastal development pressure increases, the more hazardous sites avoided earlier fill in with houses, motels, and condominiums. Also, earlier development along much of the coast becomes threatened as the shoreline gradually recedes. Episodic erosion events and other chronic hazards increasingly take their toll on this development (figures 1-1 and 1-2). The response to these hazards has generally been to construct riprap revetments, seawalls, and bulkheads that are designed to fend off waves, stabilize cliffs, and retain the shoreland. As more development occurs adjacent to the beach, normal episodes

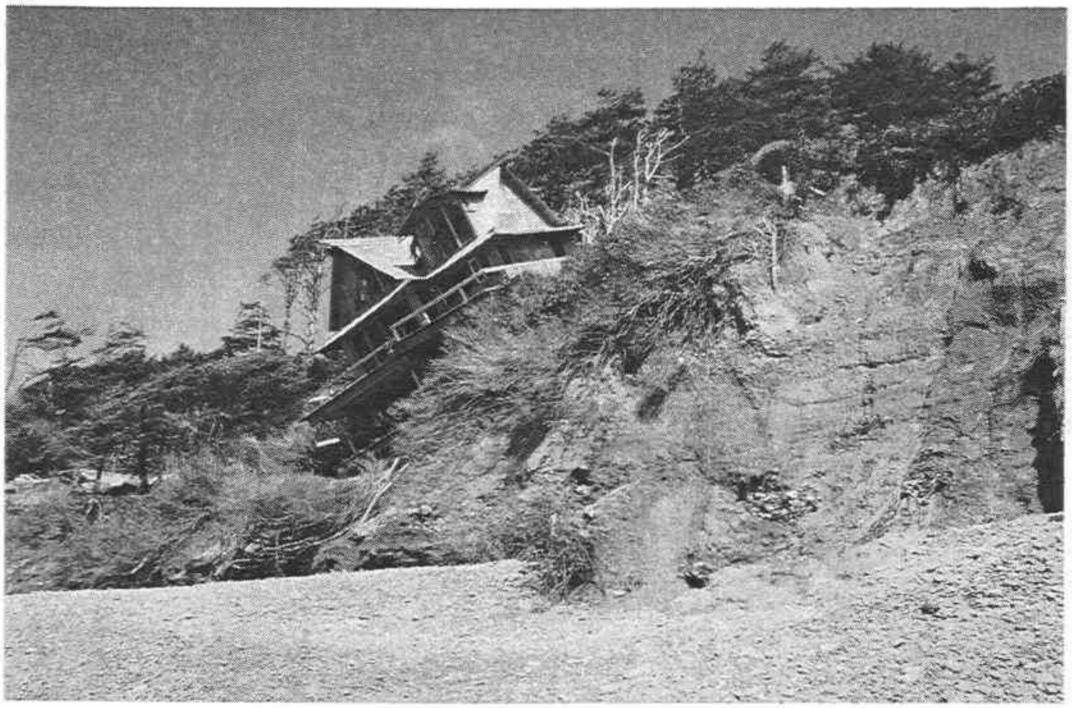


Figure 1-1. Beachfront home in distress at Cove Beach on the northern Oregon coast, May 1986.

Figure 1-2. Erosion damage to U. S. Highway 101 at Nesika Beach on the southern Oregon coast, winter 1983 (Paul Komar photo).

of erosion create a demand for more and more structures. These development and shore protection practices, in turn, have raised questions about the effectiveness of Oregon's coastal management policies—policies that were designed to protect the scenic values, recreational qualities, and accessibility of Oregon's beaches; control development in hazardous areas; and promote non-structural alternatives to revetments, seawalls, and other shoreline armoring. These concerns have been magnified by research which suggests that engineering solutions to coastal hazards sometimes lead to more problems, including accelerated erosion of the beach and adjacent properties, loss of cliff-supplied sand to the beach system, and gradual beach narrowing in the face of sea level rise.

The principal objectives of this research are to evaluate the implementation effectiveness of beachfront protection and related land use policies in Oregon, and to examine the validity of these policies with respect to recent scientific advances in coastal processes and engineering. The overall purpose is to identify policy improvements that will better achieve present beachfront management goals.

The approach to this evaluation combines traditional techniques of policy implementation analysis with a geographic information system-based case study of the outcomes and impacts of implementation decisions. The study area selected for the geographic information system (GIS) component is the 16-mile long Siletz littoral cell, located on the central Oregon coast between Cascade Head and Government Point (figure 1-3).

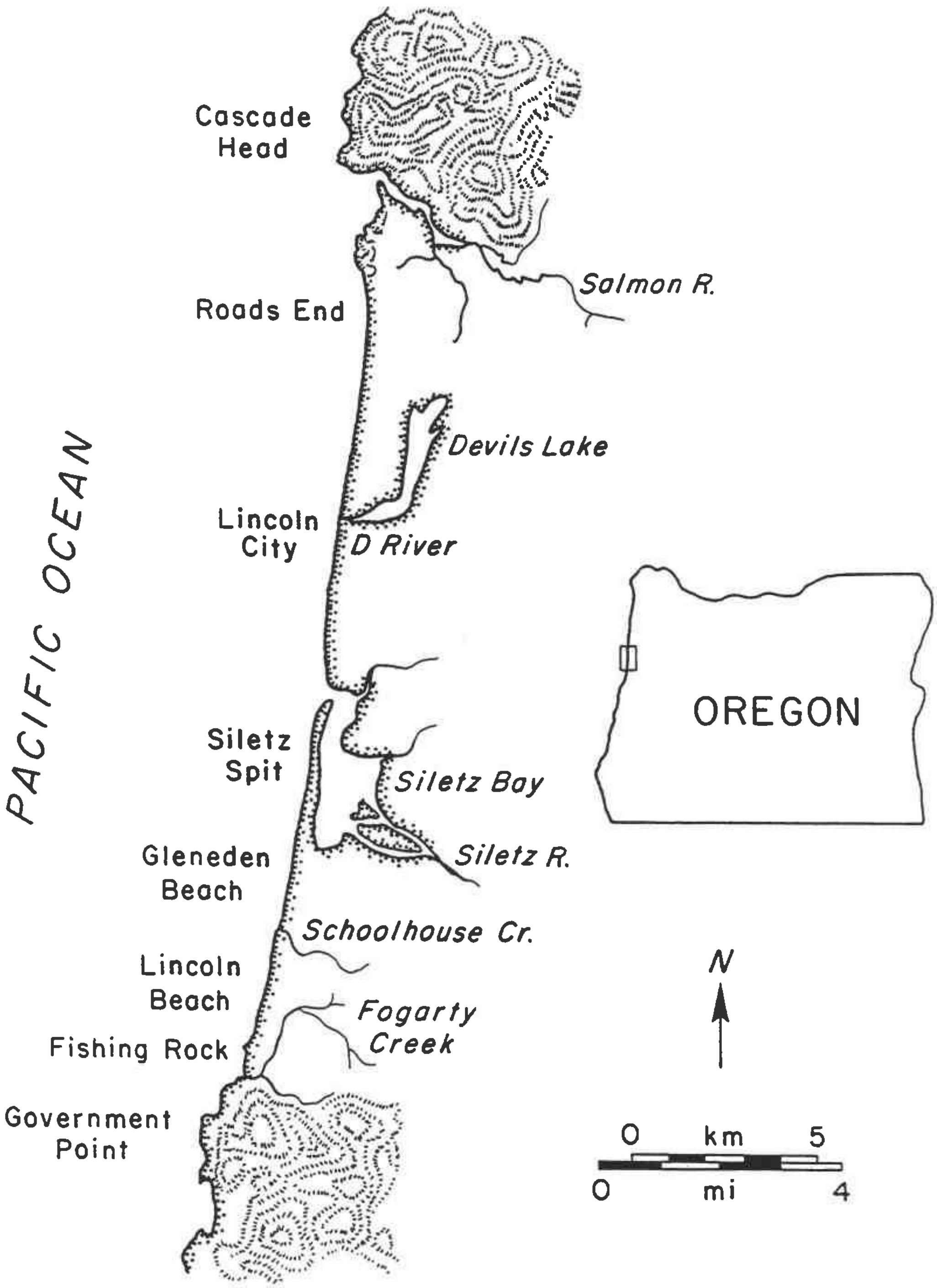


Figure 1-3. Study area: the Siletz littoral cell.

This thesis is organized as follows. The Literature Review and Background chapter examines relevant coastal science and engineering work, provides an overview of beachfront development and shore protection policy in Oregon, and reviews policy implementation analysis techniques. Research Design and Methods explains the study approach in detail, including how policy goals, objectives, and measures of policy achievement were identified; how these measures were linked to the GIS to evaluate implementation outcomes; the rationale for study area selection; and the development and application of the GIS, including the mapping and attribute database components. The Results and Discussion chapter includes a GIS-based overview of the Siletz cell study area; identifies policy goals, objectives, and measures; and presents the results of analysis for each of these objectives and measures of achievement. The Conclusions chapter summarizes the findings of the study and offers suggestions for improving beachfront management policies and policy implementation.

CHAPTER 2

LITERATURE REVIEW AND BACKGROUND

Three separate avenues of literature and background information are explored here to provide the technical, policy, and policy evaluation groundwork for this thesis. Coastal processes, natural hazards that affect the Oregon coast, and shore protection techniques and impacts are reviewed first. This is followed by an introduction to beach and shoreline management policy in Oregon, with special reference to the shore protection regulatory programs that are the principal focus of this study. Finally, there is a review of policy analysis models and methods for designing evaluation studies of policy implementation.

Coastal Processes, Hazards, and Shore Protection

The ability of coastal decision-makers to wisely manage Oregon's beaches and adequately represent the public interest in oceanfront development decisions requires the use of the best possible information about the nature of the coast, the forces and processes that shape it, and the effects of human intervention in those processes. This section explores each of these subjects, beginning with the geological setting of the Pacific Northwest and related seismic hazards. This is followed by a discussion of littoral cell sediment budgets, coastal erosion processes and other hazards, and finally, a discussion of shore protection measures and their impacts.

Regional Tectonic Setting and Geomorphology

The geologic setting of the Pacific Northwest is extremely important to understanding the evolution and present character of Oregon's coastal landforms, and the oceanic and atmospheric processes that help shape them. From a tectonic perspective, the Pacific Northwest is a continental collision coast (Inman and Nordstrom 1971) characterized by a relatively straight shoreline, raised terraces, narrow continental shelf, volcanism and seismicity. Just offshore Oregon and Washington is the 700-mile long Cascadia Subduction Zone (CSZ), the boundary between the westward-moving continental North American plate and the northeast-moving Juan de Fuca plate. Once thought to be an aseismic subduction zone (Ando and Balazs 1979), geologists now believe that the CSZ is quite active, periodically releasing accumulated strain in very large (M 8-9) earthquakes about every 300-400 years. There are a number of lines of converging evidence that lead to this conclusion, including: geodetic measurements of accumulating strain (Vincent 1989; Weldon 1991), tide gauge data from a variety of coastal locations (Mitchell et al. 1991; Shih 1992; Pittock pers. comm. 1992), sequential dating of abruptly submerged peat deposits in salt marshes all along the coast (Atwater 1987; Darienzo and Peterson 1990), records of offshore turbidity current deposits (Adams 1990), and the archeological record (Woodward et al. 1990). The evidence suggests the last large quake was about 300 years ago. The scenario for one of these events includes severe, sustained groundshaking; liquefaction of saturated, unconsolidated soils; numerous and possibly massive landslides; and a series of tsunamis beginning to arrive soon after the event (Madin 1991). However, given the wide variation in the frequency of these quakes, it is impossible to predict with any accuracy when the next event is likely to occur.

As a morphological consequence of its tectonic setting, the Oregon coast is mountainous, with rocky headlands segmenting the shore into pocket beaches of varying lengths. Seventeen coastal rivers drain the Coast Range and Klamath Mountains, discharging into the sea where they form estuaries. At the fine scale, the coast is highly irregular with a variety of landforms and rock types of varying ages and origins (see Lund 1971, 1972a, 1972b, 1973a, 1973b, 1974; Snavely et al. 1969; Snavely and MacCleod 1971; Schlicker et al. 1973; Snavely 1987). Rocky headlands composed of Tertiary basalts are one of the most prominent coastal features, often several hundred feet high and jutting seaward more than a mile. These, and other headlands composed of erosion-resistant sedimentary rocks, divide the Oregon coast into a series of 22 discrete littoral cells and subcells (Peterson et al. 1991), illustrated in figure 2-1. Much of the coastline between these headlands is sea cliffs, composed of more erodible sedimentary sandstones, siltstones, and mudstones of different ages. These cliffs are generally fronted by beaches of varying width and composition. The sea cliffs along the central Oregon coast and parts of the south coast are mostly uplifted marine terrace sands and silts of Pleistocene origin. At the river mouths, narrow, unstable bay-barrier sand spits are common, some extending north and

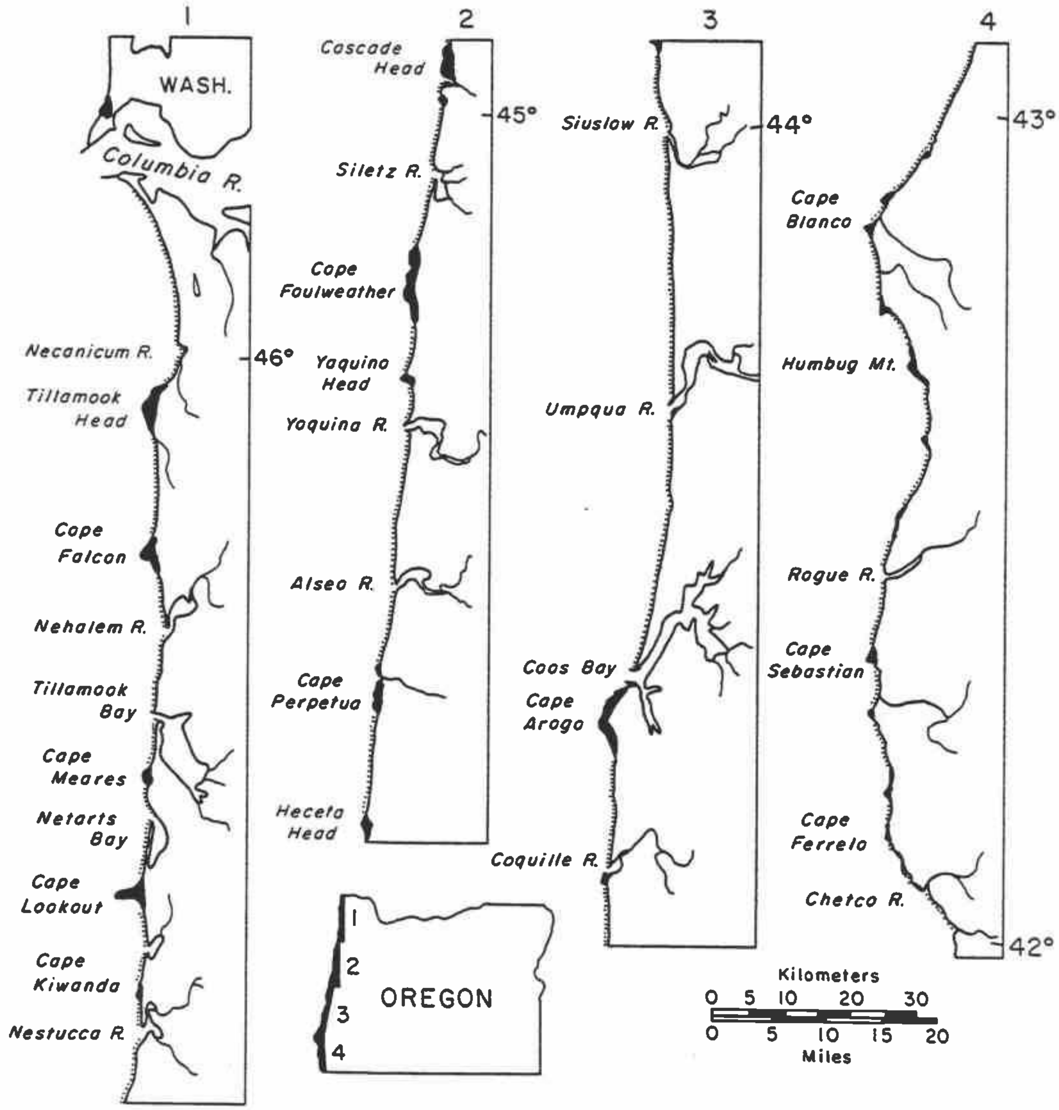


Figure 2-1. Littoral cell boundaries and other features of the Oregon coast.

others south to form the ocean side of estuaries. Large coastal sand dunes are another prominent feature of the northern and central coast, including Clatsop Plains north of Tillamook Head, Sand Lake dunes just south of Cape Lookout, and the nearly 50-mile long dune sheet extending from Cape Perpetua south to Coos Bay (Cooper 1958). Most of the latter dunes are part of the Oregon Dunes National Recreation Area. Of these 362 miles of Oregon coastline, 100 mi (28%) are rocky shore and 262 mi (72%) are sandy beach shores, including those backed by sea cliffs, dunes, and spits (Bond pers. comm. 1988).

Littoral Cell Sediment Budgets

The sediment budgets within each of Oregon's littoral cells encompasses a complete cycle of supply, storage and transport, and ultimate loss of sediment from the coastal environment. For beach and shoreline managers, even a rudimentary understanding of the sediment budget for a cell is very useful. For example, with knowledge of the important present-day sources of beach sand, efforts can be made to protect these resources.

Many Oregon coast littoral cells are dominated by relict sands, suggesting onshore transport as sea level rose after the last glacial period (Clemens and Komar 1988). Present-day sediment budget dynamics are unique for each cell. Rivers are sand sources in some cells and sinks in others (Kulm and Byrne 1966; Peterson et al. 1984; Peterson et al. 1991). Sand from sea cliff erosion is a relatively important source in some cells, particularly on the central Oregon coast (Komar and Shih 1991; Peterson et al. 1991; Shih 1992) and sand dunes are major repositories in others (Cooper 1958; Peterson et al. 1991). Offshore sources and sinks are probably important for most cells (Clemens and Komar 1988; Peterson et al. 1991; Shih 1992); however, the limited data available suggests that there is probably no net contribution of sand from offshore sources to the littoral system beyond a depth of about -60 ft (USACOE 1986).

Another set of factors in understanding a littoral cell sand budget is the overall volume of sand within the system as compared to seasonal dynamics, i.e., what fraction of the total sand volume is involved in seasonal transport alongshore, offshore, onshore, into and out of bays, etc. These dynamics are discussed below.

Erosion Processes and Hazards

Komar and Holman (1986) review factors involved in the development of shoreline erosion. Coastal erosion is generally associated with storm-generated waves, although there are a variety of contributing factors, some associated with waves and others not. Much of the energy of storm waves is actually dissipated in the surf zone offshore before reaching the beach. Directly associated with erosion is the run-up of the wave swash, which has three principal components: (a) wave set-up, which is the super-elevation of mean water level above the still-water level of the sea; (b) fluctuations of the swash of individual waves about that mean; and (c) other swash oscillations of longer period than normal ocean waves. Wave height in the deep water offshore and the slope or gradient of the beach and nearshore zone control run-up of the wave swash. The longer period oscillations are thought to be edge waves, trapped in the nearshore as either progressive or standing waves. On low-gradient or dissipative beaches, edge wave swash carries significant energy and contributes more to erosion than incident wave swash.

Seaward-flowing rip currents are another common cause of erosion, particularly on coarse-grained, reflective beaches. The resulting rip embayments can very quickly cut through the beach and attack foredunes or the base of sea cliffs (Komar 1983; Shih 1992). Rip currents form due to irregular offshore topography or in areas where edge waves have developed beach cusps. On the Oregon coast, rip currents have been important contributors to erosion episodes at Siletz spit (Komar and Rea 1975; 1976; Komar 1983), Nestucca spit (Komar 1978), Netarts spit (Komar et al. 1989) and Gleneden Beach (Shih 1992).

Longshore currents, set up by waves that approach the shoreline at an angle, transport sediment along the beach, redistributing sand eroded from sea cliffs or transported into the littoral system by rivers (Komar 1976). This process is clearly visible where jetties have been constructed at river mouths, blocking sediment transport. Net longshore transport of sediment along the Oregon coast has long been thought to be near zero (Komar et al. 1976), with northward-offshore transport during winter approximately balanced by southward-onshore transport during summer. Studies of beach response to the 1982-83 El Niño (Komar 1986; Jackson and Rosenfeld 1987; Komar et al.

1989; Peterson et al. 1990) found that unusually large amounts of sand were transported to the north during that winter, leaving some shorelines without a buffering beach and thus more vulnerable to erosion in subsequent winters. From their regional study of littoral cells, Peterson et al. (1991) concluded that for some cells, the patterns in beach width, dune field development, and beach grain size suggest a net northward transport of the finer sands, with possible loss offshore at the north ends of cells or bypassing around lesser headlands.

Short- and long-term variations in water level, as illustrated above in the discussion of wave set-up, are important factors in coastal erosion. Wood (1977), for example, found more than 100 cases in the last three centuries where exceptionally high spring tides were associated with major coastal flooding. Water levels off Oregon are normally higher in the winter, due to low barometric pressure, and strong south to southwest winds that generate northward-flowing surface currents deflected onshore by the coreolis force. During the 1982-83 El Niño event, winter sea level off Oregon was about a foot (30 cm) higher than normal for several months (Huyer et al. 1983). Examination of tide gauge records along the Pacific coast found that a very long period "wave" of raised sea level—initiated in the equatorial Pacific by the El Niño—propagated up the coast that winter (Komar 1986). This unusually high sea level, combined with an unusual number of major storms, caused severe erosion all along the west coast. It took several years for many of the beaches at the south end of affected littoral cells to rebuild.

This El Niño event illustrated the overwhelming impact that episodic events can have on seasonal cycles. And because strong or very strong El Niños occur on average every 8.5 years (Quinn et al. 1987), these events may play a more important role in overall sand budgets and sand transport than previously thought, at least for certain cells.

The effects of coastal engineering projects on longshore transport processes is another well-documented cause of erosion. A noted example in Oregon was the construction of jetties at Tillamook Bay early in this century which resulted in the demise of the community of Bayocean on the adjacent sand spit (Terich 1973; Terich and Komar 1974); erosion and deposition patterns have also been documented at other river mouths where jetties have been installed (Komar et al. 1976).

Other long-term variations in sea level have been associated with the advance and retreat of continental glaciers. Some 20,000 years ago, sea level stood about 400 ft (120 m) lower than today. It rose relatively rapidly until about five thousand years ago when it stabilized (Milliman and Emery 1968). Since that time, sea level has likely fluctuated around the present level. A number of investigators have estimated sea level changes during the last century, with estimates ranging from 1-3 mm/year (see for example Emery 1980; Gornitz et al. 1982; Barnett 1990).

In their recent studies of sea cliff erosion along the Oregon coast, Komar and Shih (1991) and Shih (1992) found central coast cliffs to be the most erosion-prone, with north and south coast cliffs relatively stable and well-vegetated. This difference correlated with variations in tectonic uplift rates reported by Vincent (1989) and Mitchell et al. (1991) and was also reflected in relative sea level rise differences between Newport (1.3 mm/yr), Crescent City, California (-0.9 mm/yr), and Astoria (-0.5 mm/yr) (Shih 1992). Thus, regional tectonics combined with eustatic sea level rise probably exerts a first order level of control on Oregon coast sea cliff erosion. There was also significant local variation, however, owing to a variety of cliff, beach, ocean, and other factors (Shih 1992). The most important erosion risk factor, according to Shih, was the elevation of the beach-cliff junction. On dissipative beaches, this elevation was often 3-4 ft lower than reflective beaches, leading to greater cliff erosion from wave runup. Priest (pers. comm. 1992), in recent field investigations of beachfront sea cliffs along the central coast, also found that rock composition at the beach-cliff junction to be an important factor in relative erosion rates. Relatively well-consolidated Tertiary rocks, when they break the beach surface along cliffs, tended to resist erosion better than the more loosely-cemented Pleistocene terrace sand deposits.

More speculative are the predictions of accelerated eustatic sea level rise during the next century associated with projected global warming caused by increasing atmospheric concentrations of CO_2 and other heat-trapping gases (NRC 1983, 29). Predictions from a number of modeling efforts range from 1 to 11 ft (0.2 to 3.4 m) by 2100, with typical means in the range of 3-4 ft or 1 m (USEPA 1983; NRC 1983; NRC 1987; IPPC 1990; Meier 1990). The National Research Council's Committee on Engineering

Implications of Changes in Relative Mean Sea Level suggested three scenarios for coastal evaluation purposes——0.5 m, 1.0 m and 1.5 m by 2100 (NRC 1987, 29). Any of these scenarios would have significant implications for the Oregon, particularly along the central coast where tectonic uplift is least. Flooding of low-lying lands, landward migration of barrier sand spits, and erosion of beaches and sea cliffs would result (Titus et al. 1991).

Landslides are the most frequently occurring terrestrial natural hazard along the sea cliffs of the Oregon coast (North 1964; Stembridge 1975; Gentile 1978; RNKR Associates 1978). Common types of landslides are slumps, mudflows, soil creep and debris avalanches. For any single area, the nature, location and frequency of slides depends on the combined influences of lithology and structure, as well as the nature and degree of human disturbances along and above the cliff face. While landslides are sometimes associated with wave undercutting, other processes are often more important.

Landsliding is most active in areas where Pleistocene marine terraces overlay seaward-dipping Tertiary mudstones, mostly along the central Oregon coast (Gentile 1982, 101). In such areas, groundwater often plays an important role in mobilizing slides. The Jump-off Joe landslide in Newport, Oregon is probably the best-known regional example of such a landslide (Sayre and Komar 1988). Weathering due to rain, wind, and surface runoff also contribute to sea cliff erosion (Komar and Shih 1991), as does infrequent freezing and thawing of groundwater seeping from cliff faces.

Shore Protection Along the Oregon Coast

Nearly half of Oregon's 262 mi of beachfront land is privately owned (Bond pers. comm. 1988). These privately-owned lands include some dune-backed shore, but are mostly along sea cliffs. In response to erosion and related hazards, private landowners (and in some cases public entities) have employed a variety of shore protection measures. Shore protection is used here in the generic sense and means any measure taken to stabilize the backshore (cliff, dune, etc.) or to stabilize or maintain the beach (Kraus and McDougal 1991). Measures of shore protection are loosely divided into two categories: land management/non-structural techniques and structural stabilization.

Land management and non-structural shore protection measures include: building setbacks for new construction (Houlahan 1989; Kraus and McDougal 1991; Keillor and Miller 1987); relocation of existing erosion-threatened buildings (NRC 1990; USACOE 1981); hazard-resistant building design (Godschalk et al. 1989; Pilkey et al. 1983); surface drainage and groundwater infiltration controls (Herdendorf 1984; Keillor 1986; Tainter 1982); the creation and/or restoration of erosion-buffering dunes (Carlson et al. 1991; USACOE 1984); vegetative stabilization of both dunes and sea cliff slopes (Herdendorf 1984; USACOE 1984 Carlson et al. 1991), often in combination with bank and bluff sloping (Herdendorf 1984; Keillor 1986; USACOE 1981); and beach fill or nourishment (Dean 1983; Kraus and McDougal 1991; USACOE 1984). A number of these techniques have been used along the Oregon coast, some extensively, such as dune stabilization with beach grass (Cooper 1958; Ternyik 1979). Others that have been used extensively elsewhere, such as beach nourishment (along the east and Gulf coasts), have not been used in Oregon.

Structural shore protection measures are reviewed generally in Kraus and McDougal (1991) and are given a much more technical treatment in the *Shore Protection Manual* (USACOE 1984). Examples of structural shore protection include revetments, seawalls, groins, and detached and floating breakwaters, and combinations of these with beach or nearshore sand fill. Along the Oregon coast, revetments and seawalls of various types are the most common structural response to erosion and related hazards. They are often referred to as "hard structures," in part because of the materials used to construct them and in part because they establish a fixed position for shoreline defense (Kraus and McDougal 1991).

Riprap revetments, illustrated in figures 2-2 and 2-3, are the most common type of structure used along both beach-dune and beach-sea cliff shorelines. Revetments are sloping structures (typically 1V:1.5H or greater) built to protect existing land or newly created embankments against erosion by wave action, nearshore currents, or weather (Mulvihill et al. 1980). Riprap refers to the large, erosion-resistant quarry rock commonly used to construct these structures, though other materials may be used. Typical revetments include a graded rock bedding or fabric filter layer, overlain by armor stones; a toe trench dug down to bedrock or the water table to prevent undermining

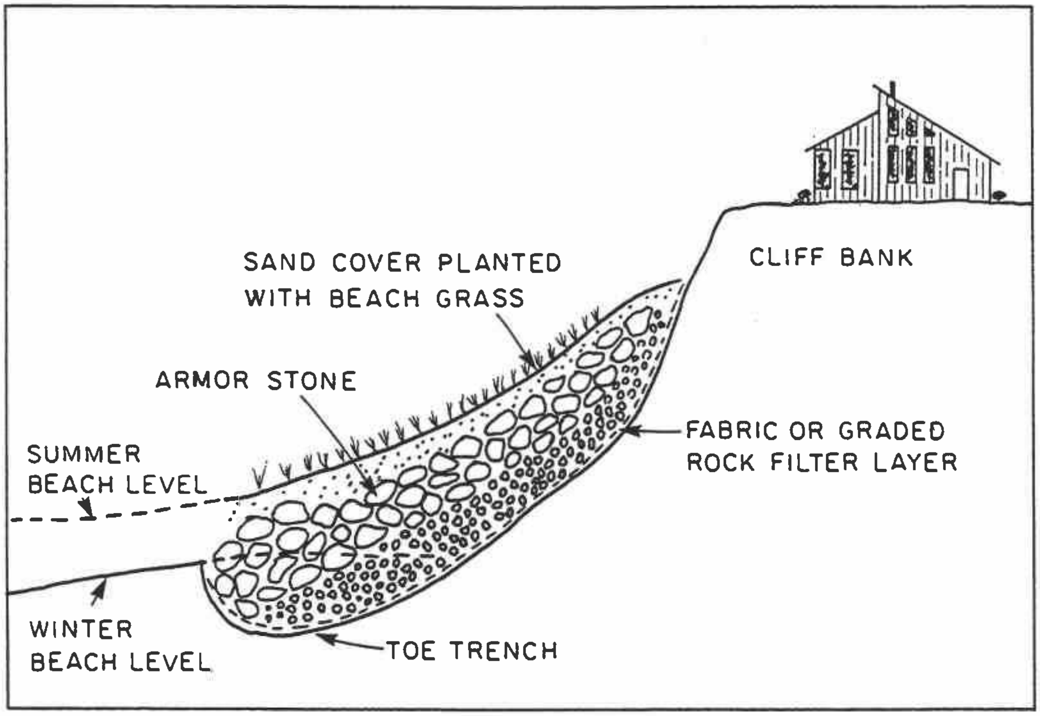


Figure 2-2. General design characteristics of a riprap revetment.

Figure 2-3. Riprap revetments, such as this one under construction at Gleneden Beach, are common along the coast.

when the beach is lowered by erosion; and often, a covering layer of sand planted with beach grass (USACOE 1984; Kraus and McDougal 1991). Along the Oregon coast, all beachfront revetments must be built as far landward as possible to prevent encroachment on the public beach, so the base of the toe trenches are well above mean sea level (MSL). Only during the largest storms and elevated water levels are these structures directly affected by wave action, and then only by wave runup on the order of 1-2 ft in height. The exceptions are those revetments installed along the dune line of highly mobile sand spits. During unusual events such as the severe El Niño-induced erosion of Alsea spit from 1983-87 (Komar 1986; Jackson and Rosenfeld 1987; Peterson et al. 1990), shoreline revetments may experience direct attack by comparatively large waves.

Seawalls are another shore protection technique used along the Oregon coast, particularly along sea cliffs prone to landsliding. A seawall is defined as a vertical or near vertical structure, or a stepped series of such structures, made of concrete, wood, steel or some combination thereof, designed to prevent landsliding or control wave-induced erosion (Mulvihill et al. 1980). The terms seawall, bulkhead, and retaining wall are often used interchangeably, including in this report. Technically, however, seawalls protect the shore from waves, retaining walls provide for slope stability, and bulkheads serve both functions (USACOE 1981; Kraus and McDougal 1991). While seawalls are generally discouraged by state regulators in Oregon in favor of revetments, they are still used in areas where a revetment might encroach too far out onto the beach, or where there is historical precedent, so that new structures blend in with existing seawalls.

Typical seawalls along the Oregon coast include concrete-reinforced or concrete block structures, and steel or wood-pile bulkheads, examples of which are illustrated in figures 2-4 and 2-5. Very large gravity-type seawalls have been used only sparingly here, and seawalls composed of stacks of sand-filled geotextile bags (Gutman 1979; USACOE 1981) have not been used at all. The latter structures, sometimes referred to as "soft" structures, actually fix the shoreline in place much the same as other seawalls. However, they are more vulnerable to vandalism and the wave-thrown drift logs common along the Oregon coast. They also lose their strength and decompose when exposed to sunlight (UV).

The other common type of coastal engineering structures found along the Oregon coast are the rock jetties designed to stabilize navigation channel entrances of 10 coastal ports (USACOE 1975); the impacts of jetties on coastal processes and beaches have been discussed by Komar et al. (1976). These structures, extending a mile of more seaward of the shoreline, act much like minor headlands, segmenting natural littoral cells into subcells.

Impacts of Hard Shore Protection Structures

While hard shore protection structures (SPSs) have been used for many years along coastlines throughout the world, there are few conclusive answers to questions about their effects on nearby beaches and adjacent property. Kraus (1988) reviewed about 100 technical papers on the

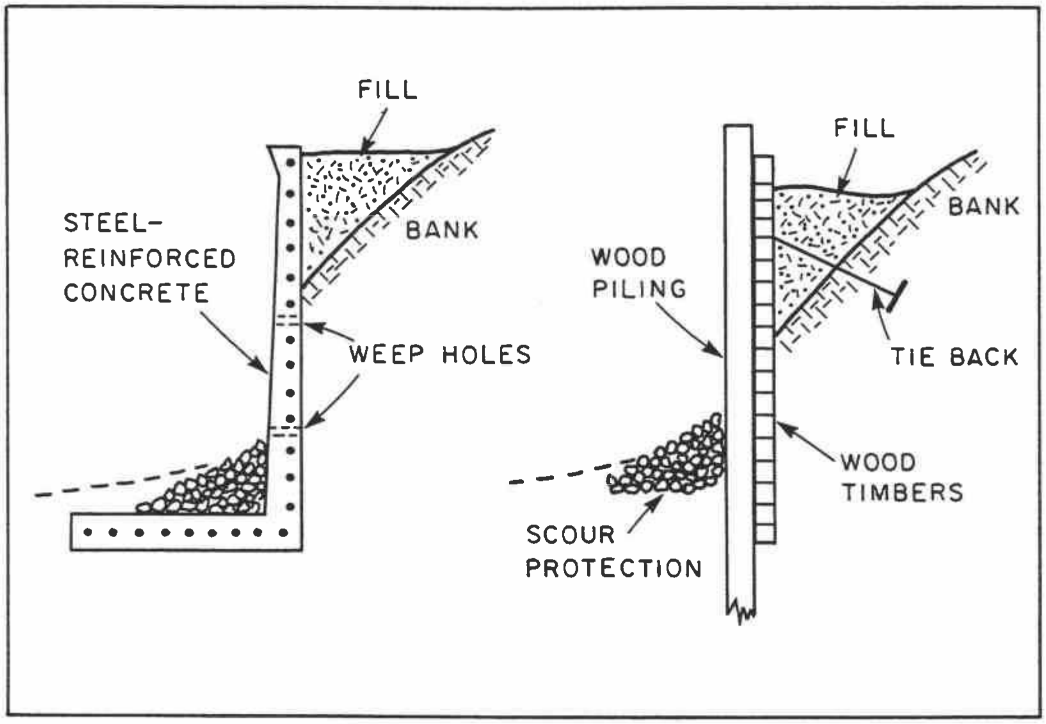


Figure 2-4. General design characteristics of seawalls.

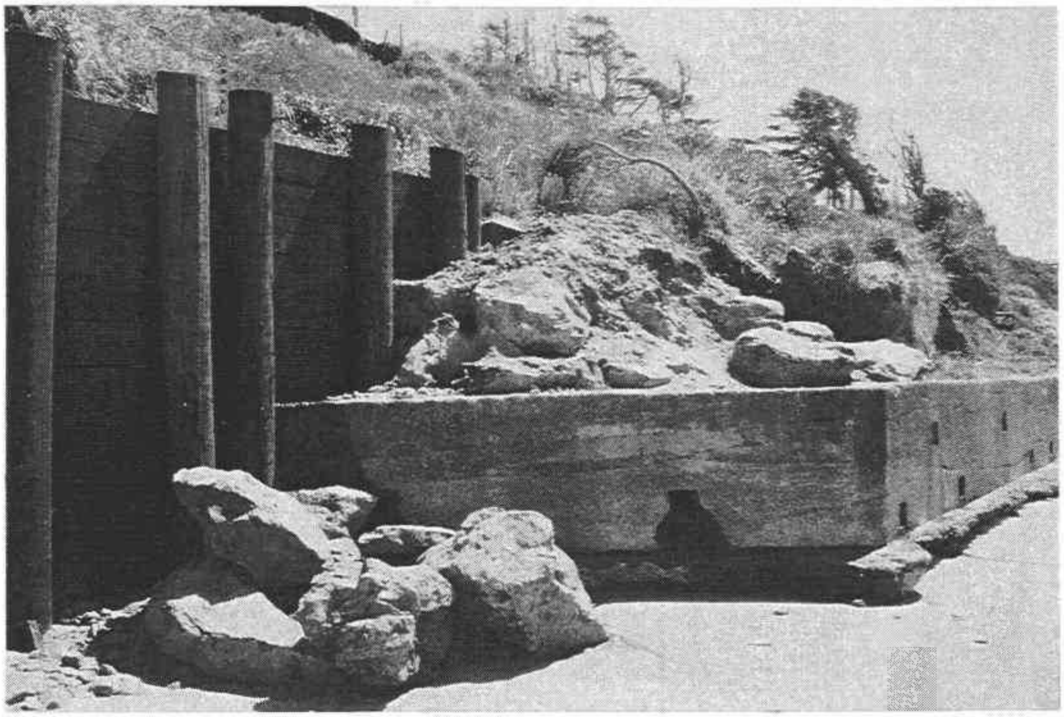


Figure 2-5. Old concrete-reinforced seawall adjacent to new timber-pile retaining wall at Arch Cape on the northern Oregon coast.

effects of seawalls on beaches, concluding that beach change near seawalls, both in magnitude and variation, is similar to that on beaches without seawalls, *if* a sediment supply exists. However, on beaches with seawalls, the form of erosional response is different, with toe scour and flanking effects common. Laboratory studies conducted by Komar and McDougal (1988) quantified this effect; erosion adjacent to a vertical seawall increased in both the longshore (70% of structure length) and shore-normal directions (10% of the structure length). Their field studies along the Oregon coast have been inconclusive because few storms have affected monitored structures.

In a study relevant to Oregon because of similar beach types, energy regimes and structure types, Fulton-Bennett and Griggs (1987) evaluated 32 shore protection structures along a 125 mile stretch of the central California coast. They found that massive engineered concrete seawalls outperform less expensive wooden seawalls and riprap revetments. Where maintained, they found that riprap revetments were relatively effective in slowing erosion, but maintenance costs were quite high and increasing, and many of the alleged benefits did not hold during storm conditions. For riprap revetments founded on sand, settlement was the most common cause of failure, followed by sliding or toppling of rock down the sloping face. Overtopping and subsequent erosion behind the structures was also common, especially with non-engineered structures. They also found, as did Komar and McDougal (1988) in Oregon, that revetments placed at the base of high marine terrace sea cliffs did not prevent continued erosion above the structure caused by surface drainage, gullying, seepage, debris slides and other terrestrial erosion processes. The success of concrete seawalls had most to do with the quality of their design and construction, with many reported failures attributed to overtopping and undermining. Wooden seawalls, while cheaper to install, experience the same overtopping and undermining problems as other vertical structures. They are also highly vulnerable to battering by floating logs and debris, and decay after 10 to 20 years in the harsh marine environment.

Other field studies by Griggs and Tait (1988) along the central California coast found that seawalls and revetments cause excess winter scour in front of and at the ends of the structures. They believed this resulted from a combination of wave reflection and sand impoundment upcoast. Pilkey and Wright (1988) compared dry beach width of a number of protected and unprotected beaches on the east coast. They found that dry sand widths in front of seawalls is consistently and significantly narrower than beach width along unprotected shores. They point out that beach destruction may take place over several decades and that the study of single events or short-term changes may be of limited value in understanding the effects of seawalls. Another aspect of the debate over shore protection impacts has to do with cause-effect relationships (Weggel 1988; Kraus 1988). Do seawalls exacerbate erosion or is it simply that beaches with chronic erosion problems attract SPSs? Terich and Schwartz (1990), in their literature review of the subject, conclude that while more SPSs may be installed on chronically eroding beaches, the preponderance of evidence suggests that seawalls do accelerate erosion of nearby beaches and adjacent properties.

Scientists, engineers, and coastal managers alike point out the need for regional solutions to erosion control and shoreline management problems rather than the haphazard, case-by-case approach (Fischer 1985; Fulton-Bennett and Griggs 1987; Komar and Good 1990; Kraus and McDougal 1991). In a similar vein, a review of federal programs affecting coastal resources was critical of coastal management efforts for failing to address the cumulative impacts of permit decisions (NOAA 1981). Determining the cumulative impacts of shore protection requires knowledge of the present extent of protective structures and the potential demand for new structures. This information, combined with what is known about sand budgets, coastal processes, beach and upland morphology, and upland natural hazards should provide much of the technical information needed to develop workable regional shoreline management programs.

Ocean Shore Protection Policies in Oregon

Oregon's land use management program, state-approved local comprehensive plans (LCPs), and other relevant state laws and policies together comprise the Oregon Coastal Management Program (OCMP). In May 1977, the OCMP was approved by the Secretary of Commerce as meeting provisions of the federal Coastal Zone Management Act (CZMA) (16 USC 1451-1464). Laws and policies of the OCMP and LCPs that relate to shore protection and land use management are described below, along with related federal programs. Together, they constitute the management framework for Oregon's beaches and oceanfront lands, and are the subject of the policy evaluation discussed throughout this report.

State Shore Protection Policies

The installation of shore protection structures (SPSs) along the oceanfront are regulated by two state laws: the Oregon Ocean Shore Law (ORS 390.605 - 390.770) and the Oregon Removal/Fill Law (ORS 196.800-196.990). These are administered as a joint permit program by the State Parks and Recreation Department (SPRD) and the Division of State Lands (DSL), respectively. The principal effect of the first of these laws (hereafter referred to as the Beach Law) was to create permanent public recreational easement to the ocean shore--the wet and dry sand beach from low water up to a surveyed zone line, approximately coincident with the 16 ft (MSL) elevation or the vegetation line (figure 2-6). Subsequent interpretation by the Oregon Supreme Court decision Thornton v. Hay (254 Or. 584, 462 P.2d 671 [1969]) confirmed that the public has legitimate beach access rights up to the vegetation line by virtue of customary use. The Beach Law further declared Oregon's beaches to be a state recreation area, within which there was a public interest in maintenance of beach recreational and aesthetic qualities. To protect these public interests and rights of free and uninterrupted use, the law established a "beach improvement" regulatory program. To evaluate permit applications for revetments, seawalls and

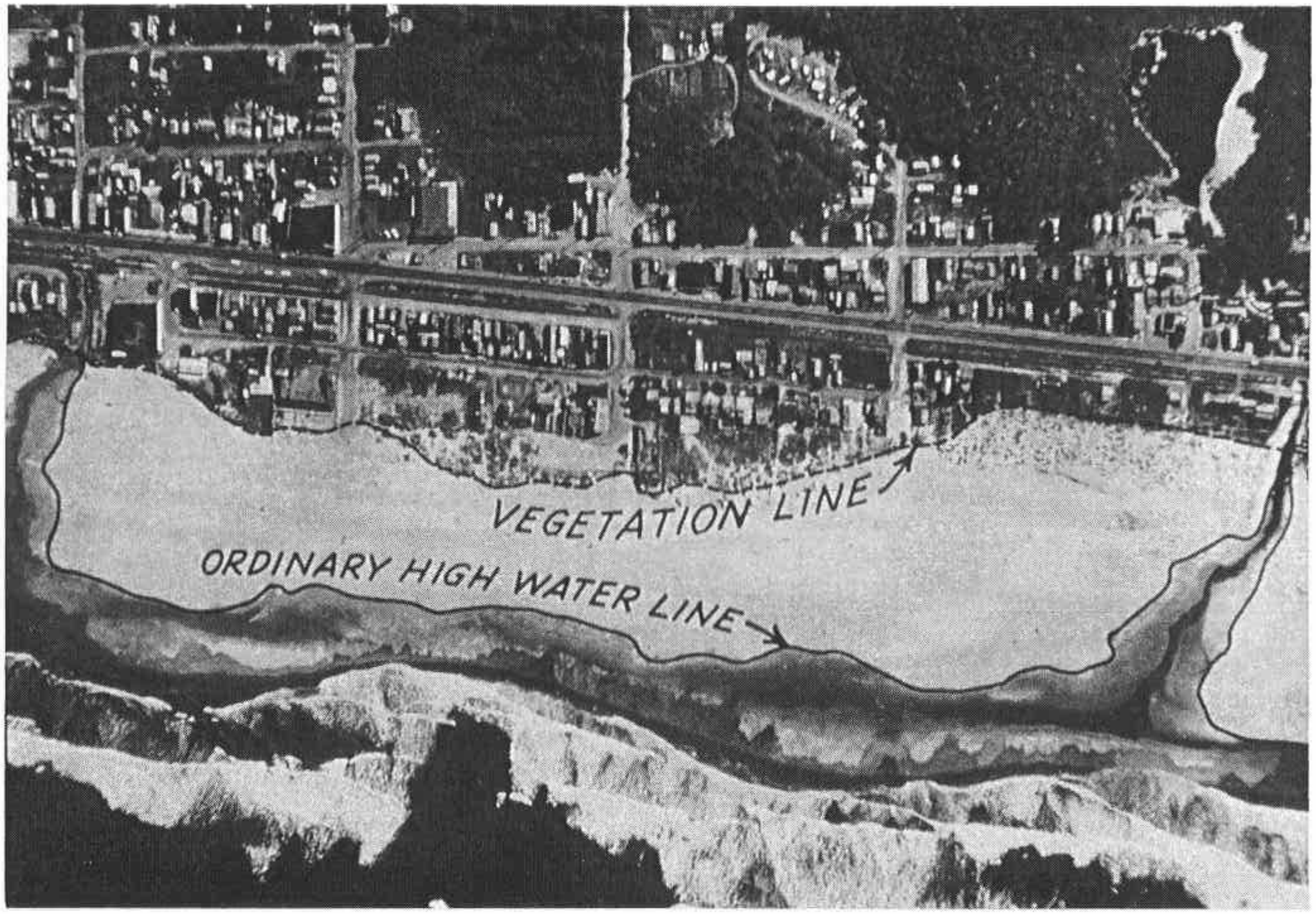


Figure 2-6. Oregon's ocean shore recreation area, established by the 1967 Beach Law, includes the dry sand beach extending from ordinary (mean) high water (OHW) landward to the vegetation line (or the 16 ft MSL beach zone line [BZL]) and the state-owned land below OHW.

similar structures, SPRD has developed "beach improvement standards" (OAR 736-20) based on specific considerations in the law related to public safety, recreation, aesthetic values, and public access. These have been supplemented by required standards outlined in the Statewide Planning Goal 18, Beaches and Dunes, described later.

The Removal/Fill Law, administered by DSL, regulates filling, removal, and shore protection for waters of the state, including the Pacific Ocean shore, to the line of established upland vegetation or the highest measured tide, whichever is greater. DSL's jurisdiction for SPSs thus moves with the shoreline, rather than being tied to a surveyed zone line, as with the SPRD permit program. However, it only regulates SPSs that contain 50 cubic yards or more of material; as a consequence, DSL may not have jurisdiction over most concrete or wood seawalls. DSL assumed jurisdiction over the installation of oceanfront SPSs in 1977.

Oregon's Statewide Land Use Planning Program includes planning goals that address coastal natural hazards and ocean shore protection. These goals were used by local governments to develop local comprehensive plans (LCPs) and must be considered by other state agencies for programs affecting land use.

Goal 7, Natural Hazards, mandates that development subject to natural hazards not be located in known areas of natural hazards without appropriate safeguards. The goal defines natural hazards to include stream flooding, ocean flooding, erosion and deposition, landslides, earthquakes, and other hazards. The term "appropriate safeguards" remains undefined.

Goal 17, the Shorelands Goal, also speaks to reducing hazards to life and property. LCPs are required to consider geologic and hydrologic hazards along the ocean shorelands, defined at a minimum as all coastal headlands, areas subject to ocean flooding [low-lying marine terraces, dunelands and bay barrier sand spits], and lands within 100 ft of the ocean shore [sea cliffs, marine terraces]. When problems of erosion or flooding arise, hazard mitigation preference must be given to land use management practices and non-structural erosion controls. SPSs, when needed, must be designed to minimize adverse impacts on water currents, erosion, and accretion. The goal also requires the maintenance, restoration, and where appropriate, enhancement of riparian vegetation (including vegetation on dunes and bluffs).

Goal 18, Beaches and Dunes, addresses coastal natural hazards in a more comprehensive way than other goals. The beach and various categories of dunes are defined and related to management policies in the goals. The goal prohibits development on hazardous dune and interdune lands, and prohibits breaching of foredunes except in certain unusual circumstances. Development on more stable dunelands requires findings that such development is adequately protected from erosion and other hazards.

With respect to the installation of SPSs, Goal 18 requires that permits for beachfront protective structures be issued only where "development" existed on January 1, 1977. Development is defined as houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through construction of streets and provision of utilities to the lot, or areas where special exceptions have been approved. For SPSs, the goal requires that visual impacts must be minimized, necessary access to the beach be maintained, and that negative impacts on adjacent property and long-term or recurring costs be minimized. SPRD has incorporated these requirements into its beach improvement standards (OAR 736-20-003 et seq.).

Local Shore Protection Policies

Land use planning and development in Oregon is principally the province of local government, though cities and counties must address Statewide Planning Goals (LCDC 1985), parts of which were outlined above, and must have their LCPs approved by the state. All coastal jurisdictions completed their initial round of planning in the early 1980s and adopted LCPs and implementing ordinances that were subsequently approved by the LCDC.

Specific LCP provisions for regulating development and shore protection structures vary. Some cities and counties require their own shore protection permits, while others just review and comment on state permit applications. All counties have required construction setbacks, either fixed or variable. Lincoln County, for example, bases its setback for new construction on a line determined by landform height and long-term erosion rates. Tillamook County bases construction setbacks on ocean view maintenance or a line drawn between existing structures. Some require geologic hazard reports from a registered geologist or engineer, and in some instances, such as with small lots, these reports and recommended stabilization measures can be used to justify waivers of established construction setbacks.

Federal Shore Protection Policies

The U.S. Army Corps of Engineers (USACOE) regulates installation of SPSs under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (P.L. 95-217). The Portland District COE issued a new Nationwide Permit for "bank stabilization" (NWP 13), with regional conditions for Oregon, effective February 14, 1992. It replaced a similar regional permit issued in 1986. NWP 13, with regional conditions, authorizes riprap revetments that meet certain criteria, such as less than 500 feet in length and less than one-half cubic yard of material per running foot below the high tide line. Most of the riprap revetments installed along the Oregon coast would fit within this category. NWP 13, however, does *not* authorize vertical retaining walls or concrete bulkheads, the other common types of SPSs along the coast.

Another federal program affecting management of the ocean shore is the National Flood Insurance Program (NFIP) (42 USC 4001), administered by local governments through the Federal Emergency Management Agency (FEMA). The program provides federally-subsidized flood insurance to property owners in communities that have adopted flood plain ordinances that meet federal standards. While the program has been criticized for actually providing incentives for coastal development (USGAO 1982), there have been a variety of steps taken in recent years toward its goal of reducing federal expenditures for flood emergencies and preventing future loss of human life and property.

One of these steps, the withdrawal of flood insurance for undeveloped coastal barriers identified under provisions of the 1982 Coastal Barrier Resources Act (CBRA) (16 USC 3509), does not yet apply to Oregon. Another is the Upton-Jones amendment to the NFIP included as Section 544 of the 1987 Housing and Community Development Act (P.L. 100-242). That amendment authorizes advance payment to property owners for relocation or demolition of any structure which is covered by a current NFIP policy and which is subject to imminent collapse due to erosion. This provision has not yet been applied in Oregon and it is not likely to be an important management tool. This is in part due to the fact that much of the erosion damage along the Oregon coast affects bluff-top property. Few property owners 50 ft or more above the beach own flood insurance policies. Even in low-lying flood hazard zones, the traditional solution to erosion problems is to install a SPS.

Implementation Analysis and Evaluation

Policy researchers have divided the policy-making process into a number of distinct stages, mostly to provide a conceptual framework for policy analysis. While different authors have identified varying numbers of stages, most can be simplified to the three identified by Nakamura and Smallwood (1980)——formulation, implementation, and evaluation. For the more complex policy-making frameworks, most of the differentiation is within the formulation stage, in part because this was the preeminent focus of policy research for many years (Putt and Springer 1989, 11-19) and in part because it is still an important, dynamic area of theoretical work (Sabatier 1991). Because the emphasis in the present study is on the analysis and evaluation of implementation, the simple framework suffices. It also fits well with the flexible framework for implementation study design suggested by Ingram (1990, 471); she points out that "Policy formulation, implementation, and outcome need to be seen as a seamless web rather than distinct stages affected by separate variables."

So what is implementation? While the boundaries of this and other stages of the policy process are not clear, Sabatier and Mazmanian (1981, 5) define it simply as "the carrying out of a basic policy decision," usually a legislative one, but not necessarily so. Implementation activities vary and may include such things as development of rules and operating procedures; the recruiting and training of staff; establishment of interagency communication and coordination processes; initiation of monitoring programs and subsequent reporting; the issuance of permits; and so on.

Evaluation is the principal feedback stage in the policy process (Putt and Springer 1989). Though evaluation may play a variety of important roles in the policy formulation stage, it more often focuses on analysis of implementation activities, impacts and outcomes, and processes.

Evaluation of policy implementation serves a variety of purposes. Putt and Springer (1989, 48-54) outline some of these purposes in order of increasing complexity. Program monitoring and reporting, for example, lets those who have a stake in the policy know what happened after the policy was initiated. At a more complex level are studies of impacts or outcomes, which seek to identify the degree to which a program is achieving its goals and objectives. Process evaluations, often the most complex, explore how programs are implemented, looking for insight into why certain policies have succeeded or failed. They also seek to identify courses of action that might improve implementation success. In a geographic context, the present study serving as an example, policy implementation analysis can also improve our understanding of spatial patterns and allocations, human-environment interactions, and environmental impacts (Mitchell 1989, 284). This type of information is especially useful to planners and natural resource managers. Whatever the case, the underlying purpose of all implementation analysis is to foster improvement (Browne and Wildavsky 1984).

The following sections review the role of implementation analysis and evaluation in coastal management at the national and state levels, with an emphasis on Oregon, and then go on to examine and describe analytical approaches that were useful in designing the study plan for the present research.

Evaluation of Implementation Success in Coastal Zone Management

Evaluation of implementation success of coastal zone management (CZM) policies and programs has become progressively more sophisticated as the federal program and state components of the national CZM system have matured. At the federal level, evaluation of the CZM program has largely been driven by legislative oversight and reauthorization requirements (USGAO 1976; OCZM 1979; USGAO 1980; USDOC 1980). There have also been a number of important academic contributions to federal CZM evaluation. Lowry (1985), for example, demonstrated that the federal CZM program has been relatively successful, in spite of its broad goals and lack of clear causal theory about what kinds of actions will result in goal achievement. He attributed this success to the skill and commitment of implementing officials and to the broad and relatively strong base of constituency support. Archer and Knecht (1987), in the role of policy entrepreneurs, illustrate another kind of evaluation—one that focuses on needed program and process improvements. Brower et al. (1991) conducted what is undoubtedly the most comprehensive evaluation of CZM at the national level, which was initiated in response to the upcoming 1990 CZMA reauthorization. Their study included the first-ever attempt to measure and compare the economic benefits and costs of coastal management at the national level.

Ironically, one of the principal shortcomings noted in both Congressional and academic evaluations of federal coastal management is the poor quality of federal oversight and evaluation of state programs. Section 312 of the federal Coastal Zone Management Act of 1972 (PL 92-583, Sec. 312) requires that the Secretary of Commerce conduct a "continuing" review of state CZM programs. These evaluations are conducted by the federal Office of Ocean and Coastal Resources Management (OCRM), formerly the Office of Coastal Zone Management (OCZM). However, Section 312 evaluations have been subject to continued criticism from Congress (USGAO 1976; 1980), the states (Travis 1980; Saurenman and Loeffler 1989; OCRM 1989), and academics (e.g., Lowry and Okamura 1980; Archer and Knecht 1987) for their lack of depth and ineffectiveness in stimulating policy improvements.

There have also been numerous evaluations of state CZM programs and of various management strategies and processes. Examples include evaluations of state CZM in Florida (Guy 1983) and North Carolina (Owens 1985); of state-local power-sharing in CZM (McGilvray 1987); and of the networking approach to state program development (Born and Miller 1988).

In Oregon, evaluation of coastal management program implementation has been limited, except for the periodic Section 312 evaluations conducted by federal CZM overseers. The single exception was an evaluation of shoreline erosion management (SSWCC 1978). Though this study examined many of the same questions addressed in the present study and suggested a number of policy improvements, none were actually implemented. There may be several reasons for this. First, the state had adopted its coastal planning goals less than two years before the study; politically, the timing was not right to be changing policy or adding new requirements (R. Cortright, pers. comm., 25 June 1992). Furthermore, the recommendations were largely the work of a single individual, and needed consensus-building for the changes had not occurred in the evaluation process. Finally, the evaluation was not in response to a locally-perceived problem, but rather was a mandated shoreline erosion planning exercise based on a 1976 amendment to the federal CZMA.

Oregon's intentions regarding more comprehensive evaluation of program implementation have been promising, as illustrated by the preparation of several analytical frameworks. But the results have been disappointing. The first of these analytical frameworks (Economic Consultants Oregon 1980) focused exclusively on measures related to the attainment of goals and objectives in LCDC Statewide Planning Goals, emphasizing the coastal goals. In its 1985 Coastal Management Program Document, the DLCD noted that it has "deferred such an evaluation to await full implementation of program policies through acknowledged local comprehensive plans" (DLCD 1985). The wait continues. In the interim, another comprehensive evaluation proposal for Oregon's entire land use management program was prepared in 1987 (BGRS undated) that includes a major coastal program evaluation element. Funding was sought for the entire program and independently for the coastal resources element, both without success. I participated in the BGRS process and not coincidently, this study addresses a number of the issues outlined there.

Analytical frameworks for Evaluation of Implementation Success

Since the mid-1970s, there has been a veritable explosion of implementation studies and evaluations (Pressman and Wildavsky 1984; Ingram 1990). Inspired by Pressman and Wildavsky's *Implementation* (1973), hundreds of studies have been initiated and completed, numerous books written, and a variety of theoretical frameworks have been proposed (see Ingram 1990 for a recent review).

In part, this work has been driven by a problem that has come to be called the "implementation gap." In this context, "implementation gap" refers to the inconsistency between a policy idea conceived at one level or branch of government and the translation of that idea into specific actions at another level or another branch (Lowry 1985, 288). In their search for the causes and cures for this gap, analysts have spent a great deal of effort trying to understand, classify, and describe the determinants of successful policy implementation. In the process, they have also provided a basis for designing evaluations of implementation activities.

The descriptive models that have emerged from this ferment can be grouped into several categories (Lowry 1985). First, some theorists characterize implementation as administrative politics; basically, they say that the implementors adjust programs to suit their own needs and preferences. Examples include Bardach (1977), who stressed the means by which semiautonomous bureaucrats shaped programs by responding to the demands of their organization; and Ingram (1977), who focused on the role that bargaining plays in the implementation process. A second group of scholars emphasize the adaptive and evolutionary nature of implementation processes, typified by Browne and Wildavsky (1984). They describe implementation as a process of mutual adaption in which policies and programs adapt to their environment and each alter the other. Their model has an interesting geographic analog in Carl Sauer's "cultural landscape" construct, with policies and programs substituting for the people (Sauer 1925). Another group of policy analysts suggest that the implementation is often structured by the statutory requirements. Sabatier and Mazmanian (1981), for example, emphasize the ability of a statute to structure implementation in their conceptual model. The model includes 17 independent variables grouped into three categories: the tractability of the problem; the ability of the statute to structure implementation; and non-statutory variables affecting implementation (figure 2-7). The dependent variables in their model are the stages of the implementation process.

The conceptual framework of Sabatier and Mazmanian and the explicit conditions they suggest for effective implementation (detailed below) were an attractive starting point for designing the present study. In their view, a major policy decision will achieve its objectives under the following conditions:

> 1. The enabling legislation or other legal directive mandates policy objectives that are clear and consistent or at least provides substantive criteria for resolving conflicts.

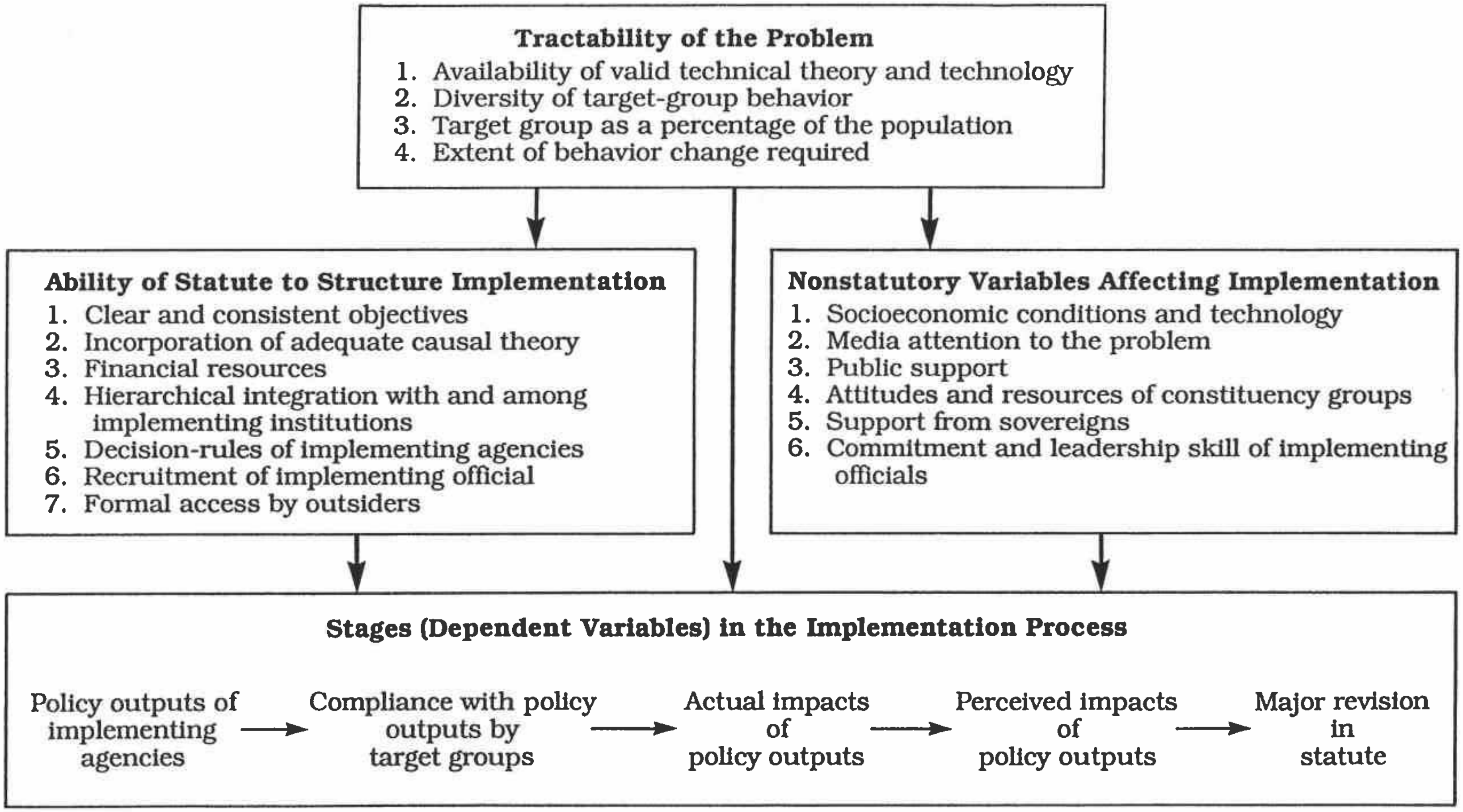


Figure 2-7. Flow diagram of variables and stages in the implementation process (after Sabatier and Mazmanian 1981).

2. The enabling legislation incorporates a sound theory identifying the principal factors and causal linkages affecting policy objectives [i.e., the kinds of actions that support or are at least consistent with attainment of policy objectives], and gives implementing officials sufficient jurisdiction over target groups and other points of leverage to attain, at least potentially, the desired goals.

3. The enabling legislation structures the implementing process so as to maximize the probability that implementing officials and target groups will perform as desired. This involves assignment to sympathetic agencies with adequate hierarchical integration, supportive decision rules, sufficient financial resources, and adequate access to supporters.

4. The leaders of implementing agencies possess substantial managerial and political skill and are committed to statutory goals.

5. The program is actively supported by organized constituency groups and a few key legislators (or a chief executive) throughout the implementation process, with the courts being neutral or supportive.

6. The relative priority of the statutory objectives is not undermined over time by the emergence of conflicting public policies or by changes in relevant socioeconomic conditions that undermine the statute's causal theory or political support. (Sabatier and Mazmanian 1983, 7)

This framework is attractive for several reasons. First, its focus on policy objectives and the kinds of actions that should result in policy attainment is amenable to design of an evaluation framework where the outcomes are discernible through geographic, site-specific analysis. Second, because the policies in question deal with decisions that affect beaches and shorelands, the much-improved scientific understanding of coastal processes and the hazards that affect these areas can be factored into the evaluation. That is, the appropriateness of policies vis a vis advancements in scientific understanding since those polices were developed can be evaluated simultaneously with evaluation of how well policy objectives are being achieved. Other factors important to this study are also included in Sabatier and Mazmanian's conditions, such as administrative environment, the role of the courts, and the support of constituency groups. Finally, the framework has been applied successfully to other coastal policy studies, first by the authors themselves, who used it to evaluate implementation of the California Coastal Initiative of 1972 (Sabatier and Mazmanian 1983), and later by Lowry (1985), who used it to evaluate the implementation success of the federal Coastal Zone Management Act of 1972.

How this model is adapted to the overall framework of this study is described in the next chapter——Research Design and Methods.

CHAPTER 3

RESEARCH DESIGN AND METHODS

The principal purposes of this research are to evaluate the implementation effectiveness of beachfront protection and related land use policies in Oregon, and to examine the scientific validity of these policies with respect to recent advances in coastal oceanography and engineering. This research grew out of questions that were repeatedly raised during shore protection Extension education programs that were organized and/or conducted by the author during the mid-1980s. These questions were clarified at a July 1988 workshop of coastal planners and state coastal managers, a meeting that marked the beginning of the present research.

Consistent with much work in geography, the research design outlined below is somewhat eclectic. The policy analysis framework for the study is explained first, borrowing mainly on the work of political scientists and other policy analysts discussed in Chapter 2. This is followed by a description of the design and methods used for the geographic information system (GIS) component of the study.

Policy Analysis Framework

The policy analysis framework below describes the set of conditions for successful implementation that serve as the overall study framework and as the basis for integration of study results. It also describes how policy goals, objectives, and measures or indicators of achievement were identified.

Criteria for Evaluating Implementation Success

The criteria for evaluating how well the policies for regulating beachfront protection and development are working are derived principally from the work of Sabatier and Mazmanian (1981; 1983), as discussed in Chapter 2. The "conditions for successful implementation" they suggest are modified and reformulated below as questions. The first five questions deal primarily with the ability of the relevant statutes and administrative rules to structure implementation (see figure 2-7).

1. What are the individual and collective policy goals and objectives; are they clear and consistent, or, if not consistent, are there at least means for resolving conflicts among them?

2. Do the policies, individually and collectively, incorporate sound causal theories about what kinds of actions will result in achievement of policy goals and objectives, and do they give implementing officials sufficient jurisdiction to attain them?

3. Do the policies structure the implementation processes in a way that maximizes the probability that implementing officials will perform as desired?

4. Do the leaders and staff of the implementing agencies possess the needed managerial, political, and technical skills and are they committed to policy goals and objectives?

5. Are the policies, individually and collectively, actively supported by organized constituency groups and by key elected officials throughout the implementation process, with the courts being neutral or supportive?
6. Are the policy objectives still high priority, or have priorities changed over time due to the emergence of conflicting public priorities, or changes in socioeconomic conditions that weaken the causal theory or political support for the policies?

Variables other than the structure of the statute are important for evaluating several of these questions. For example, the second question is also a function of available knowledge and technology (a "tractability of the problem" factor in figure 2-7), and the fifth question is significantly affected by non-statutory variables. The sixth question is conditioned mainly by non-statutory variables and, with the addition of the technical information component, relates back to the tractability of the problem.

My research emphasizes the first two questions. This is because they deal with goals and objectives for which measures can be identified and evaluated in a geographic context, i.e., the GIS can be queried and numbers, locations, and other measurements can be made and interpreted. However, answers to the rest of the questions also have some component of geographic expression, as we shall see. Other non-statutory factors are also brought into the discussion of results, particularly in the Results and Discussion chapter, where answers to these six questions are used to summarize study results.

How Goals, Objectives, and Measures were Identified

The principal statutes, administrative laws, and other policies that comprise the "management regime" to regulate shore protection and oceanfront land use in Oregon were discussed in Chapter 2. That discussion emphasized the authorities that are part of the state's federally-approved Coastal Management Program. At the state and local levels, these authorities include:

1) Beach Law (ORS 390.605-390.770) and Beach Improvement Standards (OAR 36-20);
2) Removal/Fill Law (ORS 196.800-196.990) and Administrative Rules (OAR 141-85);
3) Comprehensive Land Use Planning Law (ORS 197);
4) LCDC Statewide Planning Goals:
   - Goal 7, Areas Subject to Natural Hazards and Disasters (OAR 660-15-000)
   - Goal 17, Coastal Shorelands (OAR 660-15-010)
   - Goal 18, Beaches and Dunes (OAR 660-15-010)
5) Lincoln County and Lincoln City Comprehensive Plans and Zoning Ordinances

Each of these policies were examined in detail, as discussed below, to determine goals, objectives, and measures or indicators of policy achievement. The local plans and ordinances examined largely reflected ORS 197 and LCDC planning goals. While there is some variation among coastal local governments in how these requirements are incorporated into their plans and implementing ordinances, the state mandates were assumed to be reasonable proxies for local plans and ordinances with respect to the issues being examined. Emphasis for identifying goals and objectives was therefore on state statutes and administrative rules.

Federal authorities were also examined but not explicitly included in the policy evaluation because they play relatively minor roles in the shore protection regime. These include the U. S. Army Corps of Engineers Section 10/404 regulatory program, including the Nationwide Permit (NWP 13) for "bank stabilization;" and the National Flood Insurance Program (NFIP) (42 USC 4001), including the Upton-Jones amendment related to coastal hazards and loss.

Policy Analysis Technique. To determine policy goals and objectives for the management regime as a whole, each state law and set of administrative rules for that law were first reviewed independently, and relevant goal or objective language cited and referenced. Possible measures or indicators of objective achievement were also identified. These terms are defined here as follows: a *goal* is a broad statement of desired ends or outcomes; an *objective* is a specific (and usually measurable) statement of action that, if taken, will lead toward or be consistent with a goal; and a *measure* or *indicator* is the specific quantitative or qualitative data or evidence needed to determine if and how actions are achieving objectives.

Once each policy was examined independently, the goals and objectives were categorized and an overall goal or objective statement developed for each grouping. Similarly, measures or indicators of achievement were identified and integrated under appropriate policy objective categories.

Once this integration of goals, objectives, and measures or indicators for all the policies that make up the "management regime" was accomplished, methods to make different measurements were formulated, possible GIS queries developed, and critical attribute data needed to make the queries identified and used for database design. This was the point in the study process and the means by which the policy analysis framework was linked to the GIS framework.

Geographic Information System Framework

Methods for developing and analyzing data for the geographic information system (GIS) components of the study—study area selection, map coverage development, and the attribute database—are discussed below.

Selection of the GIS Study Area

The 16-mile long Siletz littoral cell (figure 1-3) was selected for GIS analysis of shore protection and related land use practices for a number of reasons. First, the cell is diverse in its geomorphology, with a variety of small, rocky outcroppings north and south; several small pocket beaches; and a central 12-mile beach segment, part of which is backed by receding, sand-supplying sea cliffs of varying height, and part backed by the dunes of the Siletz spit. The Siletz and Salmon Rivers and several smaller streams emptying into the ocean drain a significant part of the mid-coast basin.

Second, the area has been the subject of many scientific and engineering investigations focusing on beach, dune, and sea cliff erosion processes, littoral sand transport, the sediment budget, landslides, and other hazards. While the information base is less than ideal, it is still better than what is available for other cells.

Third, the Siletz cell's beachfront lands are among the most extensively developed along the entire Oregon coast. Much of that development is situated in extremely hazardous locations with respect to erosion, slumping, landslides, ocean flooding, and other natural hazards. Remaining undeveloped beachfront lands are under great development pressure, and few lots are immune from these same hazards. As a consequence of these hazards, this shoreline is also the most heavily protected on the coast, with riprap revetments, seawalls, and other engineering devices common. Approximately half of the SPS permits issued by SPRD and DSL for the entire coast are for properties within the Siletz cell.

Given this situation, the cell represents the "worst-case" beachfront development scenario for property owners, developers, the beach-using public, local planners, and state coastal managers and regulators. If there are problems today in managing beachfront development and mitigating hazards through shore protection in the Siletz cell, the same problems are only a decade or two away for less-developed portions of the coast. Because of this, the

Siletz cell serves as an excellent model for "what might be avoided" elsewhere.

Mapping Component of the GIS

The GIS developed to examine beachfront policy implementation is based on large-scale tax maps. While the decision to use assessor's tax maps as the base led to complications in geographic referencing and unavoidable locational errors, it was founded on the logic that decisions related to these policies are made on a tax lot basis, e.g., SPS permits, conditional use permits, and building permits. Policy implementation processes and outcomes, the reasoning went, would only be discernible and comprehensible at this level of geographic specificity.

Blueprint copies of 57 tax maps covering the shoreline from Cascade Head to Government Point were obtained from the Lincoln County Assessor for digitizing. The scale of 51 of the maps was 1 in = 100 ft, two were 1 in = 200 ft, and four were 1 in = 400 ft. The geographic reference system for these maps is the Public Lands Survey System (PLSS), which is not tied to the state plane coordinate (SPC) system, latitude-longitude, or other true geographic location grid system. PLSS corners on the tax maps were converted to the SPC system to provide a common frame of geographic reference for joining the 57 tax map coverages and adding beach zone line coordinates. The transformation from PLSS to the SPC system was accomplished with the help of staff of the federal Bureau of Land Management geographic coordinate data base program. Using four global positioning system (GPS) stations in the study area as starting points, more than 200 land surveys from the Lincoln County Surveyor's records were collected and delivered to the BLM. BLM calculated the SPC for each tax map reference point, based on the 1927 NAD. For several maps, there were only three PLSS registration points and for one, there were only two points. In these cases, shoreline meander corners or artificial registration points had to be created, leading to errors.

The GIS software used for this application was pcARC/INFO version 3.4D. The software was installed on a IBM-compatible 386/20 microcomputer. Tax maps were digitized using a GTCO "Super L" series digitizing pad with a 17 × 24 in effective area, large enough for an entire map.

The digitized maps were edited in pcARC/INFO to detect and correct errors and were also visually inspected. The individual map coverages were then transformed from the PLSS reference system to the SPC system. Transformation errors ranged from less than 1 ft to 36 ft, with a mean of 8.2 ft. Most of the larger errors were associated with the smaller scale maps or the use of meander corners as registration points. After removing these 11 expected outliers from the data, the mean of the transformation errors was just 5.3 ft. After transformation, the individual map coverages were merged into one large coverage of the entire study area—the oceanfront tax lot coverage. Finally, BZL coordinates, listed by SPC in the Beach Law (ORS 390.770), were added to the coverage as annotation features. Overlaying the BZL with the oceanfront tax lot coverage and plotting the maps at 1:4800 scale provided yet another visual means for error analysis. In the great majority of cases, errors were small; however, near headlands where the map scale was small, the apparent errors were larger.

The errors associated with this large-scale GIS application negate the usefulness of the system for detailed measurements and area calculations, e.g., to measure area of SPS encroachment west of the BZL. This disadvantage was overcome by including such data in the parcel attribute database. Despite its geographic location shortcomings, the GIS, in combination with the rich attribute data files, is a valuable tool to visually communicate information about processes, impacts, and outcomes related to shore protection policy implementation. To develop and plot GIS maps, the study area was divided into seven 1:4800 scale map "windows," each measuring approximately 22 × 32 in (figure 3-1). These windows served as the base maps for display of query results.

Database Component of the GIS

The database manager used in this study was dBASE IV, which is fully compatible with pcARC/INFO Version 3.4D. Seven database files, fully described in Appendix B (except for the query file), were created as follows:

TAX MAP - a PLSS location cross-reference file with two-digit map numbers for all tax lot maps; contains township, range, section, subsection, and project-assigned map number

LOCATION - geographic and political location attribute data

SILETZ LITTORAL CELL GEOGRAPHIC INFORMATION SYSTEM (GIS)

Display Windows

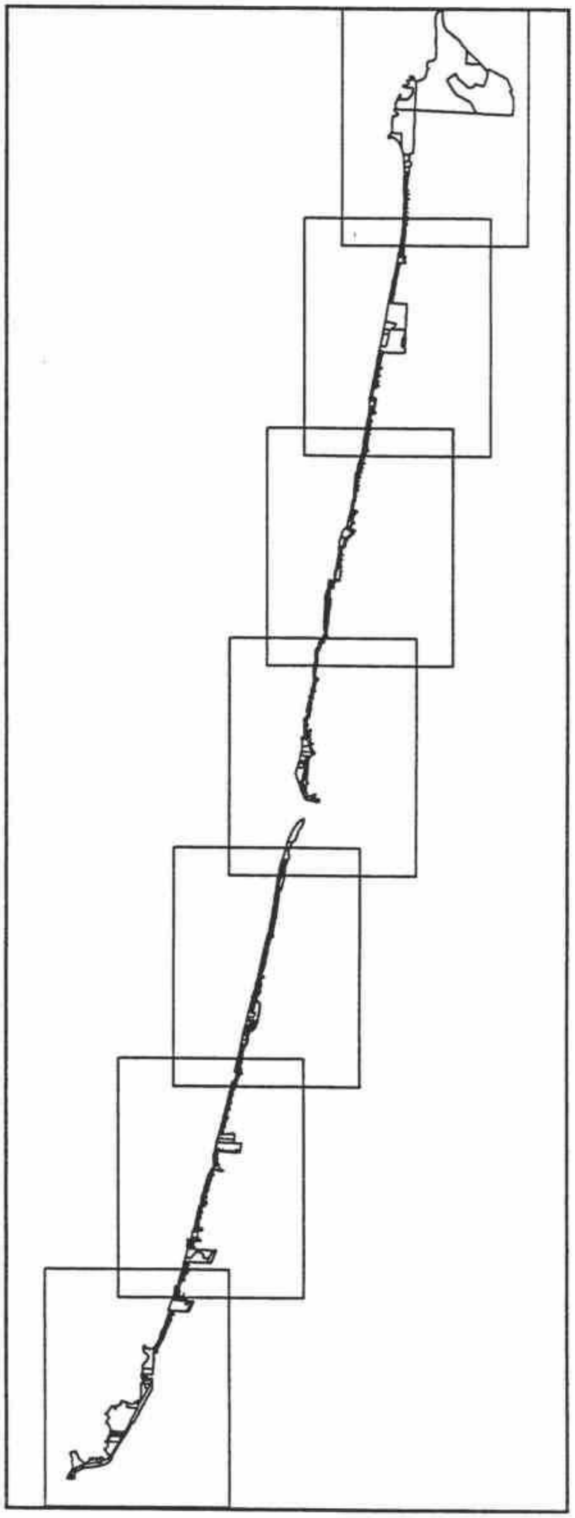


Figure 3-1. Siletz littoral cell geographic information system (GIS) coverage with map display windows for GIS query results.

ENVIRONMENT - physical and other environmental attribute data for the parcel and adjacent beach

LAND USE - attribute data on land use, ownership, upland improvements, and other cultural characteristics

SHORE PROTECTION - attribute data on structural and non-structural shore protection used on parcels

PERMITS - information about seawalls, revetments, or other beach structures permitted under SPRD and/or DSL permit programs

QUERY - composite file with selected fields from other files and special fields used for database queries

The selection of attribute data fields to include in the dBASE files (Appendix B) was based mainly on their potential usefulness for GIS/database queries that would address the measures or indicators of policy achievement identified in the policy analysis process. For example, questions about the effectiveness of the SPS regulatory program within the Siletz cell would benefit from data on structure location, type, date installed, applicant, permit number, and so on. For questions about the cumulative impacts of structures, more specific data might be needed, such as structure length, height, width, extension west of the BZL, and type of shore being protected. Using a comprehensive list of potential queries as a guide to data needs, combined with input from coastal planners and state managers, the database structure gradually took shape.

Data were derived from a variety of sources (Appendix B), including Lincoln County assessor maps, Lincoln County and Oregon Department of Geology and Mineral Industry natural hazards maps, Oregon Department of Transportation Ocean Shore photographs, Oregon Beach Access Inventory, vertical and oblique aerial photographs, ground photographs, technical reports and journal articles, SPRD/DSL permit records, Lincoln County and City development permit records, interviews, and field work. Selected data were also field verified, including the location and characteristics of SPSs and upland development. It was soon clear, however, that not all the desired data were readily available or could be easily generated with available resources, at least in my lifetime. As a result, only selected data fields were actually used in the analysis; these fields and the sources of data used are also listed in Appendix B.

The bulk of the data analysis for this research was conducted using only the relational database component of the GIS. The tables and figures throughout the Results and Discussion chapter are the products of both simple and complex queries, some of which involved creation of specialized fields, e.g., to calculate future erosion on unprotected parcels in order to project SPS demand.

The relational link between each of the dBASE attribute files is a common parcel identification field, termed PARC_ID. Similarly, each polygon in the pcARC/INFO oceanfront tax lot coverage has the same identification number in the polygon attribute table (PAT) file. Each of these identification numbers are tied to a common geographic location within the SPC reference system used for the coverage. Thus, when selected fields from dBASE files are joined with the pcARC/INFO PAT file, the attributes are available for queries in pcARC/INFO to produce graphic map output through ARCPLOT. This process was used to generate the graphical output needed to visually convey results of selected queries.

CHAPTER 4

RESULTS AND DISCUSSION

The interplay of coastal processes and hazards, public and private development decisions, and oceanfront development and shore protection policies in the Siletz littoral cell has resulted in what is probably the most intensively developed, extensively armored shore in the Pacific Northwest. This chapter documents some of the results of this interplay, beginning with an overview of the Siletz cell. Next, the shore protection and development policy goals, objectives, and measures of achievement that were gleaned from relevant statutes and rules are presented. This is followed by detailed analysis of the operation of the regulatory and land use programs and the impacts of decision-making in the Siletz cell with respect to specific policy objectives. Finally, the results are discussed in the context of the "conditions for effective implementation" outlined by Sabatier and Mazmanian (1983).

The Siletz Littoral Cell: An Overview

The Siletz littoral cell was selected for the geographic component of this study because of its diverse environmental characteristics and its extensive development and shore protection history, especially since the inception of state programs regulating the construction of shore protection structures (SPSs). Some of these attributes are enumerated in table 4-1, based on queries of the GIS database developed for this study.

Table 4-1. Selected characteristics of subareas of the Siletz cell.

Characteristic (mi of shore unless noted)	SILETZ CELL SUBAREA Salmon	Roads End	Lincoln City	Salishan	Gleneden & Lincoln Beaches	Fogarty-South	Total
ENVIRONMENTAL							
Shoreline length	2.42	1.55	5.34	2.65	3.00	2.83	17.79
Beach length	0.91	1.55	5.34	2.65	3.00	0.56	14.01
Beach type[1]	fine/diss	fine/diss	med/diss	coarse/refl	med/refl	coarse/refl	-
Landform type							
Dune	0.91	0	0.33	2.53	0	0	3.77
Cliff	0	1.55	4.95	0.12	2.92	0.35	9.89
Headland	1.51	0	0	0	0	2.27	3.78
Other	0	0	0.06	0	0.08	0.21	0.35
Shore geology							
Loose Sand	0.91	0	0.37	2.53	0	0.21	4.02
Pleistocene	0	1.30	4.97	0.12	3.00	0	9.39
Mud-Sandstone	0	0.25	0	0	0	0.35	0.60
Basalt	1.51	0	0	0	0	2.27	3.78
Landform height (mean ft MSL)	89	46	70	29	34	35	51
DEVELOPMENT							
All parcels (#)	4	136	377	128	238	21	904
Oceanfront parcels (#)	4	136	366	128	220	20	874
Parcel length (oceanfront ft)	3194	60	77	109	72	747	107

Continued next page

Table 4-1—*Continued*

Characteristic (mi of shore unless noted)	SILETZ CELL SUBAREA						
	Salmon	Roads End	Lincoln City	Salishan	Gleneden & Lincoln Beaches	Fogarty-South	Total
DEVELOPMENT							
# Built parcels	1	105	261	90	135	9	601
# Vacant parcels	3	19	84	21	71	8	206
Land use							
Residential	0	1.21	2.75	1.72	1.72	0.69	8.08
Commercial	0.91	0	0.23	0	0.15	0.22	1.51
Park/access	0	0.13	0.18	0.56	0.26	1.17	2.30
Street-end	0	0	0.13	0	0.03	0	0.16
Vacant	1.51	0.22	1.16	0.35	0.84	0.75	4.83
# Access/mi[2]	0	4.5	6.0	0	6.3	1.4	3.5
Jurisdiction	County	County	City	County	County	County	-
SHORE PROTECTION							
Beach w/SPSs							
# Parcels	0	75	147	121	115	1	459
Total length	0	0.73	2.42	2.09	1.46	0.11	6.81
Types of SPSs							
Riprap	0	0.44	1.27	2.09	1.40	0.11	5.31
Concrete wall	0	0.27	1.08	0	0.02	0	1.37
Other	0	0.02	0.07	0	0.04	0	0.13
Beach w/o SPSs							
# Parcels	1	61	221	7	107	9	406
Total length	0.91	0.83	2.93	0.57	1.50	0.35	7.08

[1]Includes generalized sand grain size, and beach gradient (diss = dissapative; refl = reflective)
[2]Acceways at Salishan not included since there is no public access from land side

An overview of littoral cell characteristics is presented first, followed by more detailed discussion of the six subareas illustrated in figure 4-1 and used to present data in table 4-1: Salmon River, Roads End, Lincoln City, Salishan, Gleneden Beach-Lincoln Beach, and Fogarty-South.

The 16-mile ***Siletz littoral cell*** is bounded on the north by Cascade Head and on the south by Government Point, two erosion-resistant basalt headlands that effectively isolate it from adjacent cells (figure 4-2). The cell contains two major coastal drainages—the Siletz and Salmon Rivers—and several minor ones. Several small basalt headlands near the north and the south ends of the cell extend seaward into the nearshore zone, but most of the cell is fronted by beaches. The principal stretch of beach extends 12.5 mi from Roads End at the north to Fishing Rock at the south, with the only major interruption being the mouth at Siletz Bay at Taft. Other beaches are along the Salmon River spit and Fogarty Creek beach. Sea cliffs back the beach along nearly 10 mi of the cell, averaging more than 50 ft in elevation (MSL). Dune fields are found on the Salmon River spit at the very north end of the cell and the Siletz spit in the central part of the cell.

On a lot-by-lot basis, the Siletz cell shoreline measures 17.9 mi and is one of the most extensively developed along the Oregon coast, with nearly continuous residential, commercial, and recreational beachfront development. Included in the area are Lincoln City and the unincorporated communities of Roads End, Salishan, Gleneden Beach, and Lincoln Beach. There are 874 oceanfront land

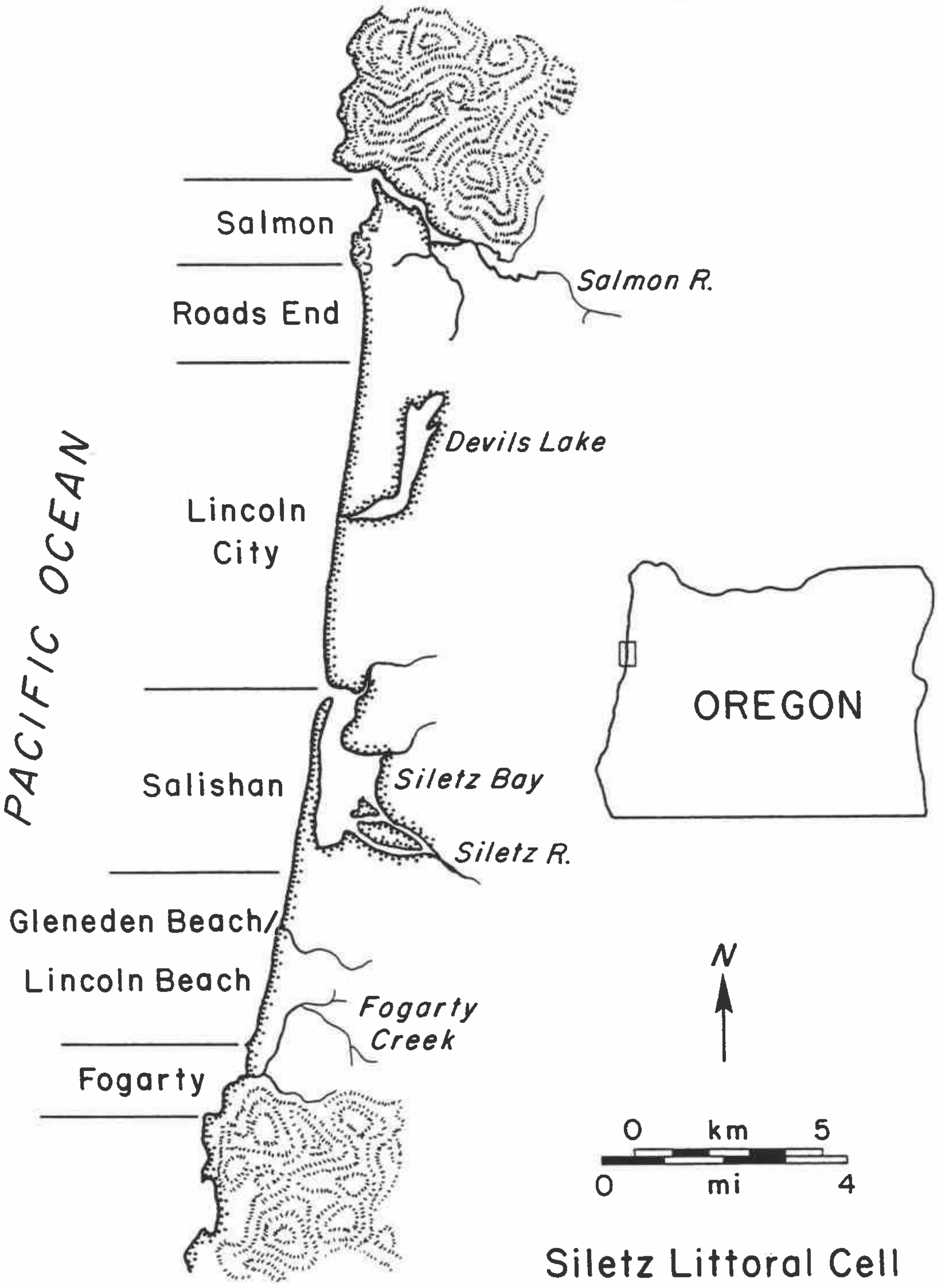


Figure 4-1. Location map for Siletz littoral cell subareas.

Figure 4-2. Siletz littoral cell, looking south from Cascade Head; the Salmon River estuary and sand spit are in the foreground, with Lincoln City, Siletz Bay, and Government Point in the background.

parcels in the study area. Of these, 601 are actual tax lots that have been built out and 206 are vacant, in many cases awaiting new infill construction (see GIS map set in Appendix D). Most of this developed shoreline consists of single- and multi-family residential dwellings (8.1 mi), but motels, recreational commercial uses, and public parks take up a good share of oceanfront as well (table 4-1).

There are also 62 public access points in the cell, or about 3.5 access points for each mile of beachfront.

The beachfront along the Siletz cell is also the most heavily protected along the Oregon coast (see GIS map set in Appendix D). This is due in part to its long history of oceanfront development. However, relative sea level rise along this stretch of coast probably plays an important role as well, making the area especially vulnerable to erosion (Shih 1992). Of the 14 mi of beachfront in the cell, nearly half (6.8 mi) has been protected with SPSs (table 4-1). Most of these are riprap revetments (5.3 mi) and concrete seawalls (1.4 mi).

The ***Salmon subarea*** comprises 2.4 mi (14%) of the cell shoreline and includes the Salmon River spit and the minor basalt headland and sea stacks to the south (table 4-1 and figures 4-1 and 4-2). The Salmon River, emptying into the sea just south of Cascade Head, drains a relatively small 75 mi^2 basin (SWRB 1965). It is a high gradient stream with a low hydrographic ratio (tidal prism/6-hr river discharge), and is likely a sand source for local beaches (Peterson et al. 1984). The beach itself is composed of the finest-grained sands in the cell (Shih 1992); though Shih did not profile this beach, it could be expected to be dissipative and flat-sloped. The Salmon subarea is mostly government-owned, undeveloped land, though the YWCA owns and operates Camp Westwind on the sand spit. The entire area is unincorporated and under the land use jurisdiction of Lincoln County. The estuary itself is part of the U.S. Forest Service's Cascade Head Scenic Natural Research Area. There are no SPSs in this part of the cell.

The ***Roads End subarea*** stretches 1.55 mi from the minor headland at the north to the north city limits of Lincoln City (table 4-1 and figure 4-1). Low sea cliffs make up the shoreland and are mostly composed of medium and fine sand and silt of Pleistocene origin, with outcroppings of Tertiary sandstone at the north. Averaging 46 ft (MSL) in height, the sea cliffs are fronted by a wide, dissipative beach composed of fine to medium sands (Shih 1992). Approximately 80% of the oceanfront land parcels in this unincorporated community are built out; all built-out lots are residential, including many vacation rentals. Lincoln County has land use jurisdiction here. There are 4.5 access points for each shoreline mile along this stretch of beach. SPSs are found on 55% of the parcels in this area; riprap and concrete seawalls are common types.

The ***Lincoln City subarea***, 5.3 mi in length, is the largest in the study area (table 4-1 and figures 4-1 and 4-3). The shoreland is mainly high to very high Pleistocene-era sea cliffs (70 ft average height MSL) fronted by beaches. There are also several low dune areas associated with minor stream outlets, such as that at the D River. With mostly flat slopes, the beaches are generally considered dissipative (Shih 1992). Sand grain sizes are in the medium range, but increase in coarseness to the south. Of the 345 tax lot parcels in the Lincoln City subarea, all but 84 (24%) are built out, mostly with residences and vacation rentals, and a mixture of motels, parks, and other uses. City government has land use jurisdiction. With 6 public access points for each shoreline mile, this is one of the most accessible and

Figure 4-3. Lincoln City shoreline looking south with D River outlet in background (ODOT photo).

heavily used stretches of beach in the study area. It is also heavily protected, with 2.4 mi of SPSs protecting 147 parcels of land. The types of structures are almost evenly split between riprap revetments and concrete seawalls. Still, 221 parcels (3.0 mi of shoreline) in this subarea are unprotected, many of which are eroding sea cliffs 100 ft or more in height.

The ***Salishan subarea***, more than 2.6 mi in length, is entirely within the boundaries of the locked-gate, upscale housing development that gives this subarea its name. The 2.5 mile-long Siletz spit forms a bay barrier for the estuary and is the principal landform in this area; it grades south into high sea cliffs of Pleistocene origin (table 4-1, and figures 4-1 and 4-4). Average landform height in the subarea is 29 ft MSL, though most lots on the spit are 20-25 ft in elevation. Siletz Bay drains a 373 mi^2 area, most of it within the Siletz River basin (308 mi^2). Its role as a sand source versus sand sink is unclear; Komar (1983) suggests it may be a sink, although the relatively low hydrographic ratio and low ratio of beach- versus river-derived sand in the estuary suggests that it could be a net source of beach sand (Peterson et al. 1984). Beach sand in this subarea is the coarsest of any in the study area (except in the relatively isolated Fogarty Creek beach). The reflective beaches in the area are steep-sloped, exhibit cusps within the foreshore, and are vulnerable to rip currents. Of the 111 oceanfront building lots in the development, all but 21 are built out. Land use, under the jurisdiction of Lincoln County, is entirely residential, with the exception of common areas

Figure 4-4. Salishan development along Siletz spit in 1978; note recently-constructed riprap revetments (ODOT photo).

and private beach accessways. All but seven lots have riprap revetment protection, making this the most fully protected part of the littoral cell (2.1 of 2.6 mi).

The 3.0 mile-long ***Gleneden Beach-Lincoln Beach subarea*** is characterized by low to medium sea cliffs with a 34 ft (MSL) average elevation (table 4-1 and figures 4-1 and 4-5). The cliffs are composed of uplifted beach and dune deposits—silts, and fine and medium sands of Pleistocene origin. The beaches in the north part of the subarea are relatively course and become finer to the south near Fishing Rock, in part reflecting the local cliff-supplied sediment sources (Shih 1992). About two-thirds of the buildable lots along the beach are built out, with much of the development relatively recent compared to Lincoln City and Roads End to the north. Again, land use in this unincorporated area is under the jurisdiction of Lincoln County and is mostly residential, with some motel, RV park, other commercial uses, and public parks. Public access to the beach is greater here than any other area along the cell, with 6.3 access points for each shoreline mile. Half of the subarea shoreline (1.5 mi) is protected with SPSs, almost exclusively riprap revetments.

The ***Fogarty-South subarea*** shoreline, 2.8 mi in length, is mostly basalt headlands with outcrops of Tertiary sandstone deposits north of Fogarty Creek (table 4-1 and figure 4-1). Average landform height is 35 ft. The principal beach in the area, Fogarty Creek, is composed of very coarse sands (Shih 1992) and is steep and highly reflective. The subarea is composed of very large, mostly public-owned land parcels, about half of which are

Figure 4-5. Lincoln Beach and Gleneden Beach, looking north toward Siletz Bay, with Fishing Rock in the foreground (ODOT photo).

developed. State parks and waysides (Fogarty Creek State Park and Boiler Bay) are the predominant land use in the subarea, though private lands have been developed for residential and commercial uses. Recent purchase by Oregon State Parks of Fishing Rock headland at the north end of this subarea will add additional park shoreline. The only SPS in the subarea is the riprap revetment that protects the U.S. Highway 101 causeway across Fogarty Creek.

Policy Goals, Objectives, and Measures of Achievement

The oceanfront development and hazard mitigation activities examined in this study are governed by a number of overlapping laws and regulations that were enacted at different times and, in some cases, for different purposes. The separate parts of this loosely-structured "management regime" are also implemented by a number of agencies and/or at different governmental levels. They also differ somewhat in language, emphasis, and detail. Despite these differences, the laws largely deal with the same geographic areas and issues—protection of the beach resource for public recreation, regulation of oceanfront development, and mitigation of coastal natural hazards. Because of this, and for other reasons specified below, a comparative, integrated approach to identifying the "collective" goals, objectives, and measures of achievement was used, as described in Chapter 3.

Although not as straightforward as examination of a single statute, this comparative, integrated approach has a number of additional advantages. First, it highlights the structural similarities and differences of the policies, thereby supporting the policy evaluation framework used in this study (figure 2-7; Sabatier and Mazmanian 1981; 1983). Policy gaps, overlaps, interrelationships, and the relative strengths and weaknesses of policies are more easily discerned. Second, the approach provides a basis for examining the entire management regime for a geographic area at once, rather than piecemeal; as a result, it illustrates how decisions made under one policy (e.g., the siting of an upland building under local land use code) influence decisions at another level (e.g., a SPS permit decision by SPRD/DSL). Finally, the integrative approach to policy evaluation vastly simplifies a still-complex evaluation process.

The individual statutes and administrative rules examined for goals and objectives were discussed in detail in Chapter 2 and outlined in the policy analysis methods section of Chapter 3.

Policy Goals

Policy goals are the broad statements of desired ends or outcomes; those described here were derived mainly from statutes, but also, in the case of land use goals, from administrative law. Three fundamental goals, related to protection of the beach resource for public recreation, development of the oceanfront area, and mitigation of coastal natural hazards, were identified. These are described below, along with the relevant statutory or administrative law citations.

Beach Recreation Protection Goal. A fundamental goal for beach management in the State of Oregon is *to protect the* *beach for public recreational use and enjoyment.* The Beach Law asserted that the public, by virtue of its "frequent and uninterrupted use of the ocean shore," had a legal right or easement in these lands, and that they should forever be protected for public recreation use and enjoyment. This position has been upheld and strengthened in several State Supreme Court cases discussed later in this chapter. Removal/Fill Law authority over activities that would alter the public beach is similarly based on sound legal principles, namely the public welfare provisions of the Oregon Constitution and the common law Public Trust Doctrine (Herman 1971, 89). Relevant citations from each statute include:

> to forever preserve and maintain the sovereignty of the state ... over the ocean shore ... so that the public may have free and uninterrupted use thereof (ORS 390.610 [1]);
>
> to protect and preserve such public rights or easements in the ocean shore (ORS 390.610 [2]);
>
> to do whatever is necessary to preserve and protect the scenic and recreational use of the ocean shore (ORS 390.610 [4]); and
>
> [it is the] paramount public policy...to protect and preserve the use of state waters [Pacific Ocean beaches]... for public recreation (ORS 196.805; ORS 196.825[2]).

The implicit evaluation question posed by this goal is: Have the actions of implementing agencies protected the beach and its inherent scenic and recreational values for public use and enjoyment?

Oceanfront Development Goal. A second fundamental goal for the oceanfront area is *to conserve, protect, and where appropriate, develop or restore oceanfront lands through* *land use controls.* In the language of the LCDC Statewide Planning Goals:

> To conserve, protect, and where appropriate and compatible with the characteristics of adjacent waters, develop or restore the resources and benefits of oceanfront shorelands, recognizing their values for water quality, fish and wildlife habitat, economic resources [the beach], recreation and aesthetics (Goal 17); and

> To conserve, protect, and where appropriate, develop or restore the resources and benefits of beaches and dune areas (Goal 18).

The implicit evaluation question posed by this goal is: Have identified resources and benefits been conserved and protected, and where appropriate and compatible, developed, or restored?

Hazard Mitigation Goal. The third principal goal for management of the oceanfront area is *to protect human life and property from natural or human-caused hazards.* In the language of the LCDC Goals:

> To protect life and property from natural hazards (Goal 7);

> To reduce the hazard to human life and property ... resulting from the use and enjoyment of Oregon's coastal shorelands (Goal 17); and

> To reduce the hazard to human life and property from natural or man-induced actions associated with these areas (Goal 18).

The implicit evaluation question posed by this goal is: Have human life and property been protected through implementation of stated policy objectives?

Answering this and the other evaluation questions requires the identification and evaluation of the policy objectives designed to reach these goals.

Policy Objectives and Measures of Achievement

Objectives are the specific (and usually measurable) statements of action that, if taken, will lead toward or be consistent with a goal; as with goals, they are derived from both statutes and administrative law, but emphasize the latter. Measures or indicators of achievement are the specific quantitative or qualitative data or evidence needed to determine if and how decisions and actions are achieving policy objectives and, by extension, policy goals.

Summary statements of ocean shore protection and related land use policy *objectives* derived from Oregon statutes and administrative rules are compiled in table 4-2. These brief statements are not the exact language found in any particular statute or rule; rather, they are synopses of the statutory or rule language cited below each objective in the table. Similarly, their order does not reflect any particular policy, but rather a logical hierarchy of policy process and decision-making.

Also included in table 4-2 are the *measures* or *indicators* of achievement for each policy objective. These measures or indicators are implicit in the language of the policies, or are formulated by asking the question, "What results would we expect to find if implementation processes and decisions made were consistent with this objective?"

Table 4-2. Beach and oceanfront management policy objectives, their basis in law, and measures or indicators of achievement.

OBJECTIVE/POLICY BASIS	MEASURE/INDICATOR OF ACHIEVEMENT
1—Regulate the installation of SPSs BL: Unless a permit ... is granted, no person shall make an improvement on [the ocean shore] (ORS 390.640 [1]). RFL/R: Fills of greater than 50 cubic yards to repair erosion damage along Pacific Ocean beaches ... shall be regulated by permit (ORS 196.825[2]; OAR 141-85-050; OAR 141-85-055).	a) process established and used to regulate the installation of SPSs b) numbers, types, and locations of regulated and unregulated SPSs constructed since 1967 (Beach Law) and 1976 (R/F Law)
2—Prohibit hard SPSs for property "developed" after January 1, 1977 G 18: Permits for ocean shore protective structures shall be issued only where development existed on January 1, 1977. BIS: To permit SPSs, the property to be protected must have been "developed" before January 1, 1977 (OAR 736-20-010[6]). RFR: To permit SPSs, the oceanfront property being protected was physically improved prior to January 1, 1977 (OAR 141-85-055[4]).	a) process established and used to prohibit hard SPSs for property "developed" after January 1, 1977 b) numbers, locations, and situations where SPSs were permitted, but development did not exist on January 1, 1977
3—SPS permits shall not be approved unless compatible with LCPs BIS: SPSs must be consistent with LCPs (OAR 736-20-010[6]). RFR: for SPSs, local land use plan and ordinance consistency is determined (OAR 141-85-050[2]).	a) process established and used to determine compatibility of SPS proposals with LCP b) numbers, conditions, situations where SPSs permitted, but LCP compatibility not determined
4—Demonstrate the need and justification for shore protection BIS: There must be a adequate justification [1981 version included "critical need"] for the structure to encroach seaward of the BZL (OAR 736-20-010[1]). RFR: May issue a permit where ... accelerated bank erosion has occurred and repair is required (OAR 141-85-055).	a) process established and criteria used to determine when a hazard exits and if a shore protection solution is warranted b) the need or justification for approved and denied shore protection permits as reported in findings; and/or actual physical or other evidence of need c) SPS application approval/denial decisions d) SPS application decisions on vacant parcels

Continued on next page

Table 4-2—*Continued*

OBJECTIVE/POLICY BASIS	MEASURES/INDICATORS OF ACHIEVEMENT
5—Examine and, if reasonable, use alternatives to hard SPSs, including hazard avoidance in land use/administrative decisions G 17: Land use management practices and non-structural solutions to problems of erosion and flooding shall be preferred to structural solutions (Imp. Req. 5). LUL/G 7: Development shall not be *planned* or *located* [sited] in known natural hazard areas without appropriate safeguards. BIS: There are no reasonable special measures which might reduce or eliminate significant public costs. Alternatives such as non-structural solutions ... have been considered (OAR 736-20-010[5]). RFR: No practicable alternatives exist which would have less impact on the beach and ocean (OAR 141-85-050[3][c]); and it is demonstrated that preference has been given, where feasible, to non-structural erosion repair methods (OAR 141-85-055[2]).	a) processes are established and used to examine and consider land use management and non-structural alternatives to hard SPSs b) numbers and locations of parcels where new development did/did not comply with required hazard avoidance setback, and subsequent SPS needed for both categories c) numbers and locations of parcels that used/did not use relocation as a non-structural alternative to hard SPSs, and the potential for future use of this technique d) numbers, instances where other alternatives to SPSs have been used to mitigate hazards, or, for issued permits, evidence that such alternatives were not feasible
6—Before issuing permits, evaluate, avoid, and minimize the individual impacts of permitted SPSs on: public access and recreation use; visual and scenic resources; beach and adjacent land erosion; public safety; other cultural and natural values and resources. BL: Issue permits only if found "... not to be adverse to the public interest" (ORS 390.650 [3]). Public interest means the "protection of the state recreation area, the safety of the public using such areas, the preservation of values adjacent to and adjoining such areas, and the natural beauty of the ocean shore and the public recreational benefit derived therefrom" (390.640[1]). RFL/R: Permits may be issued only after it has been determined that the proposed fill (SPS) would not unreasonably interfere with the paramount policy of the state to preserve the use of state waters [Pacific Ocean beaches] for ... public recreation (ORS 196.825[2] and OAR 141-85-050). RFL/R: Evaluate the probable impacts ... of the proposed activity, considering ... environmental effects, recreation, public access, scenic areas, aesthetics, etc. (ORS 196.825[3] and OAR 141-85-050[1]). BL/BIS: Protect and maintain ... [state or private] property subject to public rights or easements [to the ocean shore] (ORS 390.660); public ownership/use rights of ocean shore will be adequately protected (OAR 736-20-010[2]); the project should maintain significant public recreation use and access to or along the ocean shore (OAR 736-20-020).	a) process established and used for evaluating, avoiding, and minimizing impacts of each proposed SPS; and for establishing and enforcing permit conditions b) where SPSs interrupt/destroy public access, affected accessways to the beach are retained or replaced; where SPSs encroach on the public beach, lateral access is maintained; instances where SPSs installed at or adjacent to state parks, waysides, or public access points c) qualitative assessment of visual/scenic impacts of individual SPSs d) the design (and construction) of SPSs (size, scale, materials, shape, placement, lateral tie-in) is consistent with hazard and need; encroachment of individual SPSs on public beach; instances, situations where prohibited materials used to build SPSs e) evidence of SPS-induced beach or adjacent property erosion

Continued on next page

Table 4-2—*Continued*

OBJECTIVE/POLICY BASIS	MEASURES/INDICATORS OF ACHIEVEMENT
6—Before issuing permits, evaluate, avoid, and minimize the individual impacts of permitted SPSs ... (continued) G 17: Existing public ... access to or along coastal waters shall be retained or replaced if sold, exchanged, or transferred (Impl. Req. 6).G 18: Criteria for review of SPSs shall provide that visual impacts are minimized; necessary access to the beach is maintained; negative impacts on adjacent property are minimized; ... (Imple. Req. 5). G 17: Maintain, restore and where appropriate, enhance riparian vegetation because of its importance to recreation and aesthetics (Imp. Req. 4) and shoreline stabilization (Guidelines, A. Inventories, 6.). BIS: The design should minimize damage to key scenic natural features (beaches, cliffs, headlands), shoreline vegetation and views, and be compatible with surroundings (OAR 736-20-015). RFR: The structure is composed of rock or other clean, durable, erosion-resistent material designed to encourage vegetation growth; tires, concrete rubble, asphalt, or auto parts are not acceptable (OAR 141-85-055[2] and [3]). RFR: The existing bankline is followed and significant encroachment on the beach is avoided (except for extensive recent cuts) (OAR 141-85-055[1]). G 17: SPSs, where shown to be necessary, shall be designed to minimize adverse impacts on water currents, erosion, and accretion (Imp. Req. 5). G 18: Minimize beach and dune erosion by regulating vegetation destruction, exposure of unstable areas, and construction of SPSs which modify current or wave patterns, etc. (Imp. Req. 3). BIS: The project should be designed to avoid or minimize safety hazards to property and the public (OAR 736-20-025) and damage to other significant resources, including ... historical and archeological sites (OAR 736-20-030). RFR: Historical and archeological site preservation requirements of ORS 273.705 are met (OAR 141-85-050[3][b]). BIS: Project should avoid or minimize damage to other significant resources, including habitats, estuaries, ... (OAR 736-20-030).	f) siting of SPSs with respect to historical and archeological sites g) siting of SPSs with respect to threatened or endangered species habitat or other valuable wildlife habitats

Continued on next page

Table 4-2—*Continued*

OBJECTIVE/POLICY BASIS	MEASURES/INDICATORS OF ACHIEVEMENT
6—Before issuing permits, evaluate, avoid, and minimize the individual impacts of permitted SPSs ... (continued) RFR: Project is consistent with state water quality standards (OAR 141-85-050[3][a]); would not adversely affect rare, threatened, or endangered species (OAR 141-85-050[3][d]); would minimize impacts on and not significantly degrade aquatic life and habitats (OAR 141-85-050[3][f] and OAR 141-85-050[3][e]).	
7—Before issuing permits, evaluate, avoid, and minimize the long-term, recurring, and cumulative impacts of SPSs on: public access and recreation use; visual and scenic resources; beach and adjacent land erosion; public safety; other cultural and natural values and resources. RFR: Evaluate the probable impacts, including cumulative impacts, ... considering environmental and economic consequences; direct and indirect effects on the beach; effects on water circulation, tides, current patterns, and flood hazards; effects on special aquatic sites--refuges, sanctuaries, scenic areas; effects on water access, public recreation, and aesthetics; effects on water quality and aquatic life and habitats (OAR 141-85-050[1]). RFR: The project ... collectively would not cause significant degradation of ... aquatic life and habitats, ... or recreational, aesthetic, and economic values (OAR 141-85-050[3][e]). BIS: There must be no reasonable alternatives that would better protect public rights or reduce or eliminate ... long-term public costs (OAR 736-20-010[4], [5]). G 18: Criteria for review of SPS shall provide that ... long-term or recurring costs to the public are avoided (Imp. Req. 5d).	a) process established and used for evaluating, avoiding, and minimizing cumulative impacts of SPSs b) cumulative length of SPSs installed along the beachfront by year, type, and landform c) numbers, degree, and area of SPSs encroachment on beach (as compared to beach area available) and effects on lateral access and recreational use d) cumulative loss of sand supply to the beach due to hard SPS installation along sea cliffs

Key to Abbreviations

BL: Beach Law (ORS 390.605-390.770)
BIS: Beach Improvement Standards (OAR 736-20-003 TO 736-20-035)
RFL: Removal/Fill Law (ORS 196.800-196.990)
RFR: Removal Fill Administrative Rules (OAR 141-85-005 TO 141-85-090)
LUL: Comprehensive Land Use Planning Law (ORS 197)
G 7: LCDC Goal 7, Areas Subject to Natural Hazards and Disasters (OAR 660-15-000)
G 17: LCDC Goal 17, Coastal Shorelands (OAR 660-15-010)
G 18: LCDC Goal 18, Beaches and Dunes (OAR 660-15-010)

Ocean Shore Protection Implementation Results: Processes and Outcomes

The policy objectives and corresponding measures of achievement specified in table 4-2 are the basic organizing framework for the presentation of study results. For each policy objective, there is a corresponding discussion of findings for the measures or indicators of achievement. Also, both process-related measures (how implementation is administratively structured) and impact- or outcome-related measures (the effects of decisions made along the Siletz cell oceanfront) are evaluated for each of the objectives. Where relevant to policy questions, the results of recent scientific and engineering research on coastal processes and hazard mitigation are also included in the discussion.

Policy Objective 1: Regulate the installation of SPSs

The installation of oceanfront SPSs are jointly regulated at the state level under the Beach Law and the Removal/Fill Law. The Beach Law, administered by the SPRD, states that "unless a permit ... is granted, no person shall make an improvement on [the ocean shore]" (ORS 390.640 [1]). The principal purpose of this 1967 law was to protect existing public rights in the dry sand beach—the mostly privately-owned area between the upper limit of state-owned tidelands (mean high water [MHW]) and the upland vegetation line, approximated by a surveyed, 16-foot elevation (MSL) beach zone line (BZL). The "beach improvement" regulatory program was included in the law to prevent alterations and construction that would be adverse to public beach rights.

The Removal/Fill Law and its administrative rules, administered by the DSL, state that "fills of greater than 50 cubic yards to repair erosion damage along Pacific Ocean beaches ... shall be regulated by permit" (ORS 196.825[2]; OAR 141-85-050; OAR 141-85-055). The principal purpose of this law is to regulate alterations of waterways and wetlands throughout the state; consequently, although its jurisdiction is broader than the Beach Law, it is less well-designed to deal with oceanfront-related issues. Nevertheless, some of its provisions significantly increase the state's ability to effectively manage shore protection projects along the oceanfront.

At the federal level, the U.S. Army Corps of Engineers (COE) also has jurisdiction over SPS installation, under its Section 10/404 regulatory program. However, as discussed in Chapter 2 and below, most SPSs installed along the Oregon coast are covered by COE nationwide permit 13 (bank stabilization) and do not require individual permits. Nevertheless, the COE can not issue an authorization or an individual permit for an oceanfront bank stabilization project unless the state approves the project as being consistent with its federally-approved Oregon Coastal Management Program (OCMP).

The policy question addressed here is whether or not the objective of regulating SPSs along the oceanfront is being effectively implemented. Measures or indicators of policy achievement are outlined in table 4-2 and listed below:

a) a process is established and used to regulate the installation of SPSs;

b) the numbers, types, and locations of regulated and unregulated SPSs constructed since 1967 (Beach Law) and 1976 (R/F Law).

Each of these measures is analyzed and discussed below.

a) Process established and used to regulate the installation of SPSs. The regulatory process for installation of SPSs has changed somewhat since the state jurisdiction was first established under the Beach Law in 1967. The law and permit program was initially administered by the Department of Transportation's State Highway Division, of which State Parks and Recreation was a branch. In 1980, State Parks and Recreation became a separate division; beach management, including the beach improvement permit program, moved to the newly-created division. DSL began to assert its concurrent Removal/Fill Law authority to regulate SPSs in 1977; at present, despite some differences in authority, SPRD and DSL both have jurisdiction over most SPS proposals.

To help streamline the process for applicants, SPRD and DSL established a single permit application form and process in 1978; Appendix C is the current version of the joint application form. SPRD and DSL have also established additional coordination mechanisms. Through its north and south coast regional field offices, SPRD maintains an active beach management program; because DSL has no coastal field staff, SPRD staff take the lead and are generally more involved in the evaluation and monitoring of shore protection projects, whether or not they actually have jurisdiction (i.e., the SPS extends west of the BZL). This

SPRD/DSL relationship is explored further in subsequent policy objective sections.

Cities and counties may also have jurisdiction over the installation of SPSs. Some, such as Clatsop and Tillamook Counties on the north coast, require separate local permits. Others, such as Lincoln County, do not require separate permits, but do have veto or project modification authority if a SPS project is not consistent with the local comprehensive plan and ordinances. This local review is facilitated by inclusion of a "city/county planning department affidavit" section in the state joint permit application (Appendix C).

At the federal level, under a 1986 regional permit, the COE was also clearly in the permit loop. However, regional permit conditions were such that the COE rarely got involved directly in the decision-making process. Another factor limiting COE involvement is that their jurisdiction extends only to the high tide line—about 6.5 ft NGVD or 10.6 ft MLLW (Johnson 1991). Most oceanfront SPSs are built landward of this elevation. Under the new COE nationwide permit 13, which has even broader regional conditions, the role of the Corps in the shore protection permit process will likely be further limited.

All three governmental levels, then, are more or less involved in the SPS regulatory process. For the most part, there appear to be adequate mechanisms in place to bring about required regulation and needed coordination. How well the mechanisms work in practice is discussed below, based on analysis of SPS permit and construction activity in the Siletz littoral cell between 1967-1991.

b) Regulated and unregulated SPSs constructed since 1967 (Beach Law) and 1976 (Removal/Fill Law). Since the "beach improvement" regulatory program was established in 1967, 310 SPSs have been constructed within the Siletz littoral cell. The vast majority of structures are of two basic designs—sloped riprap revetments and vertical seawalls, usually made of concrete. The distribution of these SPSs by type of permit, type of structure, and time period are enumerated in table 4-3 and illustrated in figure 4-6. Of the 310 SPSs constructed, 215 (69%) have valid permits from SPRD and/or DSL; these include regular permits (189 or 61%) that have gone through the normal application and review process and emergency permits (26 or 8%) that have been authorized verbally and/or by letter. However, 95 of the constructed SPSs (31%) do not have permits, either because SPRD and/or DSL did not have regulatory jurisdiction (78 possible cases) or because property owners may have installed SPSs without benefit of a permit (17 possible cases).

The relatively high incidence of unregulated SPSs (3 of every 10) constructed in the Siletz littoral cell begs the question, why? There are several possible answers, most related to jurisdictional gaps or administrative problems at the state level. Some of these gaps and problems can be inferred from the comparison of regulatory programs presented in table 4-4.

Jurisdictional Gaps. One problematic gap is that SPRD, under the Beach Law, does not have jurisdiction over SPSs built east of the 1967-surveyed BZL (figure 4-7).

Table 4-3. Regulated and unregulated SPSs constructed in the Siletz littoral cell, 1967-91.

Constructed SPS Type/ Time period	TYPE OF PERMIT: SPRD Regular Permit Only	DSL Regular Permit Only	Joint SPRD/DSL Regular Permit	SPRD Emerg. Permit Only	DSL Emerg. Permit Only	Joint SPRD/DSL Emerg. Permit	No SPRD[1] and/or DSL Jurisdiction	Apparent/ Possible Violation	Total SPSs
Riprap Revetments 1967-76	43	na	na	13	na	na	45	1	102
Other types[2] 1967-76	10	na	na	0	na	na	1	0	11
Riprap Revetments 1977-91	16	19	88	9	3	1	29	15	180
Other types 1977-91	7	1	5	0	0	0	3	1	17
Total Riprap Revetments 1967-91	59	19	88	22	3	1	74	16	282
Total Other types 1967-91	17	1	5	0	0	0	4	1	28
Total SPSs 1967-91	76	20	93	22	3	1	78	17	310

[1] SPS project is east of BZL (out of SPRD jurisdiction) or landward of upland vegetation line or highest measured tide (out of DSL jurisdiction)
[2] Other types of SPSs include vertical concrete block and concrete reinforced seawalls, wood bulkheads, etc.
SPRD — State Parks and Recreation Department
DSL — Division of State Lands
na — not applicable; DSL did not take permit jurisdiction over oceanfront SPSs until 1977

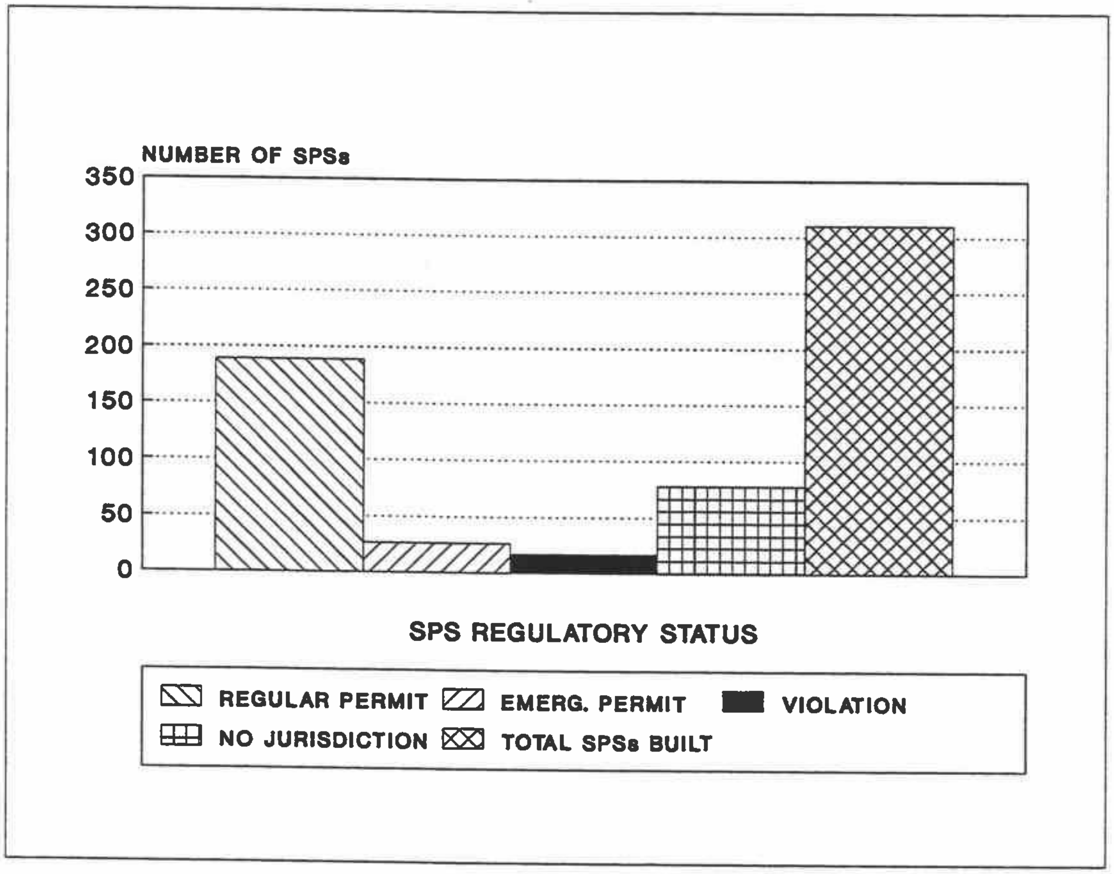
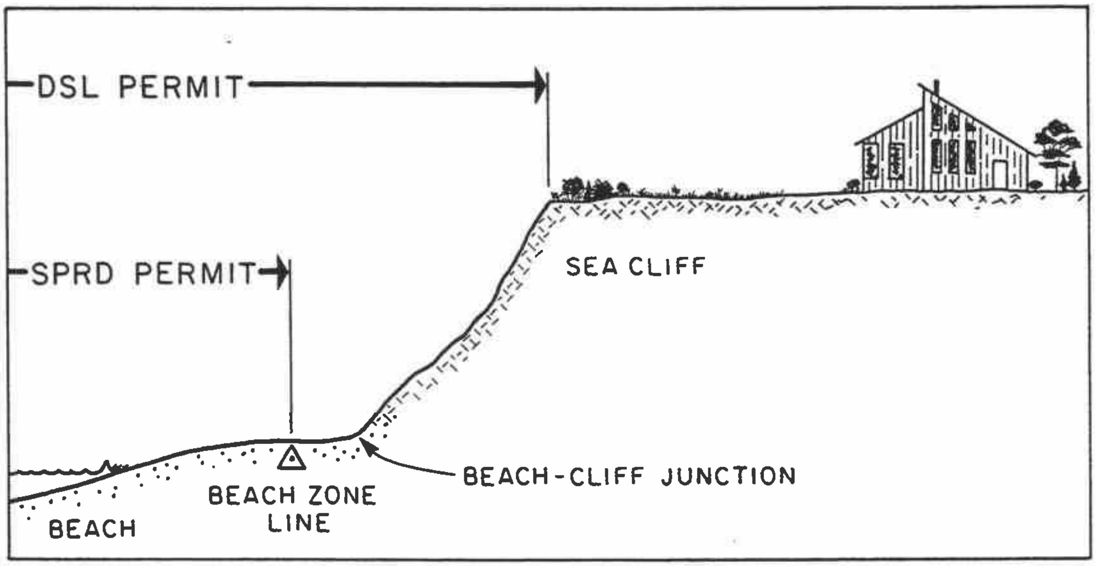


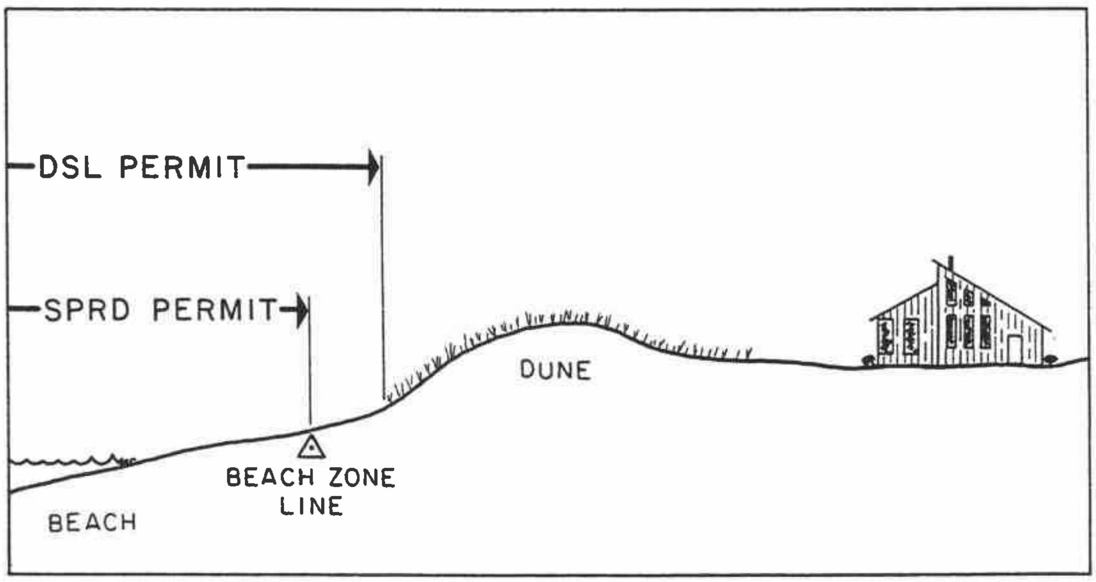
Figure 4-6. Regulated and unregulated SPSs constructed in the Siletz littoral cell, 1967-91.

Table 4-4. Jurisdictional comparison of shore protection regulatory programs in Oregon.

GOVERNMENTAL LEVEL/AGENCY	TYPE OF PERMIT	TYPES OF SPSs REGULATED	AREA OF REGULATORY JURISDICTION	THRESHOLD OF JURISDICTION
Federal/ Corps of Engineers (COE)	NWP 13 w/ Regional conditions (new/repair)	Riprap revetments; others if notification procedures followed and impact minimal	Below ordinary high water (OHW)--rivers; or high tide line (HTL)--tidal areas	<500 ft in length and <½ cu yd of riprap below OHW or HTL
	Regular (new/repair)	Vertical concrete and other retaining walls, all structures not covered by NWP 13	Same as above	>500 ft in length and >½ cu yd of riprap below OHW or HTL
State/ Parks and Recreation Department (SPRD)	Regular (new only)	All structure types, including sand or other fill	West of the 1967 surveyed beach zone line (BZL)	None--all "improvements" covered, but no permit required for repair to original condition
	Emergency (new only)	All structure types (usually riprap revetments)	Same as above	Same as above
State/ Division of State Lands (DSL)	Regular (new/repair)	All structure types, including sand or other fill	Line of established upland vegetation or highest measured tide, whichever highest	>50 cu yd of riprap or other fill (sand, concrete, etc.)
	Emergency (new/repair)	All structure types (usually riprap revetments)	Same as above	Same as above
Local/ City or County	Regular (may defer to SPRD/ DSL process)	All types but varies with city/county	Varies, but may include areas landward of state jurisdiction	Varies



SEA CLIFF SHORE



SAND DUNE SHORE

Figure 4-7. Geographic comparison of SPRD and DSL shore protection regulatory program jurisdiction.

Because the shoreline has eroded landward in many areas along the coast, SPSs can be built east of the BZL without a permit from SPRD; this occurred in 46 cases (table 4-3) between 1967 and 1976. All but four of these SPSs were riprap revetments built in front of houses or vacant lots in the Salishan development on Siletz Spit. Whether or not construction of SPSs east of the BZL is a problem or not is subject to debate. Clearly, the 1967 legislature did not intend to regulate private development east of this line. However, it is also clear that SPSs built east of the BZL have many of the same impacts on beach recreation, public access and safety, scenic attributes, and the beach itself as those SPSs encroaching west of the BZL.

In late 1976, DSL realized that it had concurrent jurisdiction over oceanfront SPS installation, based on the 1971 Removal/Fill Law, and began exercising that authority. DSL's jurisdiction is "to the line of established upland shore vegetation or the highest measured tide, whichever is higher" (OAR 141-85-015 [3][f]). Because their jurisdiction moves with the eroding/accreting shore rather than being tied to a surveyed BZL, DSL often regulates SPSs that are landward of SPRD's jurisdiction (19 instances in the Siletz cell since 1976). However, even DSL's jurisdictional area did not cover many of the SPSs built at Salishan. According to permit records (or based on the lack of records), 29 SPSs built after 1976 at Salishan were not covered by either SPRD or DSL permits. Though many were likely built east of the BZL (out of SPRD jurisdiction) and some even landward of DSL's jurisdiction, it is suspected that at least some of these actually were jurisdictional structures and, in fact, violations.

Why have there been so many unregulated SPSs at Salishan? The first reason is that many of the SPSs are likely well east of the BZL. The beach and dunes at Salishan are susceptible to rapid erosion, especially during storms when large rip current embayments cut into the beach and dunes. This high vulnerability to erosion is why 14 of the 27 emergency permits issued for the entire study area are for properties along this 2.5-mile stretch of beach. Many other lots have experienced less but sufficient erosion that SPSs could easily be installed east of the BZL. Why DSL would not take jurisdiction on 29 permits is another matter. Part of the reason is DSL's limited coastal presence—SPRD is the principal beach manager and regulator. Another reason may be the very limited public access to the area and relative lack of scrutiny. During the field survey of structures, most of these structures were well covered by sand and beachgrass; precisely locating them and making a post facto jurisdictional determination would be very difficult.

Minimum Threshold gap. DSL's jurisdiction is further limited by the volume of material used—any structure that involves less than 50 cu yd of material (most vertical retaining/seawalls) is not regulated. This provision accounted for three of the post-1976 unregulated SPSs in the Siletz cell; one was a wood bulkhead and two were concrete beach access stairs. Other types of erosion-control structures, such as gunnite walls or upper bluff structures, also likely fall outside SPRD's or DSL's jurisdiction. DSL's volume-related regulatory threshold was initially established to control removal of material in waterways. It is not a workable threshold for regulating the variety of structures installed for oceanfront erosion protection. Again, this jurisdictional gap is only a problem if these smaller structures have adverse impacts on the public rights these laws are designed to protect. These impacts are discussed in subsequent sections.

SPS Repair-related Gaps. Another jurisdictional gap has to do with SPS repairs. As long as the SPS repair action does not exceed the size of the original SPS, and if less than 50 cu yd of material is involved, no permit is required from either SPRD or DSL. Although it was not possible to evaluate this question retrospectively (no records available), it warrants consideration, given the potential for abuse and cumulative impacts.

Violations. As enumerated in table 4-3, there were 17 SPSs built in apparent or possible violation of applicable state laws. Fourteen of these apparent violations have been along Gleneden Beach since 1976. This area experienced frequent episodes of serious erosion during the 1980s, resulting in a confusing array of multiple property permits, permit denials, subsequent approvals, and emergency SPS construction. This area, along with Salishan, is the most problematic in the study area, both from the standpoint of erosion hazards and shore protection response.

In summary, these data suggest that significant numbers of SPSs are being built without the state oversight needed to protect the beach and the values it represents.

For these unregulated structures, there is no evaluation of need, alternatives, design, or safety concerns. There is no assessment of impacts on beach recreation and public access. Cumulative impacts and possible induced erosion of the beach or neighboring properties cannot be addressed.

The relatively large number of unregulated SPSs being built are one indicator of SPRD and DSL jurisdictional gaps and administrative problems. Another administrative problem is that, although the joint permit application process decreases paperwork and promotes coordination, having two separate permitting agencies is unnecessary, wasteful duplication of effort. One permit from a single agency would be sufficient to represent state interests, especially if the gaps in state authority are eliminated. Jurisdictional areas, types of structures regulated, and jurisdictional thresholds for regulation need to modified to ensure that the program covers all SPSs that might adversely effect beach resources or public interests.

Policy Objective 2: Prohibit hard SPSs for property "developed" after January 1, 1977

The policy objective, "... hard SPSs shall be prohibited for property 'developed' after January 1, 1977," originates in Statewide Planning Goal 18, Beaches and Dunes (OAR 660-31-010). This policy statement is potentially one of the OCMP's most significant with respect to oceanfront areas. In effect, it says that Oregon's shoreline management strategy is to "retreat" from those portions of the oceanfront that were not developed by 1977 (when the OCMP was adopted and approved). However, in the original goal language adopted in 1976, the term "developed" was not defined. This oversight was corrected with the 1984 goal amendments; the revised goal stated:

> For purposes of this requirement ..., "developed" means houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through construction of streets and provision of utilities to the lot, and include areas where an exception ... has been approved (LCDC Goal 18, Implementation Requirement 5).

Both SPRD and DSL have incorporated this SPS prohibition for post-1977 development into their respective administrative rules (OAR 736-20-010 [6] and 145-85-055[4]). Coastal local governments have done the same in their local comprehensive plans (LCPs).

The policy question addressed here is whether or not the objective—to prohibit hard SPSs for property "developed" after January 1, 1977—is being effectively implemented. Measures or indicators of policy achievement (table 4-2) are:

a) a process is established and used to prohibit hard SPSs for property "developed" after January 1, 1977; and

b) the numbers, locations, and situations where SPSs were permitted, but development did not exist on January 1, 1977.

Each of these measures is analyzed and discussed below.

a) Process established and used to prohibit hard SPSs for property "developed" after January 1, 1977. In response to the 1984 Goal 18 amendment that defined the term "developed" for purposes of determining what lands were subject to the prohibition on hard SPSs, DLCD, in cooperation with local government, inventoried all oceanfront lands in 1986-87. The resulting maps are used as guides for application of the SPS prohibition requirement. During periodic plan reviews and updates, these "developed lands" maps are to be incorporated into LCPs. Neither jurisdiction in the study area, Lincoln City or Lincoln County, has completed a periodic review since completion of the "developed lands" inventory. Of the two local jurisdictions, only Lincoln County has a set of the maps. At the state level, where the requirement comes into play in the permit process, no maps of "developed lands" could be located at any of the relevant agencies—SPRD, DSL, or DLCD. Furthermore, the joint permit application form (Appendix C) does not request information on the development status of the property in question. Adding a question on this issue on the joint application form would improve coordination.

b) Numbers, locations, and situations where SPSs were permitted, but development did not exist on January 1, 1977. Of the 17.79 mi of oceanfront lands (904 parcels) in the Siletz littoral cell, 5.68 mi (37%) (22 parcels) were not "developed" as of January 1, 1977, according to the above definition. Most of these shorelands are large parcels that are either private timber holdings (5 parcels/2.99 mi), state parks (7 parcels/1.29 mi), or undeveloped private lands at the tip of Siletz spit that will not be developed due to permanent conservation easements (3 parcels/0.45 mi). The remaining undeveloped shorelands (7 parcels/0.96 mi) are privately-owned and zoned for residential or commercial development.

Three of these seven "undeveloped" parcels have been developed since 1977. The Sea Ridge Condominiums were built on a single oceanfront parcel in 1984 in Lincoln Beach. Construction of the Lincoln Shores Star Resort in north Lincoln City began in early 1992 on three other parcels, two of which are "undeveloped."

The integrity of the SPS prohibition requirement was tested in late 1984 at Sea Ridge, shortly after condominium construction was completed, and later in 1988. Because the 610-foot oceanfront property was developed after 1977, the SPS prohibition applies. In late November 1984, Sea Ridge owners, threatened by erosion of the low dune fronting the property and apparently unaware of the SPS prohibition, asked for emergency authorization from SPRD and DSL to install a rock road in front of the dune. SPRD and DSL, unaware of the "undeveloped-in-1977" status of the Sea Ridge development (no inventory existed), issued the emergency permits. The rock road effectively halted the erosion. Sea Ridge owners then applied for a permit to install a permanent riprap revetment. Lincoln County, based on the Goal 18 requirement, determined that the project was inconsistent with their LCP and that an "exception" to the SPS prohibition would be needed before state permits could be granted. DLCD concurred that an exception would be needed under OAR 660-04. As an alternative to the long and costly exceptions process, the Sea Ridge owners then applied for and received a DSL permit (SP 2394) for rebuilding the eroded dune and revegetating it with European beachgrass. Such non-structural approaches to erosion control are encouraged and preferred, according to the LCP and state policies (table 4-2). DLCD also initiated discussions with SPRD and DSL to prevent recurrence of this situation, and proposed the measures below to improve coordination and define when a bona fide emergency situation exists:

> 1. Local governments should notify ODOT [SPRD], DSL and DOGAMI [Department of Geology and Mineral Industries] of developments proposed on shorelands where beachfront protective structures are prohibited. Notice would include a copy of any geologist's reports on erosion hazards. State agencies would then be aware of pending local approvals and have an opportunity to comment on the adequacy of setbacks and other hazard mitigation measures.
>
> 2. The Department [DLCD] should provide policy guidance to local governments on the interpretation of Goal 18's prohibition and other requirements for adequate setbacks (Goals 7, 17 and 18). This guidance would indicate that new development in areas subject to Goal 18's prohibition should be set back adequately to survive erosion anticipated over the life of the structure.
>
> 3. ODOT [SPRD] and DSL should notify the affected local government and the Department [DLCD] of requests for emergency permits in all oceanfront areas. Written or verbal approval will not be given until both the affected city or county and the Department [DLCD] have been consulted.
>
> 4. ODOT [SPRD] and DSL should adopt a definition of "emergency" which clearly limits approval to bona fide emergency situations. I suggest the following language as a first attempt at such a definition:
>
> There is an imminent erosion episode which:
>
> (a) substantially exceeds the extent of erosion expected at the time the development was approved; and
>
> (b) requires that corrective action be taken immediately to avoid serious damage or destruction to a properly located residence, or a commercial or industrial building; and

(c) other non-structural methods of erosion control prescribed at the time of development approval were taken and properly maintained; and

(d) the type and extent of action taken is limited to that necessary to control the immediate erosion problem.

5. Consider updating agency coordination agreements to clearly outline procedures and standards for review of ocean shore permits (letter from James Ross, DLCD director to David Talbot, SPRD Administrator, 1985).

Talbot responded to Ross' letter two weeks later saying he understood that the matter had been taken care of and that his staff would check with the local building department before issuing emergency permits (Talbot 1985). He did not respond to the other suggestions included in the letter. DSL, also a recipient of the Ross letter, likewise did not respond.

After subsequent minor erosion episodes during the winter of 1987-88 (figure 4-8), the Sea Ridge owners stated their intent to apply for an exception to the prohibition on SPSs and received support for this position from local officials. After negotiations with the state, however, they instead applied for and received a permit from DSL (SP 2906) and SPRD (BA-304-88) to again rebuild and vegetate the sand dune in front of their property.

However, the DSL permit also pre-authorized emergency placement of riprap, should subsequent erosion of the dune extend landward of a certain line along the shore (figure 4-9). This was apparently part of a compromise with Sea Ridge to drop its plan to apply for an exception. This pre-authorization of emergency riprap, however, clearly violates the intent and spirit of state policy.

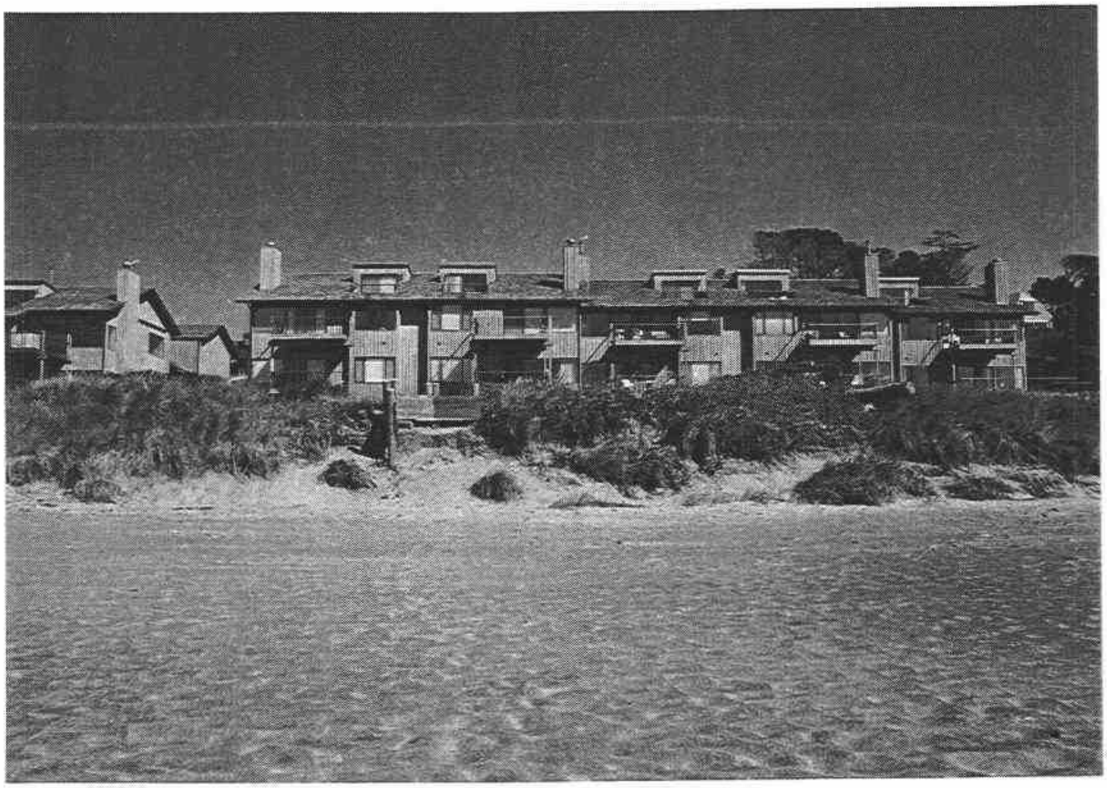


Figure 4-8. Sea Ridge condominiums, built on an "undeveloped" parcel in 1984 at Lincoln Beach; owners may place emergency riprap if erosion of the foredune exceeds a predetermined line.

Sea Ridge owners have renewed their permit each year and, according to DSL, have repaired minor dune erosion once. However, because there is no permit condition requiring Sea Ridge to repair dune damage whenever it occurs, it may be just a matter of time before the emergency riprap is installed. After-the-fact permits and an exception to the SPS prohibition are more likely to be forthcoming at that point. The more important outcome of this decision is that the pre-authorization for an emergency riprap sets a precedent that effectively negates the SPS prohibition requirement. Further, the lack of

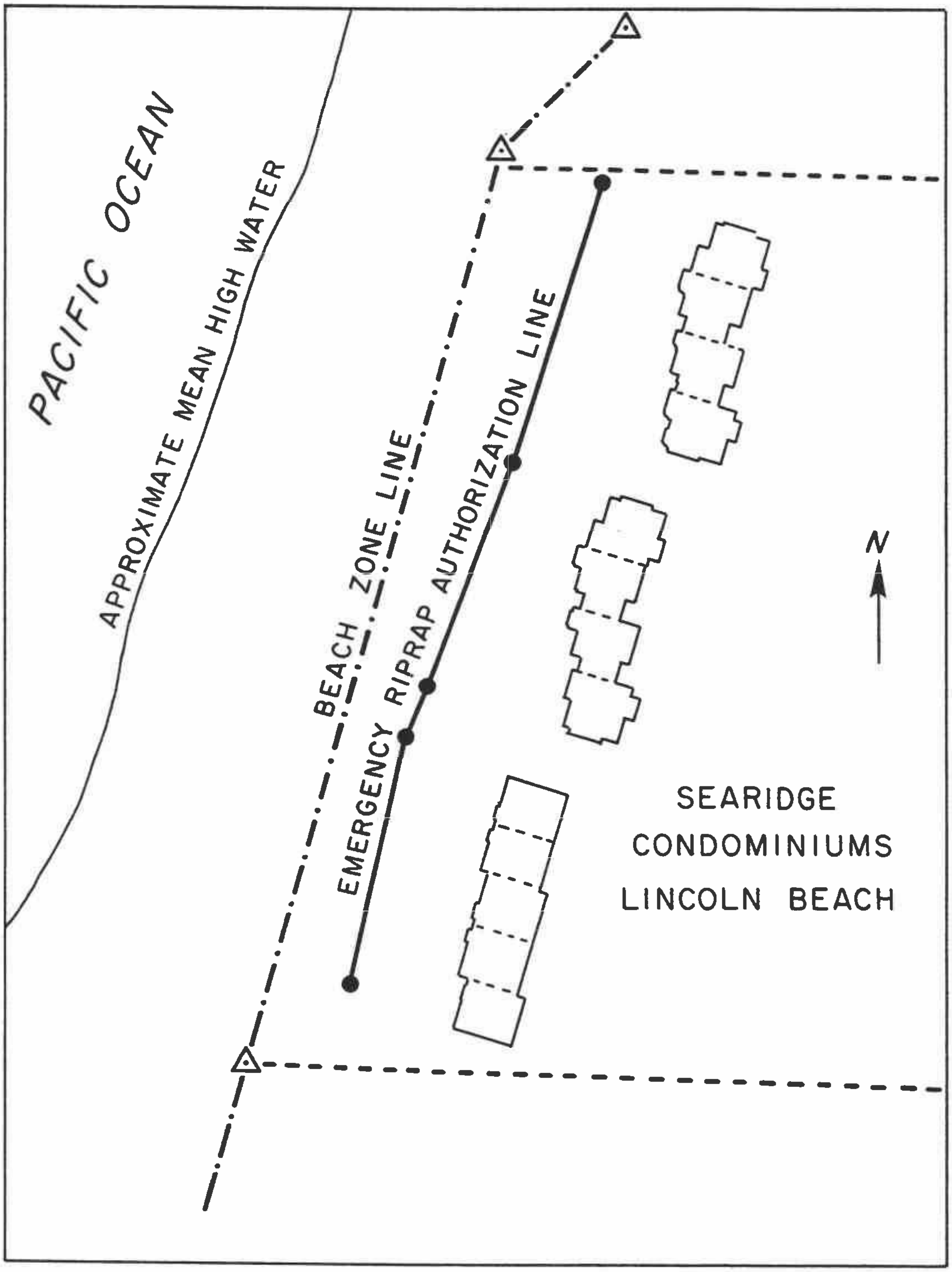


Figure 4-9. If foredune erosion proceeds landward of the solid line, condominium owners may place emergency riprap upon verbal authorization from DSL.

follow-up to DLCD's letter recommending ways to improve coordination suggests that similar problems could reoccur.

In the second case, Lincoln Shores Star Resort is being developed on two adjacent "undeveloped" parcels (1405-foot oceanfront length) at the north end of Lincoln City. A third "developed" parcel is included in the project. Because of the hard SPS prohibition provision of Goal 18, the Lincoln Shores Star Resort was subject to extensive construction setback negotiations between the developer, Lincoln City, and DLCD.

Among the conditions of approval for the development were construction setbacks ranging from 54 ft for the southernmost developed parcel (low-lying ocean flooding area) to 108 ft for the two undeveloped bluff-top parcels to the north. There was also a statement applicable to all parcels that "no beachfront protective structures shall be installed" (City of Lincoln City Planning Commission 1990). It would also have been beneficial to identify the purpose of the setback zone in the development agreement, i.e., as an erosion zone where the shoreline will be allowed to gradually recede. Unless such an understanding is included in the conditions, it is not improbable that inevitable future episodes of erosion into the setback zone will trigger requests for either an emergency riprap permit or an exception to the Goal 18 prohibition. Such erosion zone language should be explicitly included in any future project development agreements for "undeveloped" oceanfront lands.

Despite the improved coordination (as compared to the Sea Ridge project) this case illustrates, and the significant construction setbacks that resulted, the SPS prohibition policy needs further clarification. In addition to the erosion zone language suggested above, situations where policy exceptions will (and will not) be granted need to be specified.

Policy Objective 3: Ensure compatibility with local comprehensive plans

The policy objective "SPS installation must be consistent with local comprehensive plans (LCPs)..." originates in Oregon's statewide land use planning program, specifically the Land Conservation and Development Commission administrative rules for state permit compliance and compatibility (OAR 660-31). These rules require that DSL and/or SPRD, before issuing permits for beachfront protective structures, seek and obtain a statement of LCP compatibility from the local government (OAR 660-31-035). Alternatively, if there is no acknowledged LCP or the acknowledged LCP does not address the issue, DSL and/or SPRD must evaluate SPS proposals for compatibility with statewide planning goals (OAR 660-31-026). Both SPRD and DSL have incorporated these provisions into their respective administrative rules (OAR 736-20-010 [6] and 145-85-050[2]).

Appropriate measures or indicators of achievement for this objective (table 4-2) are:

a) a process is established and used to determine compatibility of SPS proposals with LCP

b) numbers, conditions, situations where SPSs permitted, but LCP compatibility not determined

Each of these measures is analyzed and discussed below.

a) Process established and used to determine compatibility of SPS proposals with LCP. As noted above, both SPRD and DSL have incorporated LCP/statewide planning goal compatibility language into their respective administrative rules. Since early 1978, SPRD has noted in its permit findings that their "review has included ... evaluations of the effects of the proposal upon public and environmental concerns as provided under ... the 1977 Statewide Planning Goals." In December 1982, the joint SPRD/DSL permit application form was revised to require a "city/county planning department affidavit." In the affidavit, the local planning official certifies that the project is either consistent, not consistent, or needs additional local approvals to make it consistent (Appendix C is the current joint application form). Further, the applicant must sign the form and certify that the project is "to the best of my knowledge and belief ... in compliance with the Oregon Coastal Management Program" (OCMP). Because state-acknowledged LCPs are part of the OCMP, it follows that an applicant should not sign or submit an application until all local approvals are obtained and the project is certified consistent with the LCP. This is not the interpretation made by SPRD or DSL, since they accept applications for projects that are not yet consistent with the LCP. Furthermore, it is probable that few applicants actually know what the OCMP is or how they would determine whether or not they are "in compliance" with it. The form is thus internally inconsistent and should be revised to assist the applicant on this issue.

b) Numbers, conditions, situations where SPSs permitted, but LCP compatibility not determined. LCP consistency data was not included in the database developed for this study; however, for the vast majority of projects, this part of the application is fairly routine and provides a good basis for state-local communication. As noted earlier, however, applicants often sign their application without obtaining all the needed LCP approvals, stating that the proposal is "in compliance with the OCMP." In one situation, SPRD and DSL actually issued a permit for a 200 ft riprap revetment (BA-267-85/SP 2382) when the planning department affidavit clearly stated that the project was not consistent with the LCP. Though the matter may have been resolved after the application had been submitted, no record of that was available in permit files. This suggests that the application form should be revised to require follow-up documentation of local approvals. In spite of this example and the need for minor revisions, the LCP consistency review is an effectively-institutionalized, useful part of the permit process.

Policy Objective 4: Demonstrate the need and justification for shore protection

The question of need and justification for a proposed shore protection project is logically one of the first questions that regulatory agencies address when they receive a permit application. It is also closely related to another question; namely, are there alternatives to the proposed action that would be more appropriate and less damaging to the beach resource? The latter question is the subject of the next section (Policy Objective 5). Though the separation of these two issues—the need for shore protection and alternative approaches—is somewhat artificial, there is merit to considering them separately and sequentially. Basically, the rationale for separation is that if there is no need or problem, no "alternative approaches" need to be considered.

The current policy objective originates in the SPRD beach improvement standards, which state "there must be adequate justification for the project to come seaward of the beach zone line and alter the ocean shore" (OAR 736-20-010[1]). Interestingly, the 1981 version of the beach improvement standards also required that there be a "critical need" for SPSs, but this provision was inexplicably deleted from the current version (1985) of the standards.

DSL policy addresses the "need" issue in a more oblique fashion; their rules state that "Where accelerated bank erosion has occurred and repair is required, the director may issue a permit ..." (OAR 141-85-055). This language implies that "accelerated bank erosion" is the only acceptable justification for issuance of a SPS permit. Neither SPRD nor DSL administrative rules elaborate further on what may constitute adequate justification or need for SPSs. To determine how these policies have been implemented, data from permit files and the findings and decisions made by SPRD and DSL are examined below.

The policy question addressed here is whether or not there has been a demonstrated need and justification for SPSs that have been permitted within the Siletz littoral cell. Specific measures or indicators of policy achievement from table 4-2 are:

a) a process is established and criteria used to determine when a hazard exits and if a shore protection solution is warranted;

b) the need or justification for approved and denied shore protection permits as reported in findings (i.e., hazard present, property threatened); and/or actual physical or other evidence of need;

c) SPS permit application approval/denial decisions through time;

d) decisions on SPS applications for vacant parcels.

Each of these measures is examined below.

a) Process established and criteria used to determine need and justification. SPRD and DSL, in their joint permit application form and instructions (Appendix C), ask the applicant to describe and show on drawings evidence of recent erosion, including an "evaluation of the active and potential erosion rate of your property." This is the only item on the application form that clearly relates to the question of need for shore protection. Permit administrators use the information provided along with their field evaluation to help determine the need and justification for the project as proposed. However, other than DSL's rule statement that erosion must be "accelerated," there are no standards or thresholds for what degree of erosion is sufficient to make that determination.

The other item on the permit application that might relate to the need and justification issue is the section asking for information on adjacent shore conditions, and whether or not these properties are protected with shore protection structures. However, exactly how this information might be used in making decisions is unclear.

Additional information about the nature and apparent causes of the hazard would also be useful in making a need and justification determination. Examples include: ocean waves that undermine the dune or cliff base; cliff-top recession due to wave-undercutting, weathering, or both; sloughing or rilling due to surface or subsurface runoff; mass movement due to landslides; and erosion induced by adjacent shore protection structures or other human disturbance.

Other questions need to be addressed as well. For example, if a bona fide erosion problem exists, must there be imminently-threatened upland improvements such as a home or commercial development to warrant SPS installation? Are SPSs equally permissible on vacant lots or might they be allowed to make an otherwise unbuildable lot buildable? These questions are raised regularly in the permit review process, but there is no clear, consistent policy.

Based on a review of the permit records, subjective factors often play an important role in determining project need and justification. These include the philosophy and personality of the state field staff person involved; the persuasiveness and political influence of the applicant or contractor, especially with higher agency officials or with politicians; the positions taken and pressure brought to bear by adjacent property owners, citizen activists, local government officials, and state and federal agencies commenting on the project; the necessary adjustments and experimentation that agencies make when new policies are implemented; the legal issues involved (e.g., liability for damage, property takings) and threats of or actual legal action by interested parties. Although it is appropriate that some of these factors be considered in decision-making, the lack of objective, measurable criteria and standards for what constitutes "adequate justification" or "critical need" means that decision making is largely discretionary. The inevitable result is inconsistent and possibly inequitable decision-making.

Requiring more information in the permit application and using measurable criteria, thresholds and other standards, would give SPRD and DSL a more consistent basis for determining need and justification. Even more desirable would be a process that gets agency regulators out of the position of reacting on a case-by-case basis to specific, detailed proposals. Such a process of advance determination for shore protection—through littoral cell planning, for example—could be used to determine in advance what approach will be used if an erosion or other hazard problem develops. It could also be used to specify that "this unprotected, undeveloped lot does/will not qualify for hard SPSs."

b) Need or justification for shore protection. How have SPRD and DSL applied the need and justification policy in practice? To address this question, information was gleaned from SPRD and DSL permit files on the hazards being experienced and the property threatened. Relevant data from permit applications, permit findings and decisions, and photographs were included in the PERMITS database file and analyzed.

The permit data reported here are based on "cases." A case is an individual parcel database record for which there has been an independent permit decision. Some parcels have multiple records because they have multiple permit applications associated with them. For example, for one tax lot in the Coronado Shores subdivision in Gleneden Beach, there are three SPRD permit numbers. Applications for the first and second permits (BA-181-78 and BA-223-82) were denied; a third permit application (BA-238-83) was approved. All are in the database, representing three separate cases. In another situation, there are 11 individual permits for a single structure fronting two parcels (one of the parcels had a 10-unit condominium with separate owners). Using the definition above, and because the permit decisions were not independent, this represents just two cases—one for each of the parcels.

Of the 290 cases examined in this Siletz littoral cell study, 236 involved approved permits and 54 involved denied permits. For each case, up to three types of "hazards" and two types of "property threatened" could be entered into the database. Because of this, the total number of hazards and threats are greater than the 290 cases. Also, no attempt was made to sort out the relative hazard or threat to property in each case; for example, slight versus severe erosion are not differentiated. Such detailed data was not available for most projects.

Hazards as evidence of need: approved permits. For the 236 cases involving approved permits (table 4-5), the predominant hazard was erosion, a problem in 144 (61%) of the cases. This was followed by cliff-top sloughing or slumping, which was a problem in 66 of the cases (28%). No apparent hazard was found in 45 of the cases (19%), and prevention of erosion or slumping was the stated or apparent hazard in 38 cases (16%). The latter two "reasons" suggest that in as many as 83 cases—more than one-third of the time—permits were issued where no hazard existed or simply to mitigate some future or suspected problem. This is even noted in permit findings in some instances, for example, in approved permit BA-294-87/SP 2747 which states "... there appears to be no immediate need for the project ... ."

Sometimes preventative SPS permits are issued because a property owner cannot obtain a local building permit for the upland until a SPS is installed. This is the case for the entire Salishan development on Siletz spit (Lincoln County Board of Commissioners 1978) and selectively at other locations, such as Coronado Shores in Gleneden Beach (Tutor 1982). *This practice demonstrates that land use policies and decisions are driving the demand for SPSs.* A variety of other hazard-related reasons for issuing permits were noted or apparent, including emergencies (38 cases), rip currents (28 cases), ocean or stream flooding (22

Table 4-5. Hazards as evidence of need for SPSs, based on DSL and SPRD records for approved and denied permits, Siletz littoral cell, 1967-91.

Hazard/Need	Approved Permit Cases[1] (n=236)	Denied Permit Cases (n=54)
Erosion	144	18
Slough/Slump	66	21
None	45	30
Prevention	38	13
Emergency	38	0
Rip Current	28	0
Flooding	22	1
SPS Repair	15	1
Surface Runoff	5	0
Adjacent SPS	1	0
Landslide	0	0

[1]"cases" are individual parcel records in the PERMITS database file for which there have been independent permit decisions.

cases), need to repair existing SPSs (15 cases), and surface runoff from sea cliffs (5 cases).

Hazards as evidence of need: denied permits. For most of the 54 cases involving permits that were denied (table 4-5), permits were requested without adequate justification. There was no apparent hazard in 30 cases (56%) and, in 13 other cases (24%), the SPS was being proposed as a preventative measure in anticipation of future problems. Again, these "reasons" might suggest why the permits were denied. However, permits were denied for 21 cases (39%) involving slumping and 18 cases (33%) involving erosion. Permit administrators apparently concluded that the hazard and associated property threat was insufficient to justify installation of a SPS.

Property threatened as evidence of need: Approved permits. Table 4-6 enumerates the types of "property threatened" by hazards, one part of the basis for project need and justification. The data came from permit records and, as with the hazards discussed above, the numbers reported are "cases"—individual parcel database records for which there have been independent permit decisions.

For approved permits, the principal type of property threatened by hazards was land itself, a problem in 216 cases (92%). Of these 216 cases, loss of land was the <u>only</u> threat in 65 cases (28%), i.e., the lot for which the SPS was requested was vacant. The issue of SPS permitting for vacant parcels is discussed further below. Other threats to property leading to approved permits included: houses, 133 cases (56%); motels, 24 cases (10%); RV parks, 3 cases (1%); and in 7 cases (3%), no threats to property. Four of these projects where there was no property threatened were for private beach access stairs; one was for sand removal at a state park; another was for a SPS construction access road that was later removed; and the last was for a riprap revetment that was never built.

Property threatened as evidence of need: Denied permits. As with approved permits, the predominant type of

Table 4-6. Property threatened as evidence of need for SPSs, based on records for approved and denied permits, Siletz littoral cell, 1967-91.

Property Threatened	Approved Permit Cases[1] (n=236)	Denied Permit Cases (n=54)
Land	216	45
House	133	31
Land Only	65	14
Motel	24	1
None	7	7
RV Park	3	1
Public Building, Park, or Access	2	0
Utilities	1	0
Other	1	0
Garage	0	0
Septic System	0	0
Street	0	0

[1]"cases" are individual parcel records in the PERMITS database file for which there have been independent permit decisions

property threatened for permits that were denied was the loss of land, noted or apparent in 45 cases or 83% of the time (table 4-6). Of these 45 cases, loss of land was the only threat in 14 cases (26%), i.e., the lot to be protected was vacant. This may have been one of the reasons for denial, combined with absence of hazard-related problems noted above.

c) SPS permit application approval/denial decisions through time. Another way to look at project need and justification issue is to examine SPRD and DSL decisions to approve or deny permits, along with their decision-making rationale. Table 4-7 details approval and denial decisions by year for the Siletz littoral cell. Of the 290 cases handled by the two agencies between 1967 and 1991, 236 (81%) were approved and 54 denied. The most active permit process years were 1973 (39 applications), 1978 (35 applications), 1987 (27 applications), and 1984 (24 applications). Actual construction activity over time, described in the discussion of cumulative impacts (Policy Objective 7), followed a similar pattern, generally related to sea level and storm anomalies associated with periodic El Niños.

Since the late 1970s, most permits have been jointly issued by SPRD and DSL, reflecting DSL's assumption of SPS jurisdiction and the increased cooperation between the two agencies. Since 1980 DSL has issued 28 individual agency permits compared to just 4 for SPRD. This reflects the greater geographic scope of DSL's jurisdiction. It also illustrates one of the problems with the permit process, namely, the lack of consistency between how SPRD and DSL process applications, assess impacts, and prepare and report findings. Generally, SPRD does a good job, though improvements need to be made, especially in the area of geotechnical and engineering review. DSL's review is

Table 4-7. SPRD and DSL permit approval/denial decisions on SPSs, Siletz littoral cell, 1967-91.

Year	SPRD Regular Permit Only		DSL Regular Permit Only		Joint SPRD/DSL Permit		Emer-gency Permit	Total Permits	
	App[1]	Den[1]	App	Den	App	Den	App	App	Den
1967	1	0	na[2]	na	na	na	0	1	0
1968	2	1	na	na	na	na	0	2	1
1969	2	0	na	na	na	na	0	2	0
1970	2	6	na	na	na	na	0	2	6
1971	0	0	na	na	na	na	0	0	0
1972	3	0	na	na	na	na	0	3	0
1973	26	5	na	na	na	na	8	34	5
1974	4	2	na	na	na	na	0	4	2
1975	1	0	na	na	na	na	0	1	0
1976	8	0	0	0	2	0	0	10	0
1977	3	0	0	0	6	0	6	15	0
1978	4	5	0	0	3	21	2	9	26
1979	2	0	0	0	1	3	0	3	3
1980	0	0	0	0	1	0	0	1	0
1981	0	0	0	0	22	0	0	22	0
1982	0	8	2	0	1	0	0	3	8
1983	0	0	5	0	12	0	1	18	0
1984	1	0	1	0	13	0	9	24	0
1985	1	0	7	0	13	0	0	21	0
1986	1	1	7	0	3	0	0	11	1
1987	1	0	5	0	14	1	6	26	1
1988	0	0	0	0	7	0	0	7	0
1989	0	0	1	0	7	0	0	8	0
1990	0	0	0	0	9	0	0	9	0
1991[3]	0	0	0	0	0	1	0	0	1
Total	62	28	28	0	114	26	32	236	54

[1]App = approved permits; Den = denied permits
[2]Not applicable; DSL did not take jurisdiction over SPSs until 1976
[3]Includes data through June 1991

relatively cursory in comparison, at least from what can be gleaned from permit records and interviews.

The 54 permit denials are clustered around several years, with 1978 accounting for half (26). Other years where there were rashes of denials were 1982 (8), 1970 (6), and 1973 (5). Together, these four years (16% of the record) account for 83% of the permit denials.

There may be a number of reasons for the especially high permit denial rate in 1978. First, the OCMP, including the SPS-related policies in the Coastal Shorelands Goal 17 and Beaches and Dunes Goal 18, was adopted and approved in May 1977. The highly public process leading to adoption created a heightened awareness among state managers and local planners of the new policies and requirements. SPRD staff, taking their broadened responsibilities under the coastal program seriously, revised their beach improvement standards in 1978 to incorporate Goal 18 criteria for evaluating SPSs. Also apparent from the permit records was the influence of a well-informed, aggressive permit reviewer in another agency who provided the detailed rationale for a number of the denial for joint permits BA-148-78/SP-1395 through BA-161-78/SP-1408 (Stembridge 1978). Finally, the rash of denials in 1978 was due in part to the overly-aggressive SPS "marketing" effort of one contractor. In several locations, this contractor recruited adjacent property owners along long stretches of beach, arguing that it would be less expensive and disruptive to the beach to install continuous riprap revetments all at once. This makes sense from a construction perspective, especially since the access/haul road along the base of the sea cliff must pass by each parcel. However, the SPS applications often included these properties, even if they were not experiencing erosion; in fact, several were heavily vegetated. This contributed to several permit denials in the cases of BA-175-78 through 181-78.

From this record, it is apparent that the need and justification is an important part of the SPS application review process. However, as also noted above, the lack of measurable criteria or standards for determining what constitutes need and justification creates inconsistency through time.

d) Decisions on SPS applications for vacant parcels. Earlier, the following issue was raised: if a bona fide erosion problem exists, does there need to be an imminently-threatened upland improvement, such as a home or commercial development, to warrant approval of a permit to install a SPS? Along the same line, are SPSs equally permissible on vacant lots or might they be allowed in order to make an otherwise unbuildable lot buildable? Both of these questions can be addressed historically, at least in a limited way, by examining SPRD and DSL decisions on SPS applications for vacant parcels. The question is whether or not owners of vacant parcels that are "developed" in terms of the Goal 18 definition (page 93), and who have been experiencing erosion or some other hazard, should be permitted to install SPSs. A more restrictive interpretation of the "need and justification" policy would suggest permit denial, the conclusion being that there must be a threatened upland building or improvement before a SPS permit is warranted. A more lenient interpretation would be that property owners have the right to protect their property if it meets the Goal 18 "developed" criteria, whether vacant or not. In practice, the latter interpretation has prevailed.

In the Siletz cell, 68 of the 206 vacant properties (33%) are protected with SPSs. Of these 68 vacant SPS-protected lots, 12 (18%) were constructed before the 1967 Beach Law was enacted; 8 (12%) were installed from 1967 to 1977, when DSL assumed SPS jurisdiction and the OCMP was adopted; and 48 (70%) were built on vacant lots since 1977. From these numbers, it is apparent that the rate of SPS construction to protect vacant lots is increasing and that the implementation of the OCMP has had no effect on this practice.

A recent example of vacant lot protection in Lincoln City is a case in point. Wesley Johns, owner of a small parcel with a 50 ft ocean frontage on S. W. Anchor Street applied for and received a building permit to construct a house (figure 4-10). The property is located on a sloping, gradually-receding bluff approximately 75 ft above the beach. The engineering report approved by the city called for the installation of a seawall at the base of the bluff and revegetation of the bare eroding slope above. When the city discovered the owner did not have a SPRD permit to install the seawall, it revoked the building permit pending issuance of the state permit. Johns then applied for and, after a public hearing, received the state permit (BA-317-89). This occurred despite the following facts:

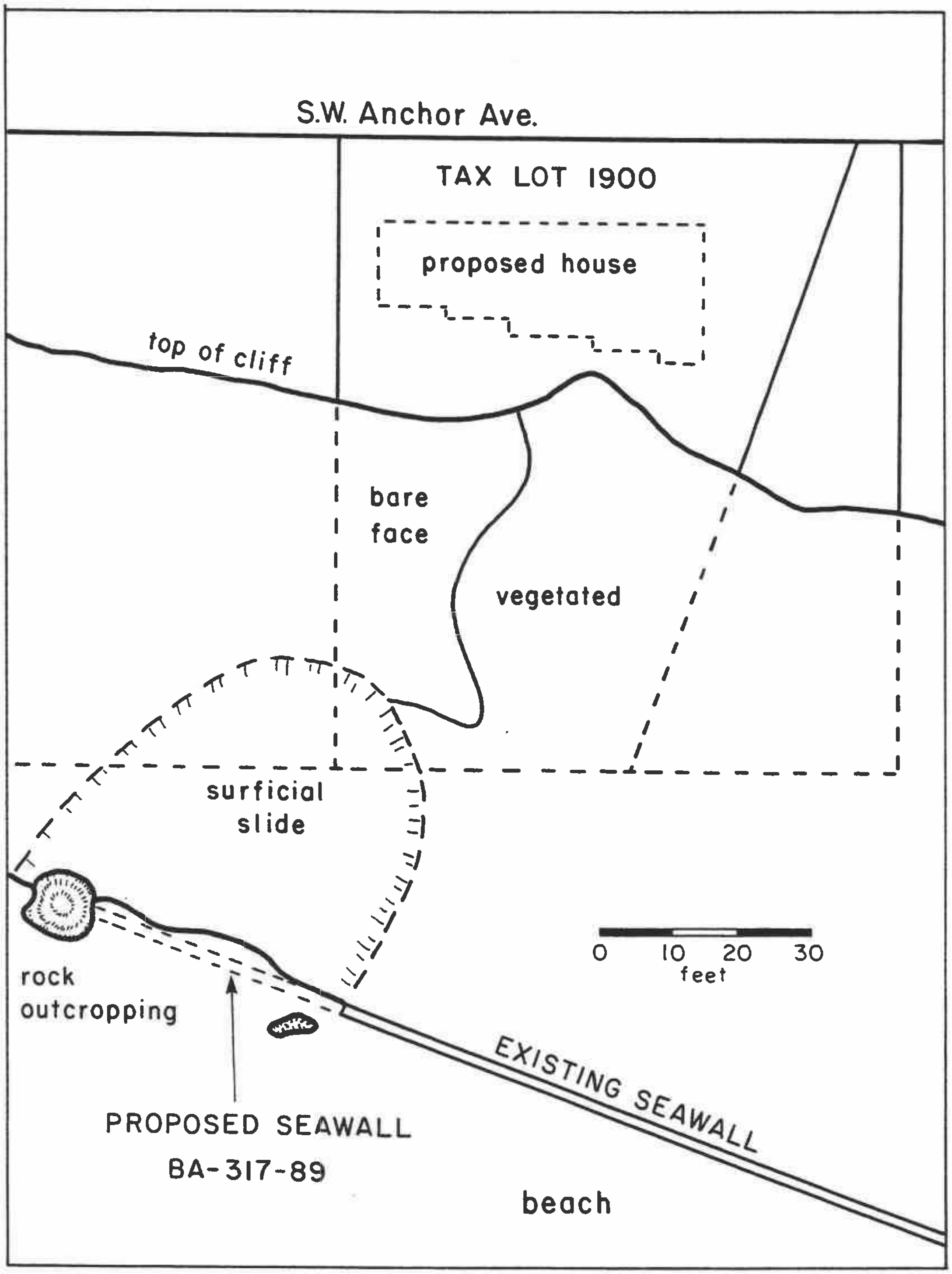


Figure 4-10. Wesley Johns oceanfront property on S.W. Anchor Street, Lincoln City, Oregon, with proposed house and SPS (SPRD Permit BA-317-89).

1) the preliminary building construction setback encompassed the entire lot, making it unbuildable; the setback was based on the moderate erosion rate (2.8-11.3 in/year) in the city hazards inventory, which translated to a 161 ft setback (2.15 x 75 ft [bluff height]);
2) the lot was apparently deemed unbuildable by the county tax assessor because of its narrow width and was assessed accordingly; its 1991 assessed value was $5,450, compared to assessments of $40,000 or more for other vacant, buildable oceanfront lots in the vicinity;
3) the footprint of the proposed bluff-top house showed construction setbacks ranging from only 5-20 ft from the edge of the bluff (figure 4-10); these had been certified as sufficient by both the registered geologist and engineer employed by the property owner, and had been accepted by the city in the original building permit, based on an exemption provision in the LCP which stated "due to extensive development that has occurred ... in this zone, the director may exempt certain development from the provisions of this section ..." (Lincoln County Comprehensive Plan, Section 3.120); and
4) the adjacent property owner, whose lot was also unbuildable, objected to the proposed permit.

Despite these findings, the SPRD permit was approved and the seawall was constructed in 1990 (figure 4-11). As of September, 1991, Johns had not reapplied for a new building permit, but the vacant lot is for sale. The asking price, according to a local real estate agent, is $77,000, some $71,550 above its current tax-assessed value and $69,000 more than the $8,000 Johns paid for the lot in

Figure 4-11. The Wesley Johns seawall (BA-317-89) was built in 1990 to make an otherwise unbuildable, narrow lot buildable.

1986. One might conclude that the actual purpose of the seawall was to turn an unbuildable lot into a buildable one, thereby creating an opportunity for a windfall sale.

From the aggregate data on SPSs built on vacant lots in the Siletz littoral cell and the above case example, one conclusion might be that the vacant or built-upon character of a parcel is not a determining factor for SPRD or DSL "need and justification" decisions. And, as noted earlier in the discussion on criteria and standards for decision-making, this issue needs to be explicitly addressed in state policy.

Policy Objective 5: Examine and, if reasonable, use alternatives to hard SPSs

Consideration of alternative approaches to hazard mitigation assumes that a need exists, i.e., that there is an existing or potential problem with erosion, cliff slumping, or other hazard, and that property is or may be threatened. As discussed in the previous section, this has not always been the case for past shore protection projects within the Siletz littoral cell. Nevertheless, the assumption is an important one for the present discussion.

There are two principal points of entry into the hazard mitigation process—when property is imminently threatened and active protection measures may be needed, or in advance when oceanfront land is being developed and hazard avoidance measures are more feasible. The discussion below focuses on hazard mitigation approaches that might effectively substitute or negate the future need for riprap revetments, concrete seawalls, and other hard structures.

The roots of this policy objective are found in LCDC Statewide Planning Goal 17, Coastal Shorelands. Implementation Requirement 5 of the goal states that "land use management practices and non-structural solutions to problems of erosion and flooding shall be preferred to structural solutions." The recognition here of the role of land use management practices in hazard mitigation is particularly significant because of the linkage between these practices and the subsequent demand for SPSs. This linkage is reflected in LCDC Statewide Planning Goal 7, which states that "development shall not be planned or located [sited] in known natural hazard areas without appropriate safeguards." The relationship between local land use and/or administrative decisions and subsequent hazard mitigation decisions, especially SPS installation, was briefly mentioned in the previous section (p. 110) and will be explored further in this section.

The preference for land use management and non-structural alternatives to hard SPSs in Goal 17 is reflected in SPRD's beach improvement standards. Permit administrators must consider whether "there are no reasonable special measures which might reduce or eliminate significant public costs" (OAR 736-20-010[5]). They must also ask if "alternatives such as non-structural solutions ... have been considered" (OAR 736-20-010[5]). DSL's administrative rules have two relevant requirements; first, that "there is no practicable alternative ... which would have less impact ..." on the beach and ocean (OAR 141-85-050[3][c]); and second, "preference shall be given to non-structural erosion repair methods (i.e., bank sloping and revegetation)" (OAR 141-85-055[2]). In response to Goal 17 requirements, LCPs also have similar policies giving preference to non-structural over structural solutions to erosion problems.

The policy question addressed here is whether or not alternatives to hard SPSs have been considered, and if feasible, used to mitigate the hazard. Measures or indicators of achievement for this policy objective are outlined in table 4-2 and listed below:

a) processes are established and used to examine and consider land use management and non-structural alternatives to hard SPSs;

b) numbers and locations of parcels where new development did/did not comply with required hazard avoidance setback, and subsequent SPS needed for both categories;

c) numbers and locations of parcels that used/did not use relocation as a non-structural alternative to hard SPSs, and the potential for future use of this technique; and

d) numbers and instances where other alternatives to SPSs have been used to mitigate hazards, or, for issued permits, evidence that such alternatives were not feasible.

Each of these measures is examined below.

a) Processes established and used to consider alternatives to SPSs. Before examining the actual process for considering hazard mitigation alternatives, a few comments about the lack of specificity in DLCD, SPRD, and DSL policy language are warranted. The language in question includes the "appropriate safeguards" term in Goal 7, the "shall be preferred" language in Goal 17, referring to the use of land use management and non-structural alternatives, and finally, the lack of stipulation of land use management and non-structural approaches to consider during project review.

Policy Specification Issues. The term "appropriate safeguards" as it relates to planning for or siting development in areas subject to hazards is not defined in Goal 7, nor has it been further elaborated in the DLCD rule-making process. Both Lincoln County and Lincoln City—the two local governments with jurisdiction over Siletz cell shorelines—have interpreted appropriate safeguards to mean "adequate safeguards" (Lincoln County Comprehensive Plan, Section 1.0055 [1], 38; Lincoln City Comprehensive Plan, 14). Generally, the "most adequate" hazard mitigation, at least from the perspective of property owners and often politically-sensitive decision makers, is a hard SPS. However, hard SPSs are supposed to be the last resort, according to other LCDC goal and LCP policies.

The phrase "shall be preferred," as it relates to the how land use management and non-structural hazard mitigation alternatives are to be considered, is also undefined. Defining this phrase is a key element in establishing a meaningful alternatives review process; leaving it undefined makes it open to a variety of interpretations. For purposes of the following discussion, the term is assumed to mean "to give consideration to, and if technically feasible and does not result in a 'taking' of private property, use the preferred approach." Coincidently, when applied to the development siting process at the local level, such a definition gives at least some guidance for evaluating available hazard mitigation options under the "appropriate safeguards" criterion discussed above.

Another important policy definition issue has to do with what the "land use management practices and non-structural solutions" are that must be considered by decision makers, either at the local level in the development siting process, or at the state level in the shore protection process. In the 14 years since the Goal 17 preference language was adopted, neither DLCD nor permitting agencies (SPRD, DSL) have developed such a list of hazard mitigation alternatives to hard SPSs and in what situations they should be used. DSL, in its administrative rules (OAR 141-85-055[2]), actually limits the term "non-structural solution" by defining it narrowly as "bank sloping and revegetation." The lack of both a clear set of definitions and a structured "alternatives review" process offers the potential for inconsistent hazard mitigation decisions at both the state and local level.

Process for Considering Alternatives to hard SPSs. There are several situations and points in time with respect to governmental decision-making where hazard mitigation alternatives must be considered. The first is when oceanfront development is being planned by local jurisdictions. The second is when development is actually sited and local land use or administrative decisions are being made. The third is when a property owner submits an application for a revetment or seawall after having experienced a problem with erosion, cliff slumping, or other hazard that is threatening his or her property. The fourth is a combination of these previous two, i.e., when the land development process at the local level proceeds simultaneously with the SPS permit process.

Regarding the first situation, both Lincoln County and Lincoln City completed their LCPs in the early 1980s in a process that was largely driven by LCDC goal requirements. As part of that process, they inventoried natural hazards along the oceanfront (RNKR Associates 1978) and established building setback criteria which they apply when new development is proposed. These criteria and how they have worked in the development siting process are described later. However, because virtually all of the privately-owned beachfront lands are "areas of known natural hazards," based on the RNKR inventory, and because virtually all of these lands are planned and zoned for intensive residential and commercial development, the implementation of the "appropriate safeguards" criterion is effectively deferred to the second decision-making situation—the actual siting of development through the local land use process. It should be noted that the principal reason for these planning and zoning decisions was that most of these lands were considered "committed to development."

With respect to the second situation for considering alternatives, the records of individual land use actions and administrative decisions for siting development were not reviewed in this study. However, the results of applying the building setback criteria in local plans—as inferred from database information—was examined and is presented in detail in the next section. As we shall see there, 61% of new construction on vacant, unprotected oceanfront lots encroached seaward of the building setback recommended in the RNKR hazard inventory. This has led to increased demand for SPSs.

In some cases, Lincoln County and Lincoln City require a hard SPS as a condition of obtaining a building permit because, in the view of the consultant preparing a geotechnical site report, it is the most "adequate safeguard" (see p. 109 for examples). This brings into play the fourth decision-making situation identified above—where both the local land use and state permit decisions proceed nearly in tandem. In these cases, the local land use or administrative requirement provides the evidence of "need and justification" the property owner must have to obtain the state SPS permit. For many of the shallow, hazard-prone lots along the oceanfront, SPSs are probably the only way to make a lot buildable. In other cases, alternatives may be available, including declaring the lot unbuildable. However, this raises the specter of the "takings issue" for local governments, especially on already sub-divided lots with full services available. Actually, based on tax assessor determinations, quite a few unbuildable lots exist along the oceanfront and are taxed accordingly. A case example of an upland development/SPS proposal on such a lot was discussed in the previous section—the Wesley Johns property.

The third decision-making situation where hazard mitigation alternatives must be considered is when a property is threatened by a hazard and the owner applies for a SPS permit. A review of SPS permit records confirms the earlier observation that the lack of clear definitions and a structured alternatives review process results in inconsistent hazard mitigation decisions at the state level.

Typically, SPRD states in their permit findings that they do "consider" whether or not some project alteration or modification would better protect the public interest. Presumably, this includes examining the feasibility of non-structural solutions to erosion problems. In practice, SPRD and DSL have sometimes promoted the use of dune building and vegetative stabilization. However, permit records suggest that the process used is neither systematic nor comprehensive. Other agencies reviewing public notices of SPS applications occasionally make mention of alternatives, but there is rarely enough information included to determine whether or not some other solution was or was not feasible. In most cases, permit findings are general or vague with respect to actual alternatives examined. For example, permit findings might simply state "there do not appear to be any reasonable project alterations or modifications" (e.g., BA-286-87/SP 2666). Further, in situations where only DSL issues a permit (east of the BZL), no permit findings are made and one must rely on the often inaccurate information provided in the permit application or on correspondence and memos in the permit record. More often than not, there is no record of what alternatives to SPSs were considered and, if they were, why they were rejected. As a consequence, viable alternatives may go unnoticed and SPSs are installed on the public beach.

Land use management and non-structural hazard mitigation techniques that might serve as alternatives to hard SPSs are outlined in table 4-8, along with situations where they might be feasible. Two of these—construction

Table 4-8. Land use management and non-structural alternatives to hard shore protection structures.

ALTERNATIVE OF METHOD	DESCRIPTION	APPLICABILITY	INFORMATION SOURCES
Construction setback	Horizontal setback from shoreline based on beach type, upland landform and erosion resistance, elevation, long-term erosion or recession rate, susceptibility to episodic erosion, relative sea level rise, relocation factor, etc.	Feasible for new or relocated construction where lot is sufficiently deep and topography relatively flat	Godschalk et al. 1989 Houlahan 1989 Keillor and Miller 1987 National Research Council 1990
Building design	Proper foundation, infiltration & drainage controls, roof design, building materials, utility location, etc. with respect to wind force, maximum storm surge and wave setup & run-up, flooding, landslide potential, earthquake shaking, liquefaction, and subsidence	Feasible for all new and remodelled construction; varies based on hazards and landform	Collier Undated Godschalk et al. 1989 Pilkey et al. 1983
Relocation	Moving existing upland buildings landward, on-site or off-site	Feasible on level, deep lots or where another site available; applicable to existing development or remodels	National Research Council 1990 USACOE 1981 Griggs 1986
Infiltration/drainage controls	Prevention of water from entering ground or removal of existing water from ground to improve slope stability; uses collectors, drains, wells, dewatering pumps, outlets.	Feasible for new and existing sites and buildings; applicable principally on high and/or stratified bluffs	Herdendorf 1984 Keillor 1986 Tainter 1982 USACOE 1981
Dune creation & restoration	Placement of mounds of sand seaward of existing shorelands fronted by beaches; stabilized by sand fences and vegetation	Useful as buffer against upland erosion; most effective in episodic (not chronic) erosion situations; not very resistant to direct wave attack; more effective in combination with "soft" structure core and vegetative stabilization	Broome et al. 1982 Jacobsen 1988 Mauriello 1989 McLaughlin and Brown 1942 Ternyik 1979 USACOE 1984 Carlson et al. 1991

Continued on next page

Table 4-8—*Continued*

ALTERNATIVE OR METHOD	DESCRIPTION	APPLICABILITY	INFORMATION SOURCES
Vegetative stabilization	Use of native and exotic vegetation to stabilize soil or sand along the shorefront or on dunes	Feasible on bluff slopes >1:1.25 where there is some soil development and where roots can penetrate; and on dunes or bare sand; not effective in stabilizing toe of bluff or dune susceptible to direct wave or wave swash attack	Herdendorf 1984 Jacobsen 1988 McLaughlin and Brown 1942 Tainter 1982 Ternyik 1979 USACOE 1981 USACOE 1984 Carlson et al. 1991
Bank/bluff sloping	Creation of a stable slope angle by placement of material at the toe (e.g., dune creation), and/or regrading the slope	Feasible for some over-steepened bluff slopes, especially in combination with infiltration and drainage control, vegetative plantings, and dune creation at base (or other toe protection)	Herdendorf 1984 Keillor 1986 Tainter 1982 USACOE 1981
Beach fill/nourishment	Placement of substantial quantities of beach-compatible sand to advance the shoreline seaward	Applicable to important recreational beaches where there is ready compatible sand source and reasonable expectation of nourished beach stability; expensive alternative; not used in Oregon	Chisholm 1990 Clayton 1989 Dean 1983 Dixon and Pilkey 1989 Domurat 1987 National Research Council 1987 USACOE 1981 USACOE 1984
Dynamic structures	Placement of movable gravel- and cobble-sized materials on perched platform to protect backshore	Feasible for bluffs where the wave/swash energy at bluff base is relatively low	Ahrens and Heimbaugh 1989 Lorang 1991

setbacks and building relocation—are discussed in detail below, based on database analysis. The remainder are discussed in less depth. In any given instance, one or more of these techniques might be considered the "preferred appropriate safeguards" when planning or siting development, or protecting existing development.

b) Construction setback use as hazard mitigation. Probably the most widely used land use management tool designed to negate the need for SPSs is the oceanfront construction setback. This approach to hazard mitigation works well for new development on vacant lots that are deep enough to accommodate both the setback and the building comfortably. In states where they have been mandated under coastal zone management programs, including North and South Carolina, construction setbacks are the cornerstone of a policy of shoreline retreat in the face of rising sea level. Typically, construction setbacks are designed to provide sufficient erosion protection for the expected life of the proposed building (see e.g., Houlahan 1989).

In Oregon, there is no uniform, state-wide procedure for determining coastal construction setbacks; instead, each local government makes its own determinations. Methods used by Lincoln County and Lincoln City are outlined below. A retrospective look at how setbacks have been applied in practice is then presented, as determined from queries of the Siletz cell database.

Lincoln County (Zoning Ordinance, Section 1.925 [3][a]) established its standard oceanfront construction setback based on long-term historical shoreline recession rates and formulas included in its environmental hazards inventory (Smith 1978; RNKR Associates 1978). Oceanfront lands were classified into three erosion rate categories and mapped accordingly. These erosion categories, based on the standard deviation of all measurements, are: slight (<2.8 in/yr); moderate (2.8-11.3 in/yr); and severe (>11.3 in/yr). Construction setbacks are calculated by multiplying the landform height above the beach times the appropriate constant: 1 (slight erosion), 2.15 (moderate), or 2.75 (severe). Calculated setbacks are then measured from the beach-upland junction (figure 4-12). Seaward encroachment on the setback are permitted if the geotechnical site report finds a different erosion rate or if other adequate hazard mitigation is used.

Lincoln City has adopted the same RNKR environmental hazards inventory by reference (Lincoln City Comprehensive Plan, Natural Hazards), including the hazards map, the coastal recession categories, and the setback determination method outlined above. However, Lincoln City does not specify in their zoning ordinance that the RNKR setback method must be used, but instead relies on case-by-case determinations in geotechnical site reports required of the developer. The city also requires a minimum 25 ft setback from shoreland riparian vegetation (Zoning Ordinance Section 3.110[4][a]1), but it is unclear when and how this setback is applied. The results below are based on the RNKR construction setback method for both county and city oceanfront properties, assuming a 1:1 landform slope.

Between the 1977 adoption of the OCMP and 1991, 112 vacant oceanfront parcels in the Siletz cell have been

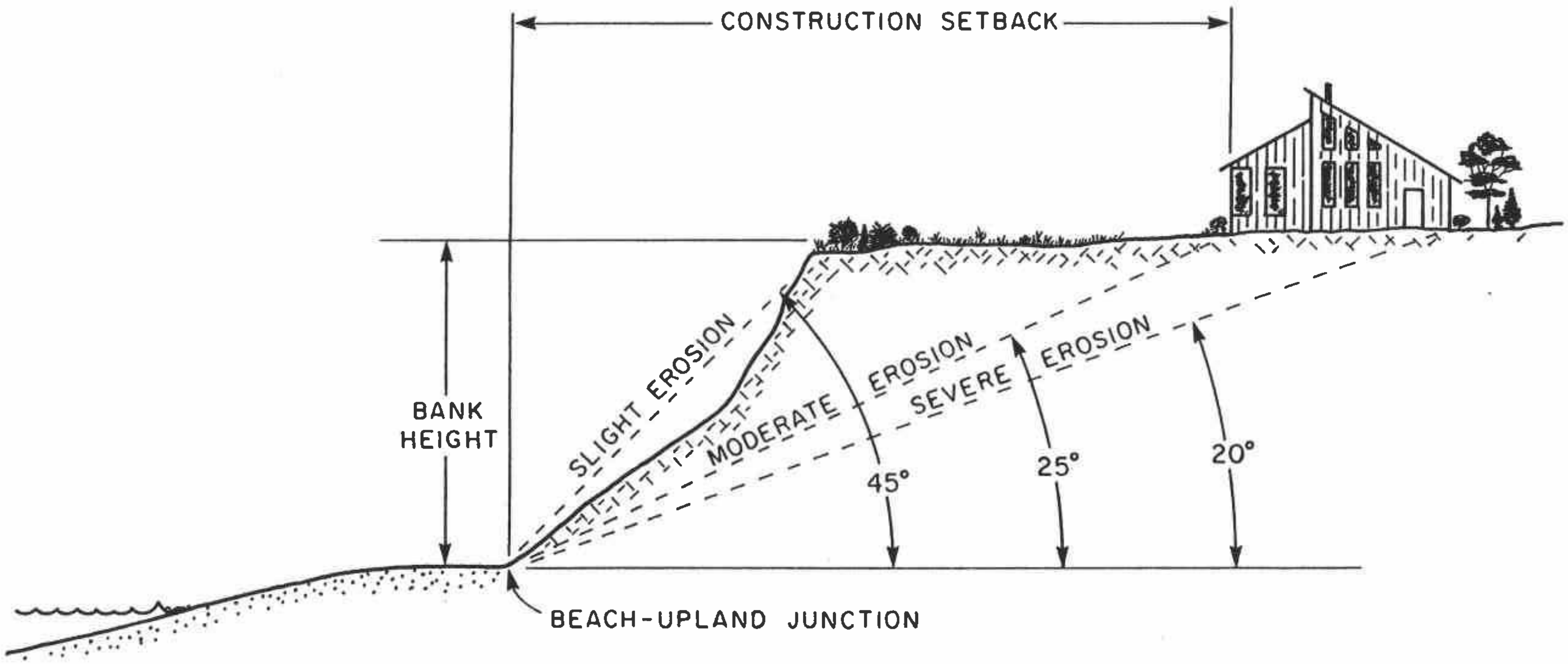


Figure 4-12. New construction setback determination method for Lincoln County, Oregon.

built upon (table 4-9, Row A). For 68 (61%) of these lots, the new buildings encroached upon the RNKR-recommended oceanfront construction setback (table 4-9, Row B). The average seaward encroachment was 32 ft (table 4-9, Row C), ranging from 2 ft to 90 ft. On the remaining 44 lots, building setbacks equalled or exceeded the RNKR setback by an average of 17 ft (table 4-9, Rows F and G).

There are a variety of reasons for this high incidence of what might appear on the surface to be setback violations. The most obvious is that 21 (31%) of the 68 already had SPSs (table 4-9, Row D); some these may have been in place for a long time, but others were likely installed a year or so prior to new upland construction in order to obtain building permits from Lincoln County or Lincoln City. Whether required for a local building permit or pre-existing, SPSs are generally considered by city and county planners as adequate hazard mitigation and construction setback requirements are therefore waived (figure 4-13).

For the remaining 47 lots that were unprotected at the time of upland construction (table 4-9, Row B - D), a probable reason for setback encroachments was that the RNKR-recommended setbacks effectively rendered the lots unbuildable. This, of course, is an untenable situation for property owners intent on building their retirement or second home. Faced with this situation, they hire a registered geologist, engineering geologist, or geotechnical engineer to prepare a site report. As required by both Lincoln County and Lincoln City development ordinances, the report details hazards specific

Table 4-9. Compliance/non-compliance with local comprehensive plan-required construction setbacks for new buildings on oceanfront lots, and subsequent need for SPSs, Siletz littoral cell, 1977-91.

	YEAR															
	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	ALL YEARS
A) Total lots with new construction (B + F)	10	10	8	8	7	7	6	9	10	3	5	9	4	11	5	112
B) Lots where new construction did not comply with plan setback	7	6	4	4	5	2	5	6	6	1	4	6	2	7	3	68
C) Average distance new buildings encroached on plan setback (ft)	32	52	45	55	25	25	39	44	36	2	2	36	16	16	18	32
D) Non-compliance lots with SPSs installed prior to new construction	0	1	2	0	1	0	2	0	2	1	3	3	0	5	1	21
E) Non-compliance lots without SPSs at construction; later needed SPSs	2	2	0	2	2	2	1	3	1	0	0	0	1	1	1	18
F) Lots where new construction complied with plan setback	3	4	4	4	2	5	1	3	4	2	1	3	2	4	2	44
G) Average distance new buildings exceeded plan setback (ft)	15	18	20	10	19	20	10	7	12	24	33	11	22	20	21	17
H) Compliance lots with SPSs installed prior to new construction	2	2	3	3	2	3	0	1	4	1	1	3	1	4	2	32
I) Compliance lots without SPSs at construction; later needed SPSs	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	5

NOTE: Data in rows B - E are for oceanfront lots where new building construction did not comply with the required setback as determined by the Lincoln County/City hazards inventory (RNKR 1978); data in rows F - I are for lots where new construction equalled or exceeded the required setback.

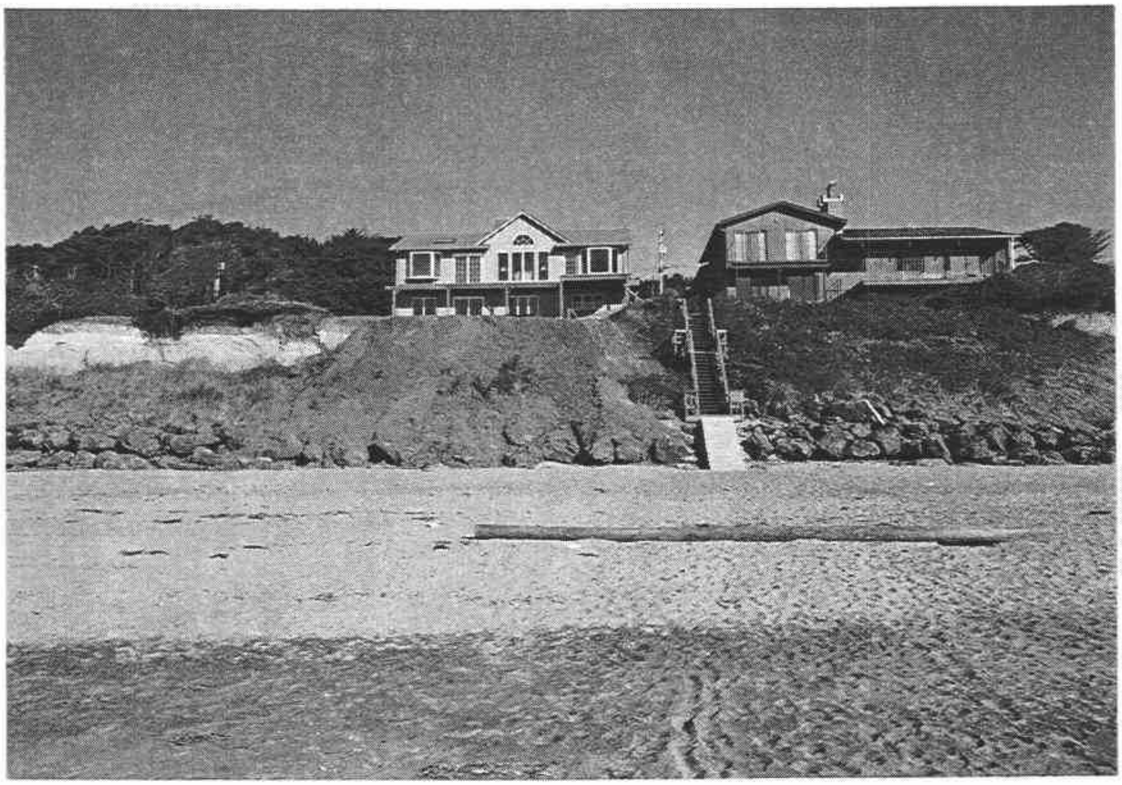


Figure 4-13. A riprap revetment installed in 1984 negated setback requirements for this home in Lincoln Beach, built in 1988 just 10 ft from the blufftop.

to that property and recommends a site-specific setback and other hazard mitigation provisions. One justification often given for not following the RNKR-recommended setback is that the erosion rates used to calculate the setbacks were generalized from about 100 measurements along the entire 16-mile Siletz littoral cell shoreline (Smith 1978). Though the erosion measurements were field-checked, they are not necessarily accurate on a lot-by-lot basis.

Often, site-specific geotechnical reports suggest a SPS to stabilize the slope and prevent erosion at the toe. Few local governments have the technical expertise to critically evaluate these reports. Even if they did, few would want to incur the potential liability associated with such evaluations. In fact, rather than discourage SPSs, they often require them, as noted above. Practically speaking, many local government units choose to limit their liability by simply accepting the stamp and recommendation of the applicant's consultant. In the present study, not one geotechnical report examined stated that the lot in question was unbuildable. Quite the opposite, one lot examined in detail was clearly unbuildable but declared buildable (see Wesley Johns case, p. 116-119).

How effective are construction setbacks as a hazard-mitigation tool in the Siletz cell? More specifically, are the construction setbacks recommended in site-specific geotechnical reports more or less effective in limiting the need for subsequent SPSs than RNKR-recommended setbacks? We can get at these questions by examining how many of the unprotected lots that were built upon after 1977 subsequently required SPSs.

As noted above, 21 of the 68 lots where buildings encroached upon the RNKR-recommended construction setback already had SPSs in place. Of the remaining 47 lots that were unprotected at the time of setback-encroaching construction, 18 (38%) subsequently required SPSs (table 4-9, Row E). Of the 44 instances where new construction did comply with RNKR setback recommendations, 12 (27%) were unprotected at the time of construction, and 5 (40%) later required SPSs (table 4-9, Row I and figure 4-14).

If the subsequent need for SPSs is used as a measure of the effectiveness of setbacks as a hazard avoidance

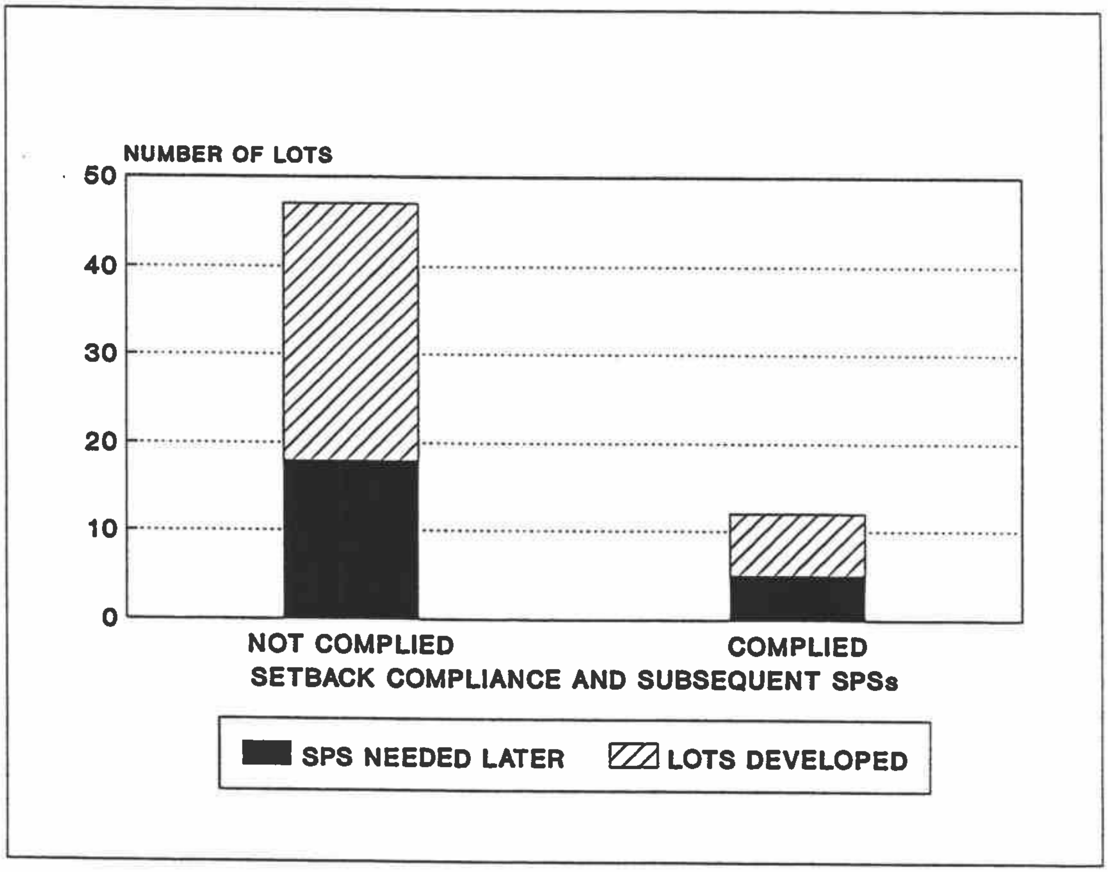


Figure 4-14. New building construction, compliance with building setbacks, and subsequent need for SPSs, Siletz littoral cell, 1977-91.

tool, neither the RNKR-recommended setbacks or consultant-recommended setbacks performed very well. The RNKR setbacks failed in part because the method itself is faulty. For example, if historic erosion has only been slight (figure 4-12) and the bank slope is about 1:1, no setback from the cliff top is required, which is, of course, absurd. As a consequence, for two parcels with slight erosion that complied with the RNKR setback, the actual cliff-top are less than 10 ft. Consultant-recommended setbacks in site reports are also ineffective hazard-avoidance tools; often, they include a SPS as the suggested mitigation (5 of 18 cases in table 4-9, Row E). To be fair, most consultants are not being paid to determine that a given lot is unbuildable but rather what can be done to make it safely buildable. For many shallow oceanfront lots, there is only one answer—install a SPS.

c) Relocation as a hazard mitigation technique. The relocation alternative involves physically moving a building or other upland improvement landward, on-site or off-site, in response to erosion or some other hazard (Griggs 1986). Relocation has been used by some oceanfront property owners in the study area. For example, when ocean waves cut into the cliff at the Coronado Shores development in Gleneden Beach in early 1987 (figure 4-15) the owners to the north (to the left) installed a large cantilevered structure and revetment under a Corps of Engineers emergency permit (071-OYA-2-007216). The neighbors to the south also had the emergency permit, but instead relocated their home landward (figure 4-16). There are other

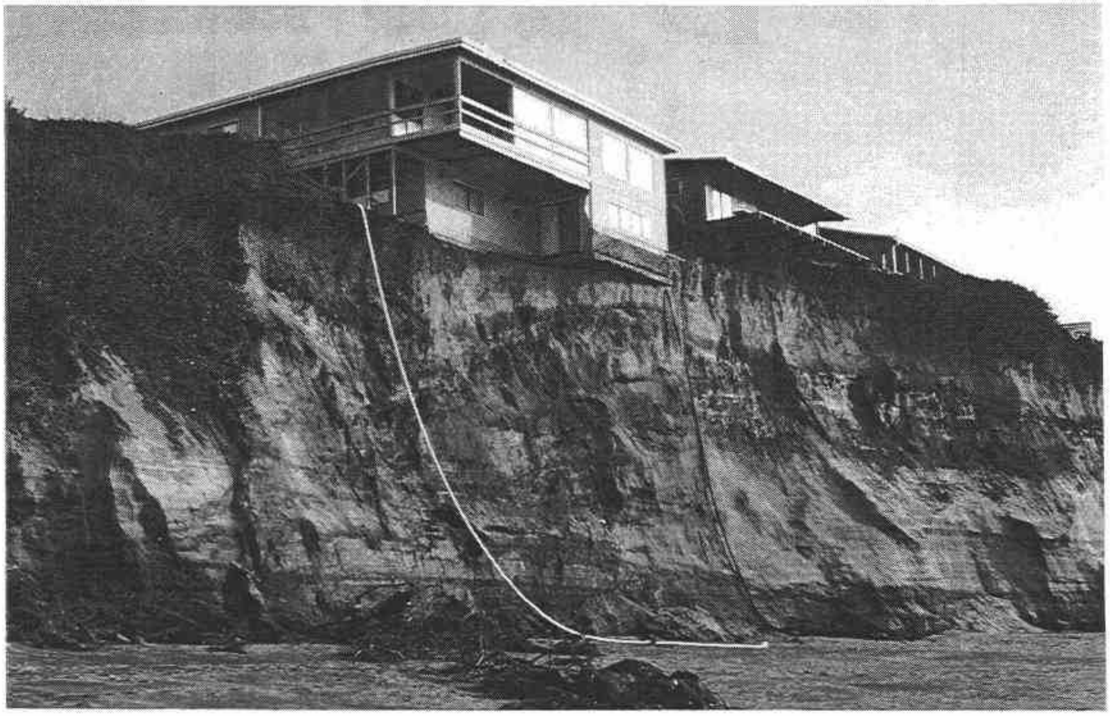


Figure 4-15. Severe oceanfront cliff erosion at Coronado Shores in Gleneden Beach, Oregon (Paul Komar photo).

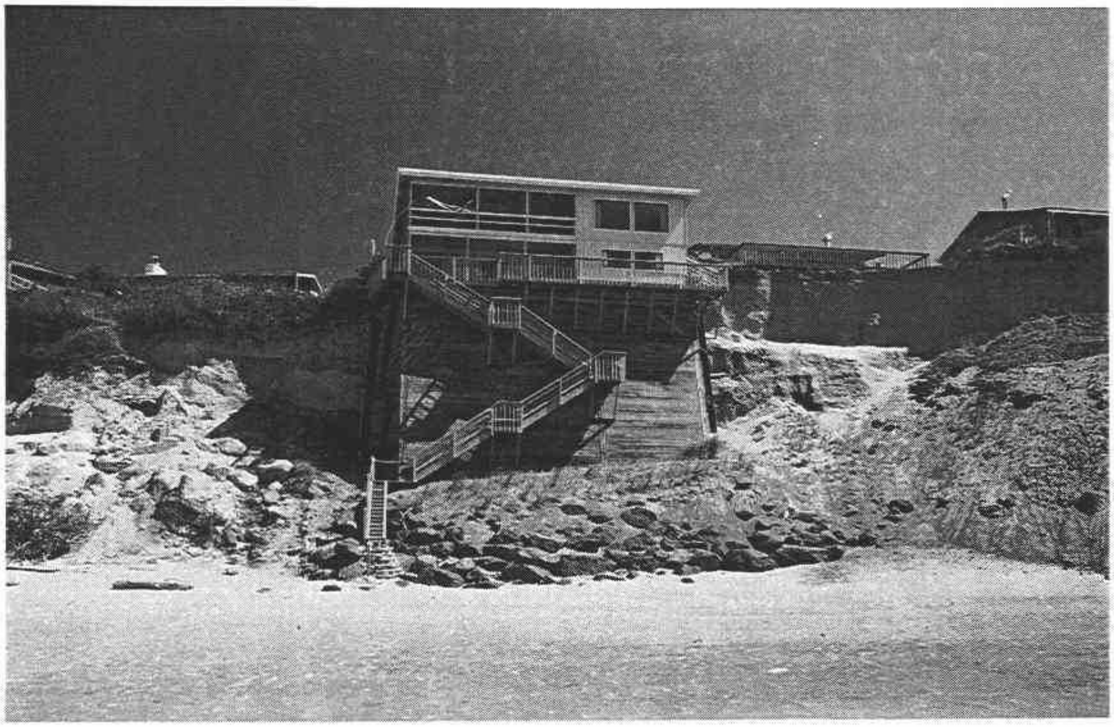


Figure 4-16. Two responses to the severe erosion in figure 4-15: owners in the center built a large seawall/revetment; owners just to the right relocated their house inland.

reported examples of this practice in Lincoln City, particularly in high cliff areas. None are documented.

One relocation-related question is whether or not the 68 post-1977 buildings that encroached upon the RNKR setback could have been set further back or, for the 18 that subsequently required SPSs, relocated as an alternative. Of the 68 post-1977 oceanfront buildings, 16 (24%) were backed up against the property line or street-side setback (10 ft or less) and 21 (31%) had street-side setbacks between 11-20 ft (table 4-10, Row B). Realistically, none of these 37 had any suitable siting alternative, unless it was not building at all. Of the remaining lots, 16 (24%) had street-side setbacks between 21-30 ft; some of these could have located further landward and perhaps avoided the need for SPSs. The 15 other lots (22%) had street-side setbacks ranging from 31 to several hundred ft; clearly, unless some other landscape feature prevented it, they had siting alternatives that would have lessened or obviated the need for SPSs.

Could the 18 properties that required SPSs subsequent to upland construction have used the relocation alternative? Half (9) had street-side setbacks from 0-20 ft (table 4-10, Row D). Only 3 (17%) had street-side setbacks 31 ft or greater. Consequently, on-site relocation was probably not a viable alternative to a SPS for most of the 18 properties.

This raises the question of how many presently unprotected lots that are built upon could take advantage of the on-site relocation option in the future (should erosion threaten), considering only street-side setback

Table 4-10. On-site building relocation potential for oceanfront lots in the Siletz Littoral cell with new buildings constructed between 1977-91, based on street-side or rear property line setback distance.

	STREET-SIDE/REAR SETBACK DISTANCE (ft)						
	10/less	11-20	21-30	31-40	41-50	>50	Total
A) Total lots with new construction (B + E)	22	42	25	10	9	8	112
B) Lots where new construction did not comply with plan setback	16	21	16	5	5	5	68
C) Non-compliance lots with SPSs installed prior to new construction	8	8	4	1	0	0	21
D) Non-compliance lots without SPSs at construction; later needed SPSs	2	7	6	2	0	1	18
E) Lots where new construction complied with plan setback	6	17	9	5	4	3	44
F) Compliance lots with SPSs installed prior to new construction	2	14	7	5	3	1	32
G) Compliance lots without SPSs at construction; later needed SPSs	1	2	1	0	0	1	5

NOTE: Data in rows B - D are for oceanfront lots where new building construction did not comply with the required setback as determined by the Lincoln County hazards inventory (RNKR 1978); data in rows E - G are for lots where new construction equalled or exceeded the required setback.

distances. Of the unprotected parcels in the Siletz cell, 257 have upland building improvements (table 4-11, Row A). Of these, 175 (68%) have buildings that encroach on the RNKR-recommended oceanfront construction setback by an average of 57 ft; the average amount of land available for relocation—the street-side setback—is 39 ft. Buildings on the remaining 82 parcels (32%) have construction setbacks that on average are 28 ft greater than the RNKR guidelines recommend; the average street-side setback for these parcels is 52 ft.

Of the 175 oceanfront buildings that encroach on the RNKR setback (table 4-11), 36 (21%) are backed up against the property line or street-side setback (10 ft or less) and 35 (20%) have street-side setbacks between 11-20 ft. None of these have a realistic, viable on-site relocation option. However, some may be able to move off-site, as has been done for several buildings in this area. Of the remaining lots with setback-encroaching development, 24 (14%) have street-side setbacks between 21-30 ft; some of these may have a relocation option, should erosion threaten. The 80 other parcels with setback-encroaching buildings (46%) have street-side setbacks ranging from 31 to hundreds of feet. Unless some other landscape feature prevents it, owners of these parcels (and local and state permit officials) should give consideration to on-site relocation as an alternative to a hard SPS in the event of serious erosion.

Although it is unclear whether the 82 parcels that meet or exceed the RNKR-recommended setback will experience serious erosion hazards, if they did need to relocate

Table 4-11. On-site building relocation potential for unprotected, built-upon oceanfront lots in the Siletz littoral cell, based on street-side or rear property line setback distances.

	STREET-SIDE/REAR SETBACK DISTANCE (ft)						
	10/less	11-20	21-30	31-40	41-50	>50	Total
A) Total unprotected lots with upland buildings	54	52	36	32	20	63	257
B) Lots where buildings do not comply with plan setback	36	35	24	22	14	44	175
C) Lots where buildings comply with plan setback	18	17	12	10	6	19	82

landward, 35 (43%) would easily have that option (street-side setbacks exceed 30 ft); another 12 (15%) might have that option (21-30 ft available); and the remaining 35 (43%) would have to look at other options (20 ft or less available for relocation).

d) Use and potential for other hazard mitigation alternatives. Table 4-8 outlines a number of other potential non-structural shore protection measures that might have application to some oceanfront erosion situations. These include dune creation and restoration, vegetative stabilization, building design and construction techniques, infiltration and drainage controls, bank and cliff sloping, beach fill or nourishment, and dynamic structures. These are discussed below, but not in great detail, either because little data was collected on their use or because their use is limited in the study area.

Dune creation and restoration. The construction of new sand dunes or restoration of existing dunes is a relatively simple, well-described non-structural shore protection technique (McLaughlin and Brown 1942; Ternyik 1979; Broome et al. 1982; USACOE 1984; Mauriello 1989, Carlson et al. 1991). Typically, sand from the adjacent beach or from an off-site location is mounded into a continuous protective "foredune." Sand fences, driftwood, or other devices might also be used to trap wind-blown sand. Vegetation—usually beachgrass or dunegrass—is planted to stabilize and further build the dune system. These artificial or rebuilt dunes do provide some buffer against upland erosion, but because they are composed of unconsolidated sand, they erode quickly when subjected to direct wave attack. Nevertheless, because erosion is episodic along the Oregon coast, such dunes may provide sufficient buffer to protect the upland against minor storm-induced erosion. They are also relatively inexpensive to construct, maintain, and repair.

The creation or restoration of sand dunes, as an explicit alternative to hard SPSs, is rarely discussed in SPS permit applications, correspondence, or findings. It apparently is not considered a viable alternative to most seawall or revetment proposals. There are exceptions, however. It was the alternative selected to protect 600 ft of shoreline at the Sea Ridge Condominiums in Lincoln Beach (see p. 95-100). This was due in part to the Goal 18 prohibition on hard SPSs on this "undeveloped" property. Sand dune building was also used for part of the Menashe property in Lincoln Beach (BA-300-88/SP 2846). In this case, SPRD and DSL permit administrators questioned the need for a riprap revetment for the entire property when erosion was threatening only a portion of it; they permitted riprap on the eroding part of the property and a dune-building sand fill on the remainder. DSL even made findings on this permit, perhaps to document its position if objections were raised. Dune building and vegetation are also being used as an alternative to hard shore protection for about 200 ft of shore at the Cozy Cove Motel, north of the Sea Gypsy and the D River outlet in Lincoln City (figure 4-17).

The planting and spread of European beachgrass at and along the base of some cliffs in the study area, in

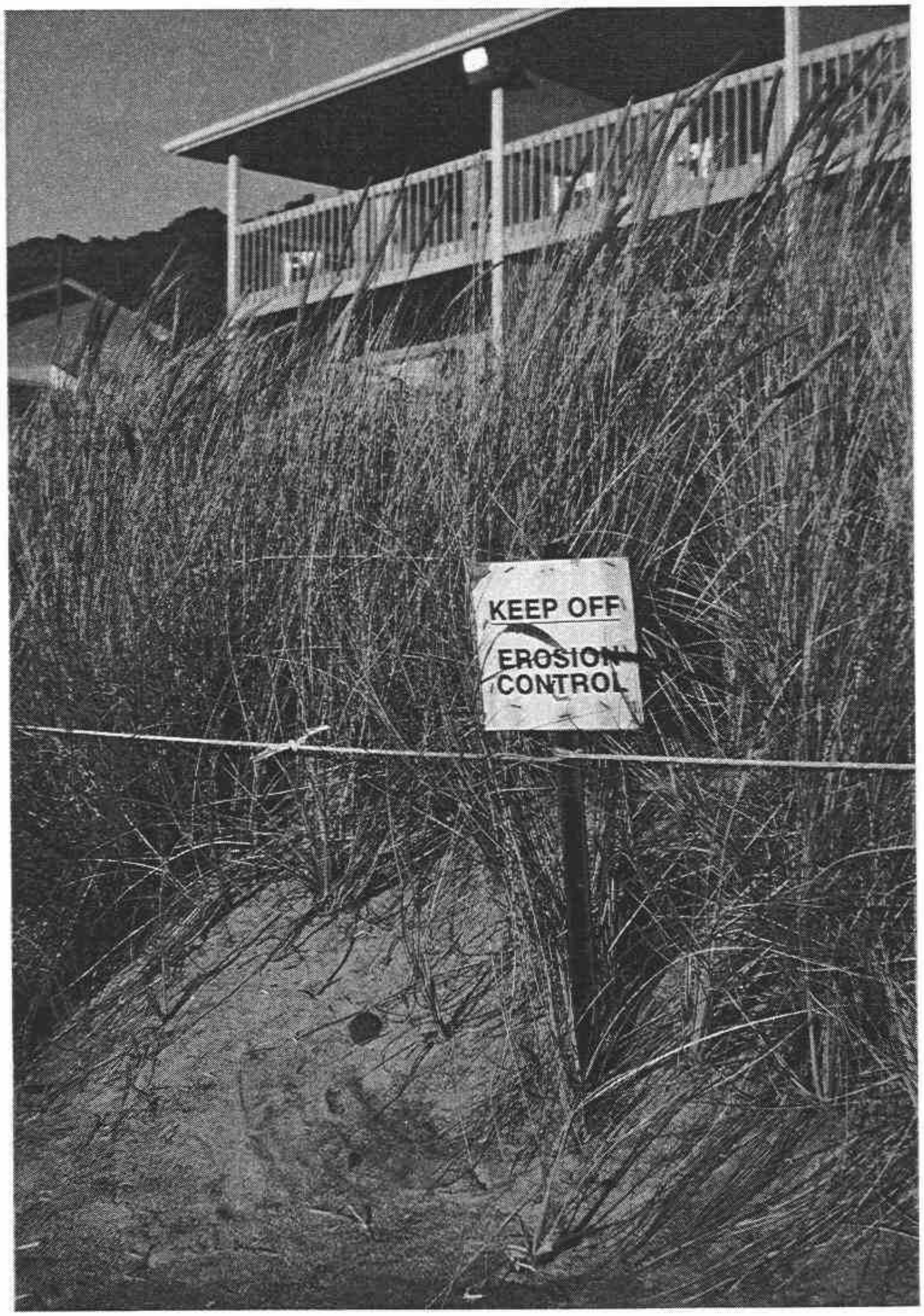


Figure 4-17. Dune building and vegetative stabilization at the Cozy Cove Motel, north of the Sea Gypsy Motel and the D River outlet in Lincoln City.

combination with natural driftwood deposits, is having the effect of building dunes in some other areas (see below). Most of the dune-building effort is private, not documented or monitored, and thus difficult to reconstruct for data base purposes. Consequently, no quantitative analysis of dune-building was attempted.

Vegetative stabilization. Both native vegetation (American dunegrass [*Elymus mollis*], salal [*Gaultheria shallon*], pine [*Pinus contorta*], etc.) and exotics (principally European beachgrass [*Ammophila arenaria*]) are used extensively along the Oregon coast to artificially stabilize dunes and the slopes and toes of cliffs (McLaughlin and Brown 1942; Ternyik 1979; Wiedeman 1984; Jacobsen 1988, Carlson et al. 1991). Although such vegetation does little to protect the toe of a cliff subject to storm wave attack, it is very effective in preventing erosion due to wind, rain, and minor surface and subsurface drainage. It also discourages people from climbing and digging on dunes and cliff faces.

As noted above, the use of vegetation to stabilize the shoreline within the Siletz cell has mostly been at the initiative of private property owners. Typically, European beachgrass is planted on the loose sand talus at the base of cliffs or on nascent dunes that form around driftwood accumulations. Salal, shore pine, and other species are sometimes planted on cliff slopes. Again, as with dune building efforts, there is little or no documentation of vegetative stabilization efforts and no useful quantitative data.

One unintended consequence of the use of dune-stabilizing European beachgrass is that it is such an efficient trapper of wind-blown sand that dune heights grow relatively rapidly, effectively blocking the view of the ocean from expensive beachfront homes. This situation, and the grading and lowering of sand dunes that resulted, led to a 1984 amendment of Goal 18 (Beaches and Dunes) that prohibited dune grading unless there was an overall regional plan for dune maintenance (OAR 660-15-010). The primary concern of management agencies was the increased vulnerability of federally-insured oceanfront property caused by the grading. Nevertheless, the practice continues. During field checks of the database in summer 1991, apparent illegal dune grading was observed seaward of homes on six Salishan lots along Siletz Spit.

Building design and construction techniques. A variety of special building design and construction techniques are used to mitigate storm, wave, flooding, earthquake, and other natural hazards in coastal areas (Pilkey et al. 1983; Rogers 1991). For example, deep-driven piling may serve as a stable foundation for a beach home elevated above storm flood levels. In a major storm, waves could then sweep beneath the structure, with dunes being rebuilt after the storm. While these and other techniques may mitigate hazards, rarely are they relevant when considering alternative means to mitigate active erosion or cliff slumping.

Infiltration/drainage controls. Adequate surface water and groundwater infiltration and drainage controls may be viable erosion-control alternatives to SPSs, or at least important adjuncts that might affect design and limit impacts of SPSs (Tainter 1982; Herdendorf 1984; Keillor 1986). Such controls help control cliff-top slumping, creation of rills, and erosion at the interface of soil strata along cliff faces.

Bank sloping. Bank or cliff sloping to achieve a more stable slope, along with revegetation, is the non-structural alternative noted in DSL's administrative rules (OAR 141-85-055 [2]). It is often recommended in conjunction with a SPS at the toe of the slope (Herdendorf 1984). Where toe erosion is not a significant threat, sloping and revegetation may eliminate the need for a hard SPS altogether. There is no clear evidence that bank sloping is used in the Siletz cell study area. Its use is limited by the fact that most lots are too shallow to allow much cliff sloping without significant loss of upland area.

Beach fill/nourishment. Beach fill and nourishment—the placement of substantial quantities of beach-compatible sand to advance the shoreline seaward—is increasingly being used to rebuild seriously eroded recreational beaches on the East and Gulf coasts, in California, and throughout the world (Dean 1983; NRC 1987; Clayton 1989; Dixon and Pilkey 1989). It has not been used in Oregon and its feasibility may be limited by economics and beach processes. Beach nourishment sufficient to serve as an alternative to SPSs is very expensive, running into the millions of dollars for relatively short stretches of beach. While this may be feasible at east coast locations like Miami Beach or Ocean City, the per-mile combined economic value of Oregon beaches and beachfront property is likely insufficient to warrant the required expenditures. Beach processes also argue against beach nourishment in Oregon and the west coast generally (Clayton 1989). Seasonal beach cycles in the Pacific Northwest are such that sand pumped or dumped onto a beach in the summer likely would be moved offshore and to the north in the winter, owing to winter storms and the predominant south/southwest swell. Whether the sand would return onshore and to the south in the summer when the swell direction switches to the northwest would depend on a variety of factors, such as the sand grain size and density of the fill material. Beach fills along the Oregon coast likely would be an expensive and risky proposition.

Dynamic structures. Dynamic shore protection structures, such as loose rock or gravel revetments where the rock moves in response to wave energy, is a relatively new concept in engineered shore protection (Ahrens and Heimbaugh 1989; Lorang 1991). This type of "structure" is actually what steep cobble beaches provide naturally for the backshore of many of the short pocket beaches along the coast. For some other locations along the coast, this type of structure may have some potential, possibly providing the short-term protection needed to weather the typical storm erosion episode.

Policy Objective 6: Evaluate, avoid, and minimize the individual impacts of permitted SPSs

Neither the Beach Law nor the Removal/Fill Law specifically require preparation of a formal impact assessment as part of the SPS permit process. However, both SPRD and DSL are required by statute to evaluate, avoid, and minimize adverse effects of proposed structures on recreational and scenic attributes of the beach.

Beach Law permits are to be issued only if the projects are found "... not to be adverse to the public interest" (ORS 390.650 [3]). The public interest is defined as the "protection of the state recreation area, the safety of the public using such areas, the preservation of values adjacent to and adjoining such areas, and the natural beauty of the ocean shore and the public recreational benefit derived therefrom" (390.640[1]). These interests are further elaborated in the Beach Law's criteria for permit standards (ORS 390.655 [1] to [4]) and in SPRD's beach improvement standards (OAR 736-20).

The Removal/Fill Law has a similar purpose. It states that permits may be issued only after it has been determined "... that the proposed fill [in this case, a SPS] would not unreasonably interfere with the paramount policy of the state to preserve the use of its waters [Pacific Ocean beaches] for ... public recreation" (ORS 196.825[2] and OAR 141-85-050). Decision-making considerations are outlined in ORS 196.825 (3); OAR 141-85-050[1]) requires DSL to "evaluate the probable impacts ... of the proposed activity ... ."

Additional guidance on impacts to be evaluated, avoided, or minimized are provided in SPRD and DSL administrative rules and in LCDC Goals 17 (Coastal Shorelands) and 18 (Beaches and Dunes). In general, these include impacts on public access to and along the beach, visual/scenic qualities, riparian vegetation, public safety, beach and adjacent property erosion, and cultural and natural resources (see table 4-2 for specific citations).

Measures or indicators of achievement for these policies requiring impact evaluation of proposed SPSs are outlined in table 4-2 and below:

a) a process is established and used for evaluating, avoiding, and minimizing impacts of proposed SPSs, and for establishing and enforcing permit conditions;

b) where SPSs interrupt/destroy public access, affected accessways to the beach are retained or replaced; where SPSs encroach on the public beach, lateral access is maintained; instances where SPSs installed at or adjacent to state parks, waysides, or public access points;

c) qualitative assessment of visual/scenic impacts of individual SPSs;

d) the design (and construction) of SPSs (size, shape, scale, materials, placement, lateral tie-in) is consistent with the hazard(s) and need; encroachment of individual SPSs on public beach; instances where prohibited materials used to build SPSs;

e) evidence of SPS-induced beach or adjacent property erosion;

f) siting of SPSs with respect to historical and archeological sites; and

g) siting of SPSs with respect to threatened or endangered species habitat or other valuable wildlife habitats.

Each of these measures is analyzed and discussed below.

a) Process established and used for evaluating SPS impacts and for establishing and enforcing permit conditions. The processes used by SPRD and DSL for evaluating the impacts of proposed SPSs consist of the gathering and review of information related to their respective administrative rules. Neither agency has developed a formalized impact assessment "process," though SPRD consistently makes written findings against its administrative rules and establishes appropriate permit conditions. These findings and conditions are based on their own analysis and on comments received during circulation of the permit application to state and federal resource agencies, the affected local government, neighbors, and other interested parties (activists, citizen groups, etc.). Because most of the permit standards are discretionary rather than measurable criteria, SPRD permit findings usually represent a "balancing" of information received by the permit administrator. There are no technical or model procedures for estimating impacts or comparing them to some measurable performance standard.

Little of the information required in the state permit application (Appendix C) or provided by applicants actually addresses potential SPS impacts; the emphasis instead is on the need and justification for the structure. Similarly, the geotechnical reports that applicants sometimes prepare to justify their proposal contain little information useful for evaluating potential impacts. Even if such reports were required, the state has no registered geologist or engineer routinely involved in the state permit review process to evaluate and certify geotechnical report accuracy and conclusions. As a result, estimating the impacts of structures and deciding how impacts might be avoided or minimized is left primarily to the SPRD on-site project evaluator. Historically, most these staff are trained and have experience in park and recreation management. Although they are well-qualified to evaluate the recreational, visual, and public access impacts of SPSs, few, if any, have had the training in coastal oceanography, geology, or engineering needed to evaluate hazards, appropriate mitigation techniques and designs, and the physical impacts of proposed and alternative protection measures. SPRD permit administrators also have a wide range of other responsibilities that take the majority of their time.

DSL may also be involved in on-site evaluations if the application is questionable or controversial, or if the project is east of the BZL where only DSL has jurisdiction. DSL has no structured evaluation and assessment process that is apparent in permit records; decisions are based principally on advice from SPRD and other reviewers. If there are no external objections, permits are generally issued with little further assessment by the agency. According to their own rules, permit administrators are not required to make findings on SPS permits they issue (OAR 141-85 [10]); instead of findings, the issued permits contain mostly "boiler plate" conditions and one or more special conditions. For example, a special condition might state where and how much riprap can be placed. There is no information included on need, alternatives, or impacts.

Thus, if only DSL has permit authority, reconstruction of permit decision-making rationale is difficult.

There are a number of possible reasons for DSL's relatively cursory review of oceanfront SPSs. First, most SPS permits are joint ones with SPRD, whose routine procedures include a comparatively thorough project assessment. In these joint permit cases, DSL generally follows SPRD's lead. When only DSL has jurisdiction, they likely follow a similar routine and do little original assessment of need, alternatives, or impacts. DSL's limited assessment of beachfront permit requests may also be due to the fact that the vast majority of their Removal/Fill Law permit applications are for wetland or waterway alterations, not beachfront SPSs. Given the wetland/waterway permit workload and requirements, beachfront structure requests simply are not a high priority. Furthermore, the training and experience of DSL permit administrators are more oriented in the direction of wetland/waterway environmental concerns.

In the enforcement arena, SPRD's authority is limited. The agency can deny a permit or, in the case of an illegally installed SPS, ask, but not require, the property owner to remove it. An example of this occurred at the Dickstein property in Lincoln Beach (BA-082-73). Dickstein installed a seawall west of the BZL without a permit. When discovered by the state, Dickstein applied for an after-the-fact permit, but it was denied. He removed the illegal seawall and rebuilt it east of the BZL. Nevertheless, SPRD has no legislatively-mandated civil or criminal enforcement authority.

DSL has much stronger enforcement authority, including civil, criminal, and administrative remedies under ORS 196.860-196.875 and 196.895-196.990. Because SPRD and DSL have joint authority over most SPS installations, this authority gives the state substantial leverage over would-be violators. DSL also has an enforcement staff, though virtually all of their time is devoted to the wetland part of the Removal/Fill program.

b) Impacts on public access. The Beach Law requires the SPRD to protect, maintain, and regulate public access, whether on public or private lands (ORS 390.660); beach improvement standards (OAR 736-20) and state planning policies (Goals 17 and 18) support and elaborate on the need to retain, protect, and increase public access to the beach recreational resource.

There are 62 public beach access points along the 16-mile Siletz littoral cell (table 4-12). Most of these access points are street-ends or walkways owned and maintained by Lincoln City or Lincoln County (74%), though three state waysides and one state park provide the most obvious and significant access (Roads End, D River, Gleneden Beach, Fogarty Creek). A fifth state wayside—Boiler Bay—is located at the rocky headland at the south end of the cell and has no beach access. A number of other public access points are easements across private land. In addition to these public access points, there are 12 private/common accessways in the Salishan development on Siletz spit, and numerous private accessways at homes along the beach.

Table 4-12. Public beach accessways in the Siletz littoral cell: ownership and inventory status.

	PUBLIC BEACH ACCESSWAYS			
Ownership and Maintenance	Public Beach Access (PBA) from State Inventory[1]	PBA from State Inventory Actually Located in Field	Other PBA not on State Inventory but Located in Field	Total PBA Located in Field (B + C)
State Government	6	6	1	7
Local Government	41	40	5	45
Private/Easement	3	3	4	7
Unknown	6	1	2	3
Total	56	50	12	62

[1]Benkendorf Associates. 1989. *Inventory of Oregon Coastal Beach Access Sites*. Prepared the Department of Land Conservation and Development and the Oregon State Parks and Recreation Division.

Of the 62 public access points, 43 (69%) provide pedestrian access to the beach and 7 (11%) provide vehicle and pedestrian access, though only one small area of the beach is actually open to public vehicular traffic; this translates to about 3.5 physical beach accessways per mile of beachfront in the Siletz littoral cell. The remaining 12 access points have only visual access.

The state inventory of coastal access includes 56 sites (table 4-12) within the Siletz littoral cell (Benkendorf 1989). Of these, seven did not exist or could not be located in the field; however, an additional 12 access points not included in the inventory were located in the field. The inventory discrepancies may in part be due to the use of county tax maps, which are outdated in some parts of the study area. The impacts of shore protection activities on these accessways are evaluated below.

Accessway replacement. Where installation of SPSs interrupt or destroy public access, affected accessways to the beach must be retained or replaced (Coastal Shorelands Goal 17, Implementation Requirement 6). Of the 62 public access sites in the Siletz cell, 24 (39%) are hardened with SPSs, mostly rock revetments. However, 15 of the 24 were built before the state permit program was instituted in 1967. Of the remaining 9 public access points, most had riprap rock placed as part of accessway construction or repair. Three, however, have resulted in public access disputes or problems.

The first of these involved encroachment of a privately-constructed seawall on a small county park pedestrian access in the Roads End area (David Sullivan property). When built in 1983 (BA-237-83), the seawall inadvertently encroached approximately 25 ft south of the Sullivan property into the public access. Sullivan, neighboring property owners, State Parks and Recreation Division personnel, and Lincoln County worked together to resolve ownership, safety, drainage, and access problems. The second project involved potential destruction of a public access at Lorraine Street in Gleneden Beach, just south of Gleneden Beach State Wayside. From the permit record (BA-295-87), it is apparent that the contractor had to be forced by SPRD to replace the access that was interrupted by installation of a rock revetment. The replaced accessway stairs are barely adequate. A third possible instance of public access loss is at Pearl Street, just one block south of Lorraine Street in Gleneden Beach. As far as can be determined, a rock revetment was built there between 1988 and 1991 without benefit of a permit; no enforcement action has been taken. However, it is unclear what kind of access was available at this site prior to construction of the SPS. Although the state inventory suggests that this is a pedestrian access point, recent photos suggest there was only visual access from the top of the bluff.

Lateral access blockage. The beach improvement standards state that SPSs should "avoid blocking off or obstructing important public access routes within the ocean shore area" (OAR 736-20-020 [2]). This is interpreted to mean that lateral access should not be interrupted by construction of SPSs that extend too far out on the beach.

There are two reasons for this policy—protection of beach users and protection of recreational values in general.

Two cases of ocean shore encroachment by privately-constructed SPSs serve as examples of structures that have the potential to interrupt lateral beach access. These are the Coho Inn structure in Lincoln City (BA-014-70) and the Swalko structure just north of the north boundary of Lincoln City (BA-286-87/SP 2666). The cumulative impacts of public beach encroachment are discussed later under Policy Objective 7.

The Coho Inn project, located on N. Harbor Drive in Lincoln City, involved two stages. First, as part of pre-sale, pre-construction site preparation work for a new motel, the property owners, in early 1966, placed approximately 20,000 yd^3 of sand fill over the bank and out onto the beach, extending about 40-50 ft seaward of the existing bankline. In 1969, the new owners (Mary and Eric Pekkola) applied for a permit to build a rock revetment to protect the toe of their newly constructed sand-fill bank and motel. According to permit conditions, the revetment was to extend no further out on the beach than the existing fill. As built, the SPS extended beyond the fill, impeding lateral access along the beach at high tide in winter months, when sea level is higher and storms scour the beach.

The Swalko project is located in the Roads End area just north of Lincoln City. The project as constructed extends 35-40 ft seaward of the BZL (figure 4-18) and, according to correspondence in the permit record, "does not come close to the requirements of the application and

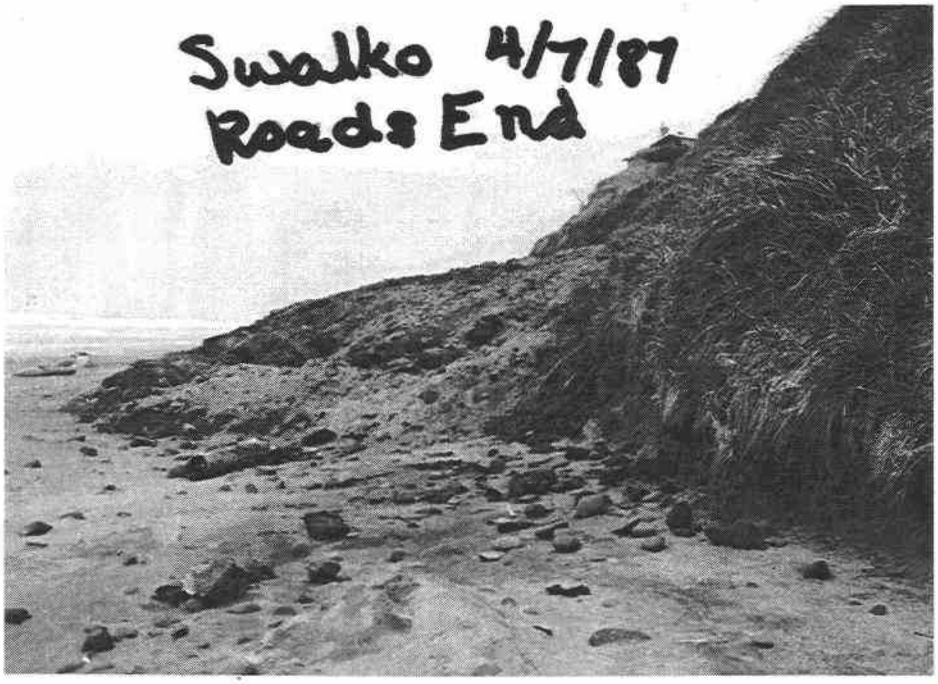


Figure 4-18. The Swalko riprap revetment extends 35-40 ft west of the BZL (Sallie Jacobsen photo).

constitutes both a visual eyesore and a blatant, unnecessary encroachment onto the public beach" (Hearn 1987). Despite apparent nonconformance with the permit, the project was allowed to stay in place; at high tide, it may interrupt access along the beach.

Other SPSs in the Siletz littoral cell, particularly those installed to protect eroding bluffs along Gleneden Beach, also extend sufficiently seaward of the beach-bluff break to interrupt lateral access and create safety hazards (figure 4-19). The issue in each of these cases is whether or not the safety hazards and loss of recreational opportunity associated with access interruption outweighs the possible loss of private uplands and structures located there. Another factor is whether or not alternatives to

Figure 4-19. Riprap revetments extend out on the public beach at many points along Gleneden Beach.

hard SPSs—relocation, sand fill and vegetative stabilization, bank sloping, or dynamic structures (see table 4-8)—could have achieved the same purpose as the SPS.

Impacts on Parks and Waysides. Some of the most important and heavily-used recreational beaches are those adjacent to three state waysides and one state park in the study area: Roads End, D River, Gleneden Beach, and Fogarty Creek. A possible measure of SPRD and DSL consideration of SPS impacts on these recreational beach resources is their willingness to deny or condition SPS permits for adjacent or nearby properties, particularly outside urban areas.

North of Roads End State Wayside, there are no structures for more than 500 ft; low-lying bluffs in the area are fronted by dune hummocks partly covered with vegetation. To the immediate south, however, the first four lots have riprap revetments, all of which were permitted in the 1980s by DSL; none of the permit files make any mention of proximity to the state wayside and adjacent recreational beach.

D River State Wayside, adjacent to the outlet of the D River, is itself protected by a concrete seawall constructed prior to the permit program. Shorelines to the north (700 ft) and south (1000 ft) of the wayside in this intensively developed area of Lincoln City all have SPSs, most of which were installed since the permit program was established. Given the developed nature of the area, proximity to the state wayside was likely not an issue in permit deliberations.

Gleneden Beach State Wayside sits atop a 25 ft bluff and includes 455 ft of unprotected shore. The 500 ft of shoreline to the north of the park is also unprotected. To the south, however, riprap revetments protect most of the parcels along several miles of oceanfront, including the subdivisions Miracle View, Coronado Shores, and others. Immediately south of the wayside, a riprap revetment permit was issued in 1987 for a 500 ft multiple-lot structure (BA-295-87). No mention of the proximity to the wayside or the intensive public use this beach receives was included in SPRD's permit findings or other correspondence.

Based on these few examples, the adjacency of state parks or waysides does not appear to be a factor in deciding whether or not to issue SPS permits.

c) Qualitative assessment of scenic, visual, and aesthetic impacts of individual SPSs.

Concerns about potential adverse scenic, visual, and aesthetic impacts of SPSs is the heart of the Beach Law, and is echoed in LCDC planning Goals 17 (Coastal Shorelands) and 18 (Beaches and Dunes), and DSL's administrative rules. Specific policies emphasize protection of key scenic features and views, maintenance of vegetation for its aesthetic value, compatibility with surroundings, and use of natural materials in construction. As part of its permit application review process, SPRD makes findings on each of these issues. If only DSL has permit authority (east of the BZL), no findings are made, so it is difficult to evaluate how visual and scenic concerns are factored into permit decisions. However, visual/scenic impacts are addressed in standard conditions when DSL does permit a revetment: DSL requires the use of clean, durable rock, and a covering of sand planted with beachgrass. These sand and beachgrass-covered revetments are unobtrusive in the dune environment, but more obtrusive along cliffed shorelines. Concrete seawalls, in part because of their perceived negative visual impacts, are discouraged by both SPRD and DSL.

A qualitative assessment of visual and scenic impacts of SPSs was not attempted as part of this study. However, it is the opinion of the author that SPSs of all types tend to homogenize the diverse natural environment along the beach and have an overall negative visual/scenic impact on recreational and aesthetic values of the resource.

d) Design and construction of SPSs consistent with hazard, need, safety.

SPS design issues are addressed directly and indirectly in Oregon law. For example, the beach improvement standards state that "the project should be designed to avoid or minimize safety hazards to property and the public" (OAR 736-20-025). The Removal/Fill rules require that the structure is composed of rock or other clean, durable, erosion-resistent material designed to encourage vegetation growth ... and that the existing bankline is followed and significant encroachment on the beach is avoided (except for extensive recent cuts) (OAR 141-85-055[1] and [2]). Goal 17 (Coastal Shorelands) requires that "SPSs, where shown to be necessary, shall be designed to minimize adverse impacts on water currents, erosion, and accretion" (OAR 660-15-010). The underlying policy objective, while not explicitly stated, is to limit the size and scale of structures to the minimum needed to effectively mitigate the hazard.

SPRD and DSL permit administrators evaluate design and construction techniques in conjunction with their overall assessment of project need. Ideally, SPRD and DSL personnel get involved early in the process, before actual permit application is made. This helps prevent problems before the permit process gets underway. Often, however, permit administrators only get involved after a property owner has applied for a permit. By this time, a structure type and design have been proposed by the contractor or engineer employed to evaluate the site and prepare the application. In these cases, design and construction review by permit administrators is a reactive process. Typically, design changes at this point relate only to structure location with respect to the BZL. From the permit record, actual design issues with respect to the hazard are rarely raised. Contractor or engineer designs, as they relate to size and scale, are generally accepted as presented. In part, this is because neither SPRD nor DSL has the geotechnical staff expertise to evaluate the hazards and structure design, and no other state agency reviewing the permits conducts such an evaluation. As a consequence, there is no effective process in place today to ensure SPS design is the minimum needed to effectively mitigate the hazard.

Given this limited design review process, what are the designs for SPSs that have been approved and constructed along the Siletz cell beachfront? And, do these designs comport with accepted engineering and construction practices, given the hazard faced?

Typical SPS Design in the Siletz cell. Two-thirds of the SPSs along the beach in the Siletz cell have been constructed since 1967, when the Beach Law permit program was initiated (table 4-13). Of these structures, 91% (282) were riprap revetments; the remainder were reinforced concrete or concrete block seawalls, wooden bulkheads, or other types.

Table 4-13. Types of shore protection structures constructed in the Siletz littoral cell, 1967-91.

	YEARS		
SPS TYPE	<1967	1967-91	TOTAL
Rr	76	282	358
Cr	46	17	63
Cb	28	5	33
Bw	4	2	6
Other	9	4	13
Total	163	310	473

Rr - Riprap revetment
Cr - Reinforced concrete seawall
Cb - Concrete block seawall
Bw - Wood bulkhead
Other- Other structure type

The "average" riprap revetment is 16 ft high, measured from the base, 27 ft wide with a 1V:1.7H slope, and protects an oceanfront parcel that is 79 ft in length and 39 ft in elevation, measured from MSL (table 4-14). Although most are not "engineered" in the strict sense, they generally conform to engineering guidelines with respect to the recommended toe protection, use of a graded stone or fabric filter, and armor rock facing. However, many revetments along the Oregon coast and even the "average" structure (table 4-14) are arguably overbuilt, considering the wave forces typically found at the upland-beach interface where these structures are placed.

Table 4-14. Mean dimensions of shore protection structures built from 1967-91, Siletz littoral cell.

	MEAN DIMENSIONS		
SPS TYPE	HEIGHT	LENGTH	WIDTH
Rr	16	79	27
Cr/Cb	12	101	9
Bw	9	90	8

Rr - Riprap revetment
Cr - Reinforced concrete seawall
Cb - Concrete block seawall
Bw - Wood bulkhead

Engineering Guidelines for Revetment Design. Among the design considerations for SPSs are the maximum water level at the site; wave height, variety, setup, and runup potential; beach slope, grain size, seasonal profile variation, and basement rock depth; shore landform height, stability, and drainage; end conditions for the structure; and available construction materials (USACOE 1984; USACOE 1985; Ahrens 1990). These considerations can be used by engineers to design a revetment of appropriate height, slope, toe trench depth, filter type and thickness, and armor rock weight.

Revetments must be built high enough to avoid wave overtopping, a common cause of failure (Fulton-Bennett and Griggs 1987). The height of the landform being protected is also a factor in structure height. The toe trench should be excavated to bedrock or the water table (Kraus and McDougal 1991), an elevation that approximately corresponds with MHW at the beach-upland interface along the Oregon coast. The size and weight of armor stones is one of the most important design features. For riprap revetment built on a 1V:1.5H slope landward of the wave breaker line (the typical situation in Oregon), the required stone weight is approximately

$$W = 16d^3$$

where W is the weight of the stone in pounds, and d is the depth of water at the revetment in feet during the high-water storm condition (Kraus and McDougal 1991). The water depth must take into account storm surge, highest measured tide, and wave runup. If the design water depth is 2 ft, armor rock should weigh at least 128 lb; if the design water depth is 4 ft, the corresponding stone weight would be 1,024 lb.

Design Conditions for the Oregon Coast. Significant wave height (the average height of the highest two-thirds of all the waves within a given time period) of offshore breakers may reach 20 ft (6.5 m) or more during winter storms. Wave runup at the beach-upland interface, however, is relatively small. Shih (1992) calculated the extreme wave run-up(R_{max}) for two sea cliff sites in the Siletz cell—21st Street in Lincoln City and Gleneden Beach. R_{max} in this case accounts for the extreme high tide above MSL, storm wave set-up, and maximum wave swash. At 21st Street, a dissipative, fine sand beach where the beach-cliff junction was approximately 17 ft (5.15 m), R_{max} (storm) was about 14 ft (4.2 m) for a 10-year return interval (this approximates the strong El Niño return interval) and 14.5

ft (4.36 m) for a 100-year return interval. At the Gleneden Beach site, a reflective, coarse sand beach where the beach-cliff junction was approximately 21 ft (6.3 m), R_{max} (storm) was about 16 ft (4.92 m) for a 10-year return interval and 17 ft (5.08 m) for a 100-year return interval. From these data, Shih concluded that under typical storm conditions, wave runup rarely reaches the beach-cliff interface. The exception is when nearshore currents, such as rip currents, cut into the beach (particularly common on coarse-grained beaches like Gleneden beach) and significantly lower the beach-cliff junction elevation. Vulnerability to rip currents is therefore an important design consideration for revetments, but it is unlikely that the beach would be lowered more than 3-6 ft (1-2 m).

Given the engineering guidelines suggested above, are the typical permitted revetments appropriately designed for the extreme hazard? To answer, consider a hypothetical worst case in the Gleneden Beach area, with an R_{max} of 5 m, and the beach-cliff junction lowered from 6.3 m to 4 m by a rip current embayment. In this extreme case, the water height at the beach-cliff (or revetment) junction would be approximately 3 ft (1 m). Armor stone weight to protect against this hazard should be approximately 432 lb. A 10-ft high revetment, measured from the lowered beach-cliff junction, would provide a 3-times safety factor for wave over-topping (figure 4-20B). Yet, this 10-foot high revetment is substantially smaller than the "average" Siletz cell revetment (figure 4-20A).

Case Example of Extreme Over-design. Probably the most extreme example of SPS over-design is the Furman

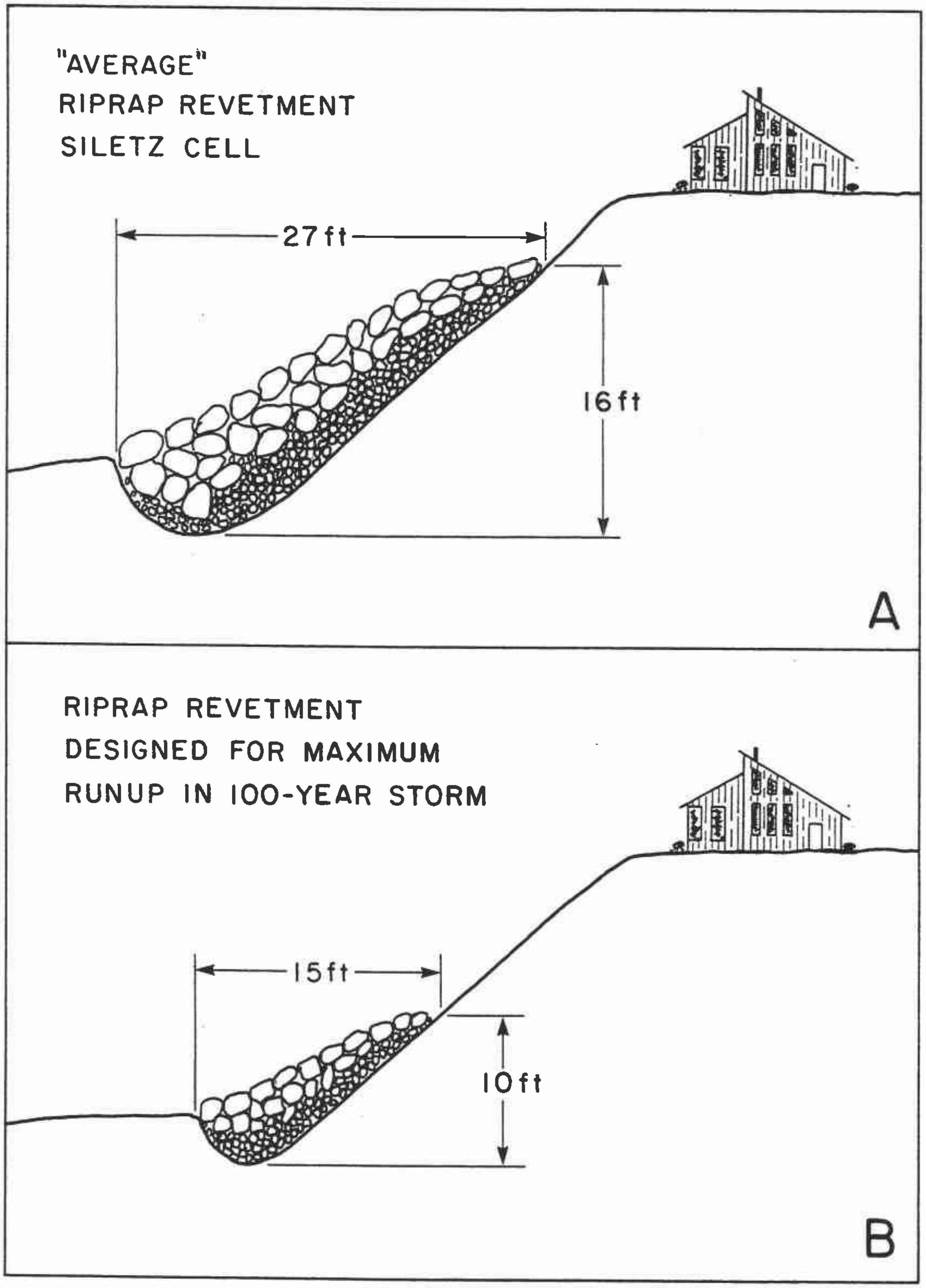


Figure 4-20. The "average" riprap revetment size for the Siletz cell (A) contrasted with a structure sized for maximum wave runup during a 100-year storm at extreme high tide (B).

revetment a short distance south of the Inn at Spanish Head (BA-313-89/SP 2710). There was and is no threat of toe erosion at the site—the last time wave swash reached the base of the cliff was in the winter of 1978. Since then, a collection of large drift logs has accumulated in front of the property, resulting in substantial dune accretion. The only hazard noted was minor cliff-top recession. The structure chosen to mitigate this hazard is a 300-foot long, 50-foot high riprap revetment, extending 20 ft or more west of the BZL, with armor-facing rock 4-6 ft in diameter, weighing up to 10 tons per unit (figure 4-21). The armor stones for this structure weigh up to 40 times greater than those in the hypothetical revetment design described above.

One consequence of such over-design is encroachment west of the BZL onto the public beach. Other examples of encroachment were given earlier in the discussion on lateral access blockage; aggregate results of BZL encroachment are discussed in the cumulative impacts section. The scenic/aesthetic impacts on the beach environment are another aspect of the over-design problem.

Construction-related Impacts. The construction of equipment access/haul roads is another impact of SPS installation rarely discussed in individual permit applications or reviews. Access to the beach for SPS construction is limited, especially along cliffed shorelines, so access roads often extend hundreds of feet along the beach, usually close to the beach-upland junction (figure 4-22). At the SPS construction site, these access/haul roads typically provide a platform area for

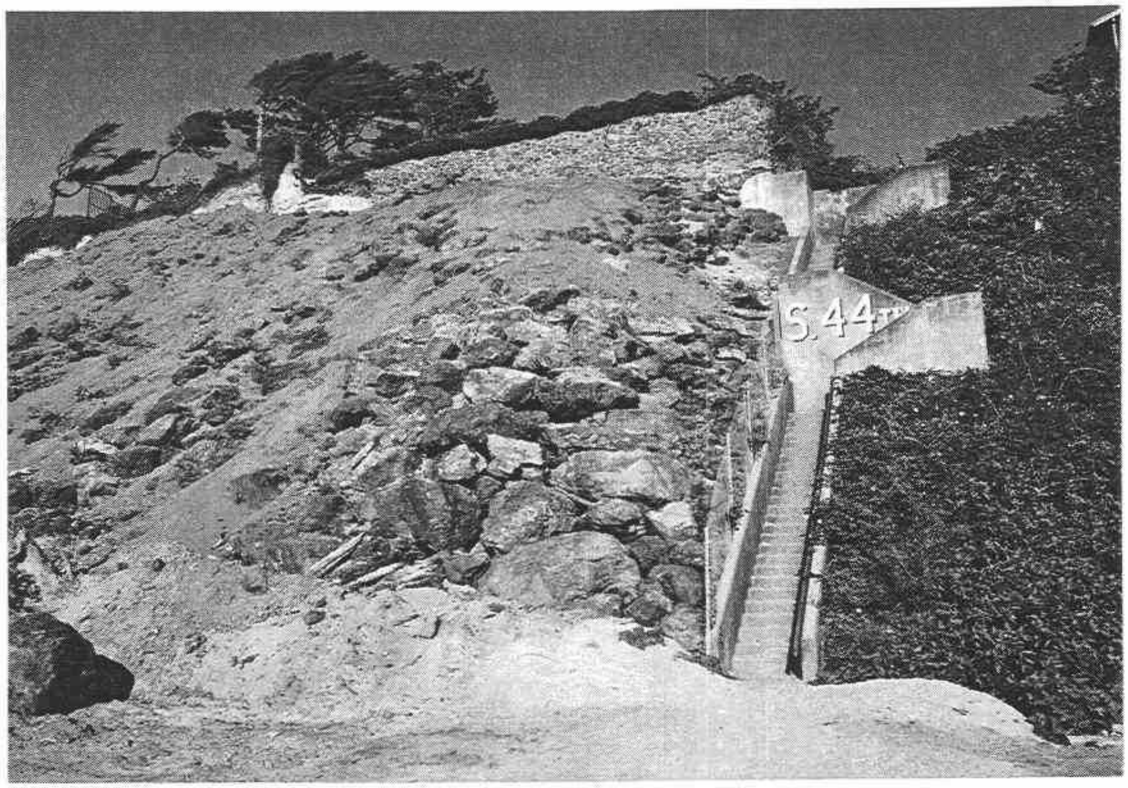


Figure 4-21. The Furman riprap revetment at S. 44th St. in Lincoln City is an extreme case of an over-designed structure.

digging the toe trench seaward of the road, and subsequent placement of toe protection rock. Later in construction, the road becomes part of the structure itself, serving as the graded rock filter upon which additional rock is placed as the revetment climbs up the cliff face.

Often, the oceanfront properties passed by access/haul roads are unprotected and not experiencing erosion or other hazards. A neighbor's SPS proposal, however, often heightens the awareness of adjacent property owners of the hazard potential of living along the beach. The heightened awareness and prospect of an access/haul road in front of their property tends to spawn multiple-parcel SPS

Figure 4-22. Equipment access/haul road for revetment construction along the shoreline at Gleneden Beach (ODOT photo).

proposals, whether or not there is an actual need on all parcels. An example of this is the 11-parcel, 550 ft revetment proposal by Hansen and adjacent property owners north and south (BA-295-87). Several lots were experiencing significant erosion, several were experiencing minor erosion, and two were well-vegetated to the base with no erosion. From an economic, design, and efficiency viewpoint, the single, large revetment proposed made good sense. From a public interest perspective, building preventative revetments along the beach just because an access/haul road exists or because a neighbor is building one causes undue proliferation of SPSs and unnecessary intrusion onto the beach. SPRD and DSL found this to be the case; they denied the permit for the two lots that did not have an erosion problem.

The above design issues argue for a more regional, planned approach to shore protection and the upland development that creates the demand for SPSs. By planning for an entire littoral cell, or logical sub-cells, the types and designs of acceptable SPSs to be permitted can be specified in advance, along with appropriate non-structural methods, building construction setbacks, and other siting criteria. This would provide the increased predictability property owners need to secure their property investments and would result in development and shore protection strategies more consistent with protection of the public beach resource.

e) SPS-induced beach or adjacent property erosion. Although SPRD standards and Goals 17 and 18 state that negative impacts of SPSs on erosion of the beach and adjacent properties shall be minimized, implementation of this policy requirement has been ineffective. Reasons include a lack of relevant information, especially in the 1970s and early 1980s, and the lack of training of state permit administrators and reviewers to apply available information to site-specific situations. This is evident from a review of representative permit findings made by SPRD. In a 1978 permit (BA-178-78) for a riprap revetment in the Coronado Shores subdivision in Gleneden Beach, SPRD concluded that "There is no factual data available to determine whether the project would increase erosion of adjacent properties." Six years later, SPRD deferred to an applicant's consulting engineer, finding that "The project engineer claims the structure will not cause a significant impact on adjacent properties" (BA-253-84). No basis for this claim was given. For a 1987 riprap permit application (BA-286-87), SPRD concluded that "It is not known to what extent if any the revetment would affect adjacent unprotected properties."

This issue—the effects of seawalls and revetments on beaches and adjacent properties—has received significant attention from coastal engineers and geologists (Griggs and Fulton-Bennett 1988; Griggs and Tait 1988; Komar and McDougal 1988; Kraus 1988; Kraus and McDougal 1991; Pilkey and Wright 1988; Terchunian 1988; Terich and Schwartz 1990; Weggel 1988). The results of these studies and reviews were outlined in Chapter 2. Briefly, SPSs can cause erosion of both beaches and adjacent properties, if there is no alternate supply of sand to replace that which is blocked by the structure, or if the structure is not designed to minimize wave reflection. Riprap revetments are one of the least reflective SPS types (and therefore more desirable from this perspective), whereas vertical seawalls are the most reflective.

The potential effects of seawalls and revetments on erosion processes should be considered on a case-by-case basis by SPRD and DSL as part of the evaluation of proposed SPSs. If the shoreland to be protected and the adjacent unprotected properties are likely to experience significant wave run-up relative to the elevation of the beach-upland junction, it should be presumed that erosion of adjacent beach and properties will be exacerbated by the SPS. Ensuring that SPS design and construction (size, shape, scale, materials, placement, lateral tie-in) are appropriate to the hazard and degree of threat is the principal means to minimize these impacts. Reducing wave reflectivity should be given particular attention, since that is the most often-mentioned cause of induced erosion. Properly designed, the riprap revetments preferred by both SPRD and DSL serve this purpose well. The dynamic structures discussed earlier (see table 4-8) might also be a good choice.

To evaluate the effects of SPSs on erosion of the beach as a whole, a study of changing beach widths over a long period of time is needed. Such a study might be accomplished using historic aerial photography that has been standardized for tide level and beach slope.

f) Historical and archeological site impacts. There are one historic and two archeological sites in the study area (Beckham 1973). Boiler Bay, at the extreme south end of the study area, is a historic site by virtue of the 1910 shipwreck there that gave the cove its modern name. Boiler Bay and the north shore of the Salmon River estuary at the extreme north end of the study area, are both native American midden sites of archeological value. None of these sites has been affected by shore protection activity.

g) Impact on threatened or endangered species habitat, or other wildlife habitat. Although parts of the study area have some potential as habitat for threatened or endangered species (Burley 1979), there are no specific references to their presence in the study area and therefore no known impacts due to shore protection activity. However, construction of SPSs, particularly riprap revetments, have significant impact on existing shoreland vegetation, destroy habitat for passerine birds that use shoreface vegetation, remove habitat for cliff-dwelling and cavity-nesting birds, and displace a variety of small mammals and other animals inhabiting the shoreface (Mulvihill et al. 1980). At the same time, revetments provide new types of habitat, whether covered with sand and vegetation or left as bare rock.

Habitat values of shoreline parcels, whether or not protected with a hard SPS, were not evaluated as part of this study. Such an evaluation would itself be a major undertaking. However, one should not discount the potential significance of the habitat loss associated with construction of many SPSs along any given stretch of beach.

<u>Policy Objective 7: Evaluate, avoid, and minimize the long-term, recurring, and cumulative impacts of SPSs</u>

Neither the Beach Law nor the Removal/Fill law specifically require analysis of cumulative impacts. However, the rules established to implement the laws and LCDC Goal 18 (Beaches and Dunes) do identify cumulative impacts to be evaluated, avoided, or minimized. For example, OAR 141-85-050(1) requires DSL to evaluate the probable impacts, *including cumulative impacts*, considering environmental and economic consequences; direct and indirect effects on the beach; effects on water circulation, tides, current patterns, and flood hazards; effects on special aquatic sites—refuges, sanctuaries, scenic areas; effects on water access, public recreation, and aesthetics; and effects on water quality and aquatic life and habitats. However, as noted in earlier in the discussion of impact assessment (p. 155), another DSL regulation that specifies the types of permits that require written findings omits oceanfront erosion control permits (OAR 145-85-035 [10]). The absence of a requirement to make written findings (and thereby clearly justify decisions) provides busy permit administrators with little incentive to spend time evaluating and reporting project impacts, individual or cumulative.

SPRD's beach improvement standards, in an oblique reference to cumulative impacts, state that there must be no reasonable alternatives that would better protect public rights or reduce or eliminate long-term public costs (OAR 736-20-010[4] & [5]). Finally, Goal 18 (Beaches and Dunes) states that criteria for review of SPSs shall provide that long-term or recurring costs to the public are avoided (Implementation Requirement 5d).

These regulations, particularly DSL's, identify a wide range of physical, biological, and socioeconomic impacts to be evaluated; however, they do not identify specific measures or indicators of cumulative impacts. Several possible measures, emphasizing physical impacts that can be quantified, are outlined in table 4-2 and below:

a) a process is established and used for evaluating, avoiding, and minimizing cumulative impacts of SPSs;

b) cumulative length of SPSs installed along the beachfront by year, structure type, and landform;

c) numbers, degree, and area of SPS encroachment on beach (as compared to beach area available) and effects on lateral access and recreational use.

d) cumulative loss of sand supply to the beach due to hard SPS installation along sea cliffs;

Each of these measures is analyzed and discussed below.

a) Process established and used for evaluating, avoiding, and minimizing cumulative impacts of SPSs. As noted above, state-level policies addressing the risks associated with cumulative impacts of SPS installation are general and based solely on administrative law. Neither SPRD nor DSL, the regulatory agencies, nor DLCD, the state coastal management agency and principal permit reviewer, have developed a process for identifying and evaluating the cumulative impacts of oceanfront SPSs. Specific cumulative impacts concerns have not been articulated, possible measures or indicators of cumulative impacts and their significance have not been identified, and no technical procedures have been developed. Given the demands on these regulatory and review agencies to quickly process individual permits and make decisions, it is not surprising that cumulative impact assessment is a relatively low priority.

There have been some less-structured attempts to assess cumulative impacts of SPSs. Both SPRD and DSL have made efforts to reconstruct their permit records to gain an understanding of the results of their permitting activity (Martin 1978; DSL 1985). However, neither of the studies is in a database or other form that allows for ongoing record maintenance or cumulative impact analysis and reporting. DSL does keep a permit database, but the data are primarily administrative and not useful for cumulative impact assessment.

SPRD, in its evaluation of individual permit applications and statement of findings, does deal with certain cumulative impacts issues subjectively. For example, they consider the character and the existing degree of alteration of the beachfront area where an SPS is proposed. SPRD also requires any reasonable project modifications or special measures that will reduce "long-term cost to the public." These usually take the form of design modifications that reduce BZL encroachment or visual impacts. Again, other than information in SPRD permit findings, no records of these project modifications are kept.

It is fair to say that there is no established process to determine the cumulative impacts and long-term risks of shoreline armoring along the Oregon coast. It follows that cumulative impacts rarely if ever play a significant role in decision-making on individual SPS permits, and virtually no role in the long-range planning for oceanfront development.

b) Cumulative length of SPSs by year, type, and landform. One measure of cumulative impact is the physical length of SPSs installed within a given area, in this case the Siletz littoral cell. To get some insight into patterns of SPS installation, the length of SPSs is examined by year or time period, by type of structure, and by type of landform protected.

Length of SPSs by year. Beachfront property within the Siletz littoral cell is gradually being hardened with protective revetments and seawalls. As of mid-1991, 6.8 mi of the 14-mile beachfront (49%) had been protected (figure 4-23). Approximately 2.1 mi (31%) of this hardened shoreline was protected prior to establishment of the SPS permit program under the 1967 Beach Law. Another 0.43 mi (6%) was in place by 1970 and an additional 2.34 mi (34%) by 1980. By 1990, another 1.83 mi (27%) of shore protection had been constructed, with the remaining 0.11 mi (2%) of SPSs built in the first half of 1991.

One obvious pattern in the data is the clear relationship between SPS construction activity and the three El Niños that have occurred since the early 1970s (figure 4-23). This relationship is explained by the fact that these global climatic events cause short-term elevated sea levels, a southward shift in the predominant winter

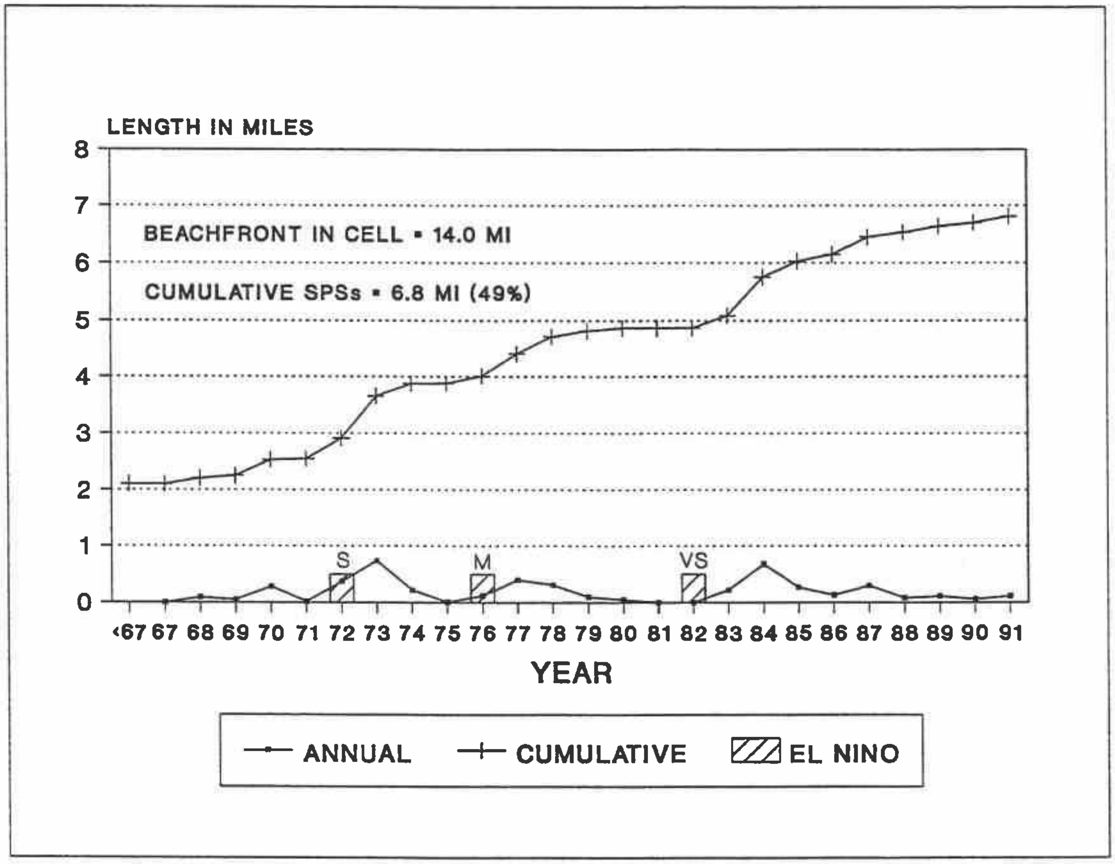


Figure 4-23. Cumulative and year-to-year length of shore protection structures constructed in the Siletz littoral cell (<1967-1991) and the relationship to the moderate (M), strong (S), and very strong (VS) El Niños events that occurred during the period.

storm track, and, at least during the 1982-83 event, increased storm intensity (Komar 1986; Jackson and Rosenfeld 1987; Peterson et al. 1990). During the 1982-83 El Niño, for example, winter sea levels were about 1 ft (30 cm) higher than normal and there were three major storms from the south with breaker wave heights at or approaching 23 ft (7 m). Not surprisingly, significant erosion occurred along much of the coast that winter and the Siletz littoral cell was no exception. Because strong or very strong El Niños occur on average every 8.5 years (Quinn et al. 1987), these periodic pulses of severe erosion can be expected to continue. In response, it can also be expected that more and more SPSs will be built along developed and developing coastlines.

Projected Length of SPSs. Given that erosion is expected to continue, what will the demand for SPSs be in the future? One method for projecting SPS demand is to compare present building setbacks for each unprotected, built-upon parcel with the estimated future erosion that is expected to occur. When the projected erosion equals or exceeds the 1991 building setback (i.e., erosion rate × years ≥ actual building setback), a future SPS is "installed" and the parcel length added to the total shoreline length protected.

Estimated erosion rates used for this analysis (table 4-15) are based on the long-term erosion rates determined by Smith (1978) and on the subsequent map interpretation of her data for the Lincoln County hazard inventory (RNKR Associates 1978). Komar (pers. comm. 1992) has suggested

Table 4-15. Erosion rate classes and actual rates used for erosion calculations, Siletz littoral cell.

	Erosion Rate Class		
	Slight	Moderate	Severe
Range (ft/yr) Smith & RNKR[1]	<0.23	0.23-0.94	>0.94
Erosion Rate[2] (ft/yr)	0.08	0.23	0.94

[1]The range of erosion rates in this row are from the Lincoln County hazards inventory (Smith 1978; RNKR Associates 1978).
[2]Erosion rates used for all database queries involving erosion calculations.

that erosion rate data from Smith (1978) is actually significantly higher than observed rates. This was one reason for using the relatively conservative rates in table 4-15.

Figure 4-24 illustrates the application of this SPS demand projection method. Based on this scenario, 1.2 mi of additional SPSs (0.02 mi/yr) would be constructed from 1990 to 2040, a dramatic slowing in the rate of SPS construction over the next 50 years. Is this a realistic projection compared to historic rates? Between 1967-1990, 4.6 mi of SPSs were built—a rate of 0.18 mi/yr (figure 4-23). Projection of the 1967-1990 trend line, assuming all vacant lots were built out, suggests that the entire 7.2 miles of remaining unprotected oceanfront land in the Siletz cell will be hardened with SPSs in only 40 years

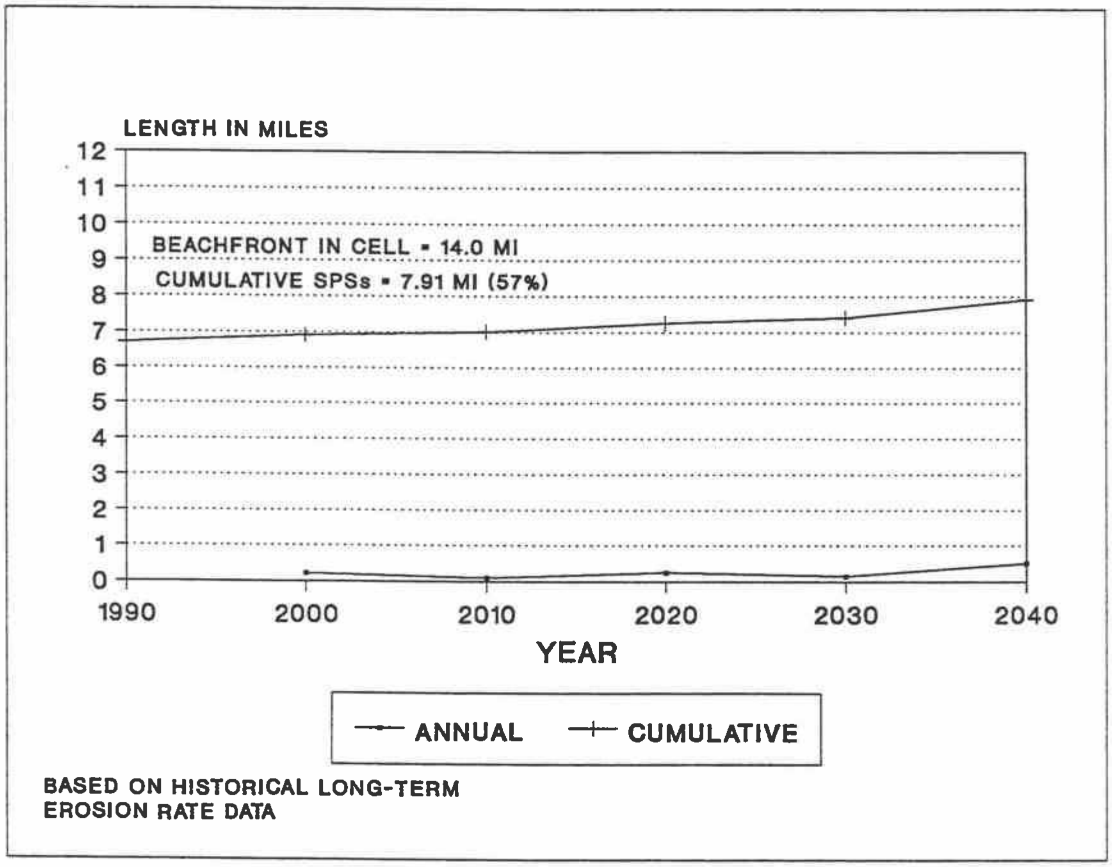


Figure 4-24. Projected cumulative length of shore protection structures in the Siletz littoral cell, 1990-2040.

(2031). Comparing this historic rate to the projected rate method illustrated in figure 4-24 suggests that the latter is actually an order of magnitude too conservative. There are at least three possible explanations for this. First, SPS construction and long-term erosion rates simply may not be strongly related. Second, the erosion-rate method of projecting SPS construction only considered unprotected lots with houses or other buildings already on them—it is likely that many of the 137 vacant, unprotected parcels in the cell will be built upon in the future and that many of these will need SPSs. Finally, it is likely that property owners, when struck by an episode of erosion, apply for and receive permits to install SPSs well before their house is in imminent peril of destruction. This is consistent with the results presented earlier on "need and justification" for SPSs, which suggest that even small amounts of cliff-top or dune erosion will trigger a SPS permit request.

Number and length of SPSs by structure type. The number and length of shore protection structures by type of structure installed over time are enumerated in table 4-16. Riprap revetments are the most common type of SPS used in the Siletz littoral cell, comprising 76% of the total SPSs installed (358) and 78% by length (5.31 mi). They have consistently been the shore protection choice, with an average of 4 to 13 SPSs installed each year, depending on the time period. Concrete reinforced seawalls or retaining walls make up the next largest category of SPSs, comprising 13% of the total SPSs installed (63) and 13% by length (0.87 mi). However, 73% (45) of these structures were installed prior to establishment of the state regulatory

Table 4-16. Number and length of SPSs constructed by time period and type of structure, Siletz littoral cell.

	TIME PERIOD					
TYPE OF SPS	<1967	1967-70	1971-80	1981-90	>1990	TOTAL
Riprap Revetment						
Number SPSs	76	17	132	126	7	358
Length (mi)	1.06	0.32	2.12	1.71	0.10	5.31
Concrete Reinforced						
Number SPSs	46	3	8	6	0	63
Length (mi)	0.56	0.10	0.12	0.09	0	0.87
Concrete Block						
Number SPSs	28	0	2	2	1	33
Length (mi)	0.39	0	0.07	0.02	0.01	0.49
Wood Bulkhead						
Number SPSs	4	0	1	1	0	6
Length (mi)	0.03	0	0.02	0.01	0	0.06
Other SPSs						
Number SPSs	9	0	3	1	0	13
Length (mi)	0.07	0	<0.01	<0.01	0	0.08
Total						
Number SPSs	163	20	146	136	8	473
Length (mi)	2.10	0.43	2.34	1.83	0.11	6.81

program in 1967; in the last 10 years, only six of these structures have been built. This is in part because SPRD and DSL have discouraged their use in favor of riprap revetments, a structure they perceive as having less adverse scenic and recreational impacts. Concrete block seawalls make up the next largest category of SPSs, comprising 7% of the total SPSs installed (33) and 7% by length (0.49 mi). Again, these structures were more commonly used before 1967 (85% of total). The remaining 19 SPSs (4%) include wood bulkheads, gunnite structures, and upper bluff fences designed to reduce the weathering effects of wind and rain.

Number and length of SPSs by landform type protected. The number and length of shore protection structures by landform type protected are enumerated in table 4-17. Sea cliffs were the predominant landform type being protected before 1967, comprising 98% of the SPSs installed and 90% of the shoreline length protected. These were shorelines that had been developed in the early and middle part of the century, mostly in the north part of the cell—Lincoln City and Roads End. The pattern changed in the 1970s, when 77% of the shoreline length protected were dune landform areas. This was principally at Siletz Spit, which at the time was being developed with expensive beachfront homes. The spit was also affected by two particularly severe episodes of erosion associated with the 1972-73 and 1976-77 El Niños; some property was lost, but most lots were rebuilt and subsequently protected with riprap revetments; in fact, Lincoln County would not issue building permits for new construction unless lots had SPSs (Lincoln County Board of

Table 4-17. Number and length of SPSs constructed by time period and landform type protected, Siletz littoral cell.

LANDFORM TYPE PROTECTED	TIME PERIOD <1967	1967-70	1971-80	1981-90	>1990	TOTAL
Cliff						
Number SPSs	159	10	43	129	8	349
Length (mi)	1.88	0.22	0.54	1.70	0.11	4.45
Dune						
Number SPSs	2	10	103	7	0	122
Length (mi)	0.10	0.20	1.80	0.13	0	2.24
Other Landform						
Number SPSs	2	0	0	0	0	2
Length (mi)	0.12	0	0	0	0	0.12
Total						
Number SPSs	163	20	146	136	8	473
Length (mi)	2.10	0.43	2.34	1.83	0.11	6.81

Commissioners 1978). After 1980, sea cliff areas once again became the focus of shore protection, comprising 93% of the shoreline length protected. Much of this shore protection was installed along the uplifted, loosely-consolidated sandstone cliffs in the south part of the littoral cell—Gleneden Beach and Coronado Shores in particular. During the 1980s, the rate of riprap revetment construction along this stretch of beach was double that of other unprotected shorelines in the cell; 0.8 mi of riprap SPSs (43% of total in cell) were installed along this 1.9 mi stretch of beach that represented only 21% of the then-unprotected shoreline.

In their unprotected condition, these eroding cliffs serve as a natural sand replenishment system, replacing beach sand that is lost to offshore, inland, and bay sinks. Just how much of this potential sand supply has been locked up by SPSs is discussed following the next section.

c) SPS encroachment on public recreation beach. Measures of cumulative impacts on public access and beach recreation include the frequency and the degree of encroachment by SPSs on the "dry sand beach" area (mean high water to the BZL). This is the area where the legislature established a permanent public recreation easement under the 1967 Beach Law. In doing so, they stated that their purpose was to "forever preserve and maintain the sovereignty of the state ... over the ocean shore ... so that the public may have free and uninterrupted use thereof" (ORS 390.610 [1]). Specific concerns related to SPS encroachment west of the BZL include the interruption of lateral access along the beach and actual physical consumption of recreational space by the structures themselves.

The beach improvement standards state that SPSs should "avoid blocking off or obstructing important public access routes within the ocean shore area" (OAR 736-20-020 [2]). This is interpreted to mean that lateral access should not be interrupted by construction of SPSs that extend too far out on the beach, because such construction could endanger the public by requiring people to move out into the water to get around the obstructions.

Of the 310 SPSs that have been built since the permit program was established in 1967, 157 (51%) extend west of the beach zone line (BZL) onto the public beach (table 4-18). Most of these SPSs—114 or 73%—extend less than 20 ft out onto the beach and probably do not create an access hazard. The remaining 43 SPSs (27%) extend more than 20 ft seaward of the BZL and 10 (6%) extend more than 30 ft. Furthermore, those that do extend further seaward account for a disproportionate share (52%) of the total area of SPS encroachment (5.17 ac).

Compared to the total "dry sand beach" area available to the public for recreation in the Siletz cell, SPSs physically occupy relatively little space. Based on an approximate summer dry sand beach width of 200 ft (Peterson et al. 1991) and a hypothetical winter dry sand beach width of 50 ft, SPS encroachment occupies only 1.5% of the summer beach and 6.5% of the winter beach (figure 4-25). However, during the higher spring tides that occur twice-monthly, the percent of area occupied would be significantly higher. This is of particular concern during winter months when the

Table 4-18. Shore protection structures built west of the beach zone line (BZL), Siletz littoral cell, 1967-91.

	DISTANCE SPSs EXTEND WEST OF THE BZL (ft)					
	0-10	11-20	21-30	31-40	>40	TOTAL
Numbers of SPSs	61	53	33	9	1	157
SPS-occupied beach west of BZL (acres)	0.76	1.75	1.30	0.90	0.47	5.17

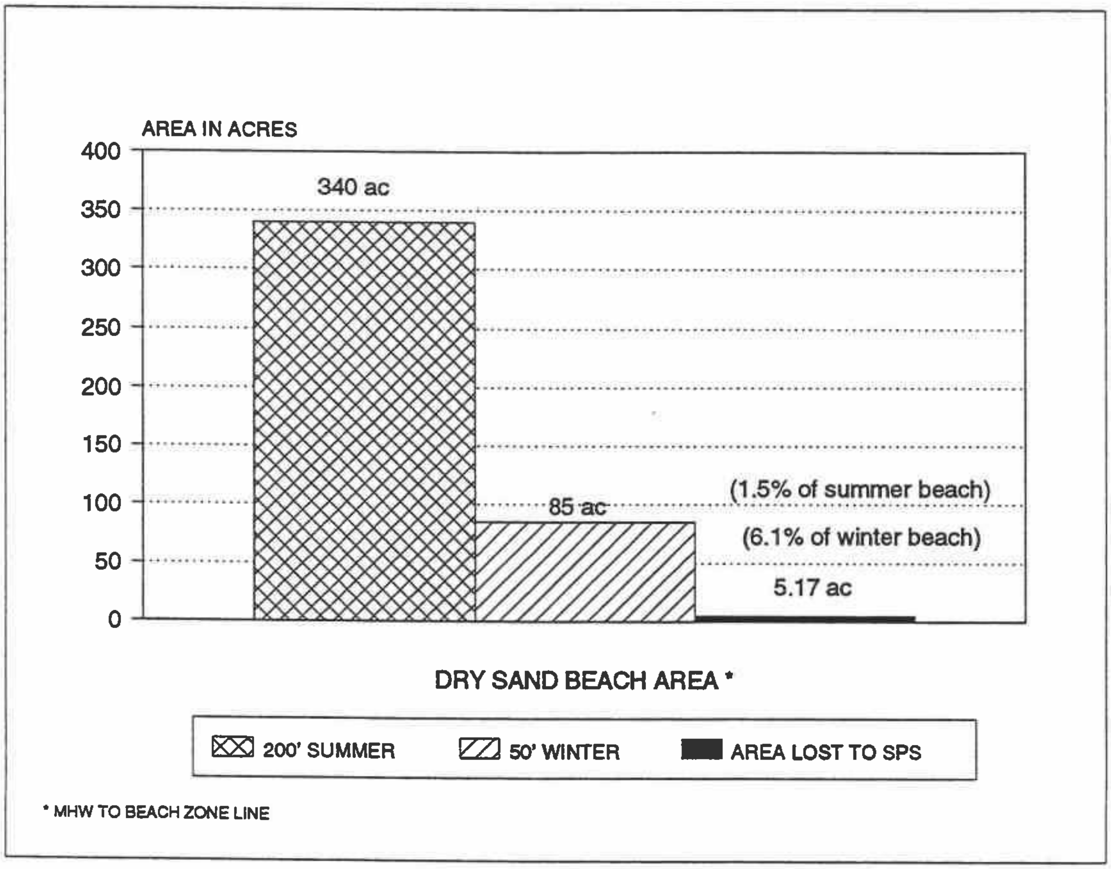


Figure 4-25. Cumulative loss of "dry sand beach" area in the Siletz cell due to encroachment of shore protection structures west of the beach zone line as compared to the hypothetical summer and winter beach.

beach is narrower, the beach profile lowered, and wave runup greater. During these periods, lateral and escape access from high waves is already a serious issue along some beaches. Given the prospect of long-term relative sea level rise and narrowing beaches, the impact of SPS encroachment (past and future) is likely to increase.

d) Cumulative loss of sand supply due to SPSs. Sand supply loss due to SPS installation is potentially one of the most important cumulative impact issues addressed in this study. Its importance rests on two assumptions: first, that sea cliff erosion provides an important source of new sand to the Siletz cell littoral sediment budget; and second, that installation of SPSs halts sea cliff erosion, effectively cutting off the supply of sand that would normally be provided by the unprotected cliffs (see figure 4-26). The first assumption implies some level of understanding of the sediment budget for the Siletz cell and the role that cliff erosion plays in the that budget; this was addressed generally in Chapter 2 is discussed in more detail for the Siletz cell in the following sections. The second assumption is intuitively reasonable.

Lost sand supply from cliffs due to SPSs. Given the assumptions, what is the estimated contribution of sand from sea cliffs to the Siletz littoral cell sand budget? And how much of that potentially-available supply has been interrupted by SPSs installed to protect upland property? To get a more localized understanding of answers to these questions, the Siletz cell was subdivided at the entrance to Siletz Bay into north and south subcells. In order to segregate the data by political jurisdiction (Lincoln County versus Lincoln City), the north subcell was further subdivided where the northern limit of Lincoln City meets the unincorporated community of Roads End. Results of the analyses are presented in table 4-19 and discussed below.

Four factors are used to calculate estimates of cliff-supplied sand to the Siletz cell sand budget. These include length of shoreline that is sea cliffs, cliff heights above the beach-cliff junction, erosion rates, and the fraction of cliff-supplied sediment that is beach sand material. Each of these are discussed below, based on the data in table 4-19.

Sea cliffs make up 9.9 mi or 56% of the 17.9-mile Siletz cell shoreline and fully 71% of the shore fronted by beaches. Of the 9.9 mi of sea cliffs, 6.5 mi (66%) are in the north subcell and 3.4 (34%) in the south. Based on this statistic alone, sea cliffs in the Lincoln City-Roads End area likely play a more significant role in overall sand supply potential.

Over the entire cell, cliff heights average 42 ft above the beach break—the interface between the relatively low gradient beach and the steeper cliff face. The beach break is assumed to be the 16 ft elevation MSL and approximately coincident with the BZL. In the north subcell, sea cliffs average 51 ft (59 ft in the Lincoln City section), whereas to the south, sea cliffs average only 22 ft. Again, the relative importance of the Lincoln City-Roads End shoreline with respect to potential cliff-supplied beach sand is apparent.

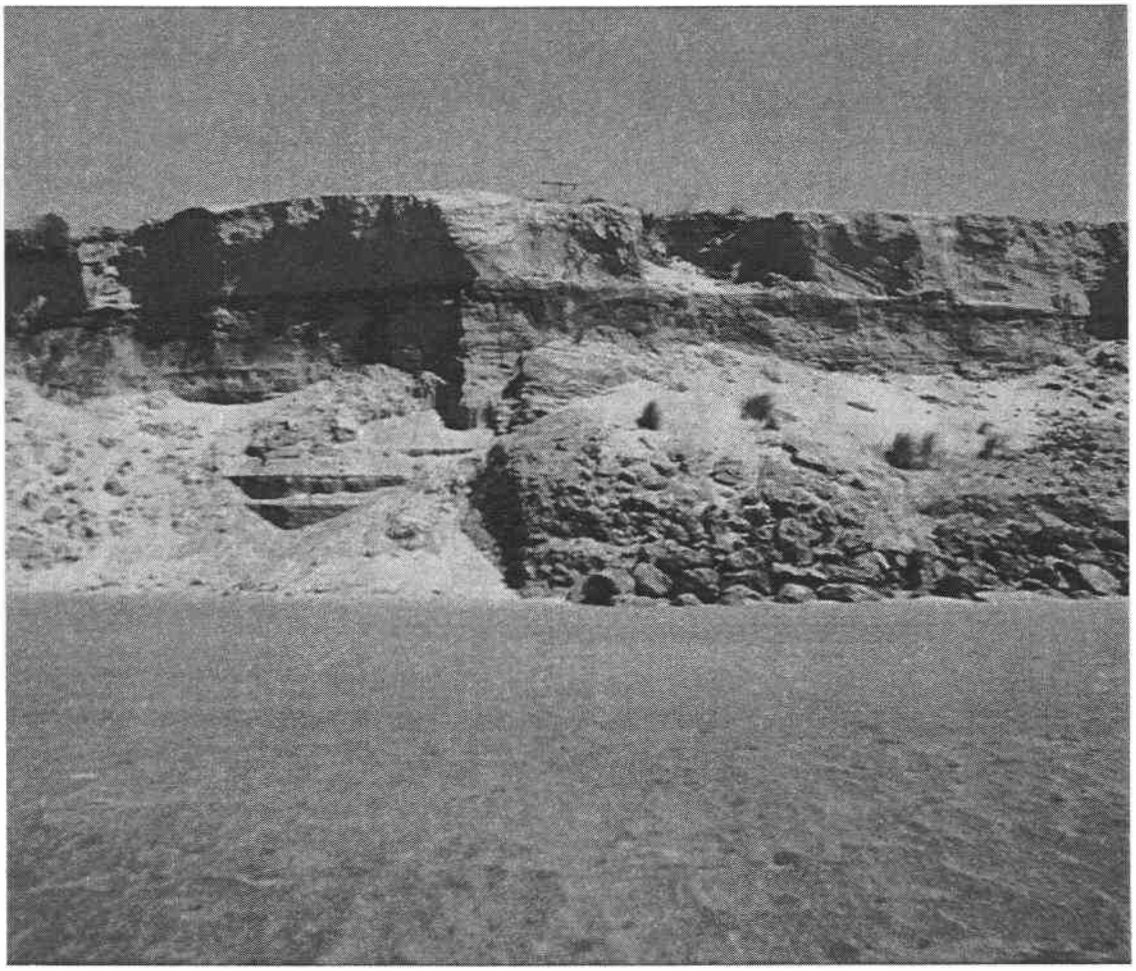


Figure 4-26. Sand can be supplied to the beach by the eroding cliff on the left; sand supply has been cut off by construction of a riprap revetment at the base of the cliff on the right.

Table 4-19. Sea cliff erosion factors and characteristics in the Siletz cell.

	North Subcell			South Subcell	Full Cell
	Roads End North (Co)	Lincoln City	North Subtotal	Siletz Spit & South (Co)	
Total Shoreline (mi)	3.98	5.34	9.32	8.47	17.79
Cliff Shoreline (mi)	1.55	4.95	6.50	3.38	9.89
Avg Cliff Height (ft)	30.14	58.95	51.10	22.40	41.54
Slt[1] Ero Cliff (mi)	0.23	0.94	1.17	0.80	1.97
Mod[1] Ero Cliff (mi)	0.83	2.77	3.60	1.59	5.18
Sev[1] Ero cliff (mi)	0.49	1.24	1.73	0.99	2.72
Mean Ero Rate[2] (ft/yr)	-	-	0.39	0.40	0.40
Total Potential Beach Sand Supply (yd^3/yr)[3]	2,770	11,930	14,700	3,340	18,040
Cliff w/SPSs (mi)	0.73	2.18	2.91	1.54	4.45
Beach Sand Supply Blocked w/SPSs (yd^3/yr)	1,110	4,020	5,130	1,910	7,040
Cliff w/o SPSs (mi)	0.83	2.75	3.58	1.80	5.38
Beach Sand Supply Still Available (yd^3/yr)	1,660	7,910	9,570	1,430	11,000

[1]Erosion classes: Slt = slight, Mod = moderate, and Sev = severe (Smith 1978; RNKR Associates 1978).
[2]Erosion rates used for each erosion class (Slt, Mod, Sev) are in table 4-15.
[3]Based on estimate that 68% of cliff-supplied sediments are sand that remains on beach (Shih 1992).

Erosion rate is another important factor in the sand supply equation. Over the entire cell, 52% of the sea cliff shorelines are in the *moderate* erosion class (0.23 ft/yr from table 4-15), 28% are in the *severe* erosion class (0.94 ft/yr), and 20% are in the *slight* erosion class (0.02 ft/yr). For the north and south subcells taken independently, these percentages vary ± 5%. Mean erosion rates were calculated by integrating data on oceanfront parcel length and erosion rate (from table 4-15) for the entire cell (table 4-19). The mean erosion rates for the north and south subcells are virtually the same—0.39 ft/yr for the north subcell and 0.40 ft/yr for the south. The rate was 0.40 ft/yr (12 cm/yr) for the cell as a whole. These rates are high compared to the average rate of 0.164 ft/yr (5 cm/yr) estimated by Komar and Shih (1991), but low or comparable for parts of the cell. For example, in the Gleneden Beach area, 15% of the 1.8 mi shoreline had a *slight* erosion class and rate of 0.08 ft/yr (2.4 cm/yr) and 70% of the shoreline had a *moderate* erosion class and rate of 0.23 ft/yr (7.0 cm/yr). While these rates are more comparable to Komar and Shih (1991), they are lower than actual erosion rates at Gleneden Beach over the last 15 years, during which several severe episodes of erosion effected the area. Actual erosion rates will vary over the time period selected for analysis; whatever the case, the rates used for this analysis do serve as a useful relative measure for examining the impact of SPSs on sand supply.

The fraction of sand from sea cliff erosion that is likely to remain on the beach is the final factor in the sand supply equation. Shih (1992, 78) found that within the Siletz cell, based on an average of seven sites, 68% of the sand from sea cliffs stays on the beach.

Using these four factors—oceanfront length, cliff height, erosion rates, and beach sand fraction—the sand supplied annually on a parcel-by-parcel basis for each shoreline segment of the littoral cell was calculated as follows:

$$SS = [\sum_{i=1}^{n} (l_1 \times h_1 \times e_c) + (l_2 \times h_2 \times e_c) + \ldots + (l_n \times h_n \times e_c)] \times S_b,$$

where

SS = beach sand supply from sea cliffs
l = length of oceanfront parcel
h = cliff height of parcel above beach break
e_c = erosion rate for parcel erosion class (table 4-15)
1, 2, ..., n = 750 parcels, and
S_b = 0.68 (fraction of cliff-supplied beach sand)

Potential beach sand supply from erosion of sea cliffs in the entire Siletz cell is 18,040 yd^3/yr, assuming that all cliffs are free to erode at the rates in table 4-15 and that 68% of the eroded material, on average, will remain on the beach. Of this total potential sand supply, 82% (14,700 yd^3/yr) is attributable to the sea cliffs in the north subcell and 18% (3,340 yd^3/yr) from the south, reflecting both the greater length and heights of sea cliff shorelines in the north (table 4-19). Lincoln City sea cliffs alone, comprising 50% of all cliffs by length, account for 66% of the potential sand supply.

The sea cliffs in the Siletz cell are the most heavily fortified along the Oregon coast, with 4.45 mi of SPSs constraining 45% of all sea cliffs in the cell (table 4-19). These SPSs block or lock up 7,040 yd^3/yr (39%) of the potential sand supply available from sea cliffs. From an absolute standpoint, the north subcell has more sand locked up by SPSs than does the south—5,130 versus 1,910 yd^3/yr. However, the south subcell has a greater proportion of its potential sand locked up—58% versus 35%. This in part may account for the apparent increased erosion vulnerability of beaches and sea cliffs in the south subcell during the last decade. Lincoln City accounts for 49% of the SPSs by length along the shore and 57% of the total sand supply locked up by SPSs.

Another way to analyze loss of sand supply due to SPS installation is by rate over time (figure 4-27). By 1991, the 349 SPSs installed along 4.45 mi of cliff shorelines had blocked 39% of the available sand supply. The largest proportion of sand in the cell had been locked up by SPSs installed before 1967 (2,970 yd^3/yr or 42%), mostly in the north subcell. Of the succeeding five-year intervals, the 1982-86 period accounted for the greatest loss in sand supply (2,020 yd^3/yr or 29%). Comparing 10-year intervals, the amount of sand supply loss between 1982-91 was more than 3.5 times the 1972-81 loss, i.e., the rate of sand supply loss is increasing. The mean annual rate of sand supply loss over the last 25 years (1967-91) is 162 yd^3/yr. Based on projections of future demand for SPSs along cliff shorelines, using the technique outlined on p. 185, an additional 17% of the available sand supply will be locked

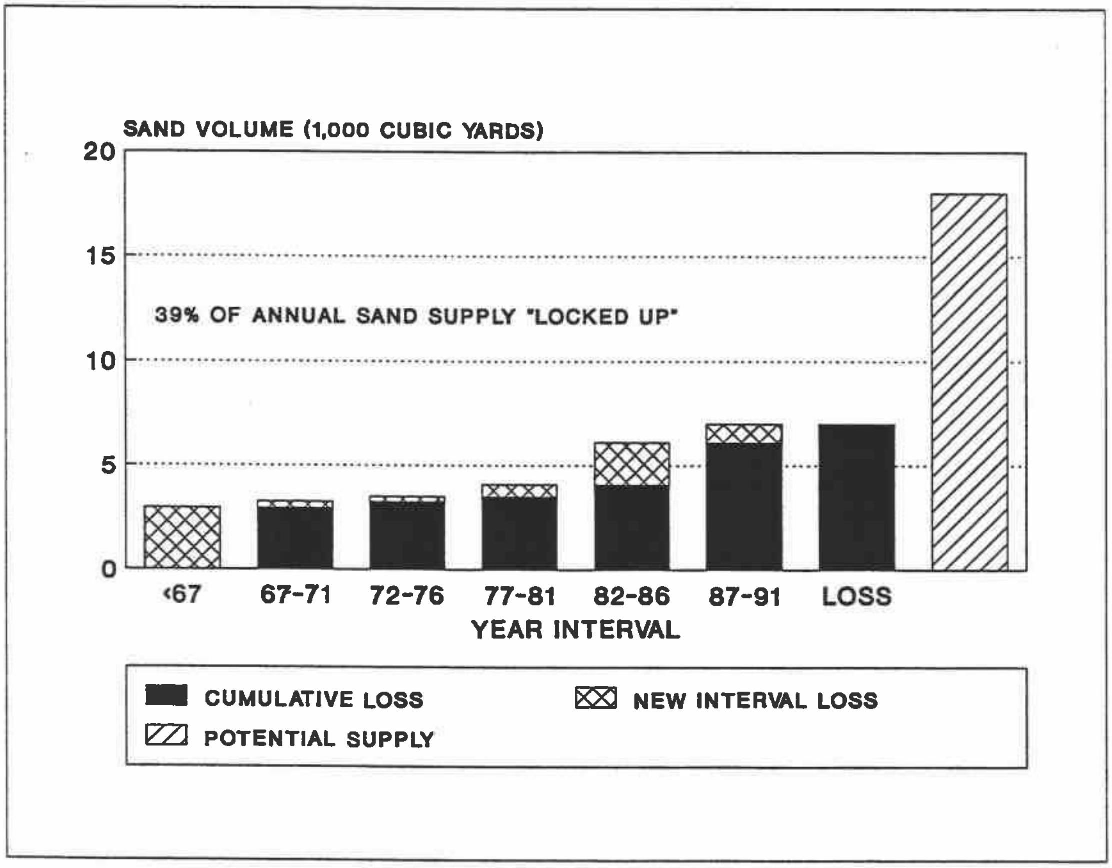


Figure 4-27. Cumulative loss of sand supply due to construction of shore protection structures in the Siletz littoral cell, <1967-1991.

up over the next 50 years by 89 new SPSs (figure 4-28), at a rate of 61 yd^3/yr. Comparing this 50-year projected rate with the historic 25-year rate suggests that the projections are about 2.5 times more conservative than historic rates. If the projected rate follows the 1967-91 trend line, an additional 8,100 yd^3/yr of sand supply will be locked up over the same 50 year period, or a cumulative loss of 84% of the total available supply. Again, an alternative and more plausible interpretation of the data in figure 4-28 is that SPS construction activity and long-term erosion rates are not strongly related and that most SPSs are installed well before erosion has reached and threatened upland buildings. The projected cumulative loss of sand supply and the erosion rate scenario on which it is based are also too conservative because they only consider lots built upon by 1991. It is likely that many of the 114 vacant, unprotected cliff parcels in the cell will be built upon in the future and that many of these will need SPSs.

Importance of cliff-supply to sand budget. Just how important is this actual and projected loss of cliff-supplied sand to the overall littoral cell sediment budget and thus the integrity of the beach? While this cell is probably the most intensively studied beach area along the Oregon coast, the sand budget is not well-understood, and data are sometimes conflicting. Nevertheless, in an attempt to get some measure of relative importance of various sources and sinks, a rough estimation of the sand budget has been made (table 4-20).

Probable sand sources include the Salmon River at the north end of the cell, the Siletz River in the central part

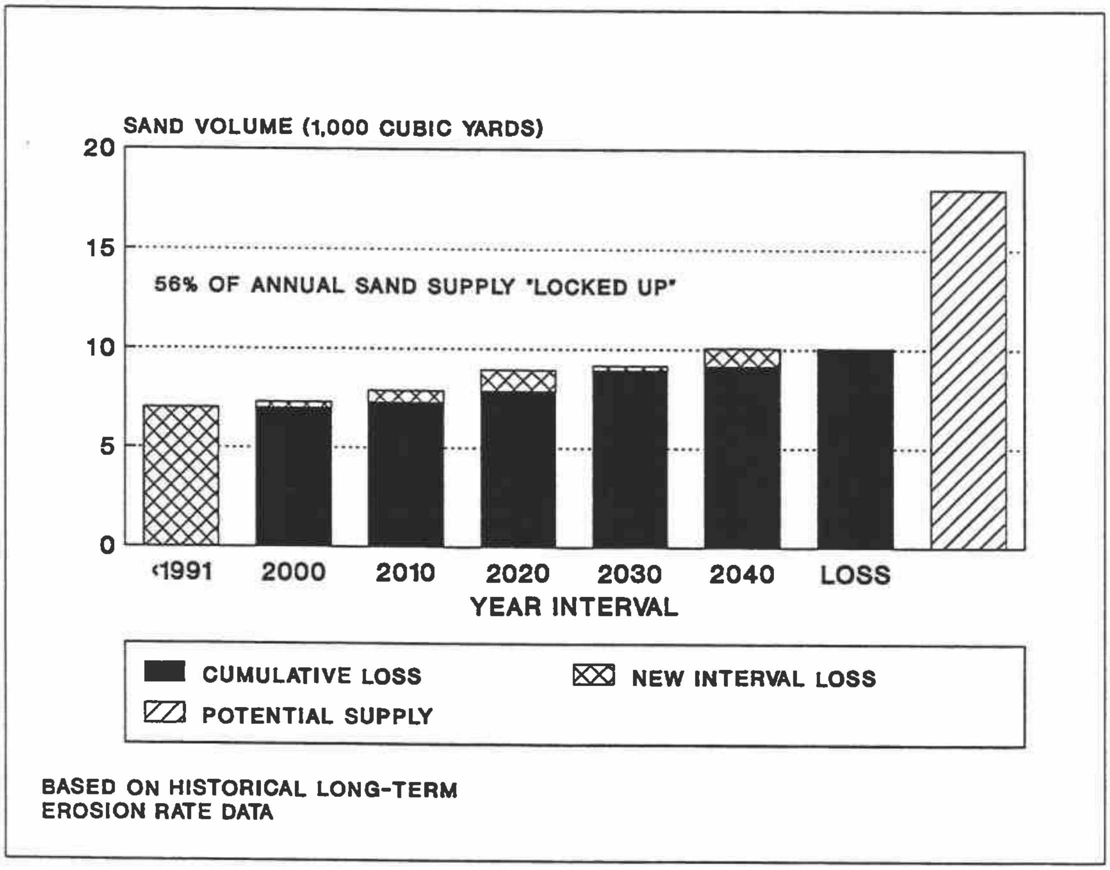


Figure 4-28. Projected cumulative loss of sand supply due to future shore protection structures in the Siletz littoral cell, 1991-2040.

Table 4-20. Probable sources and sinks, and estimated annual beach sand yield for the Siletz littoral cell budget.

Source/Sink	Source	Source Yield (yd^3/yr)	Sink	Sink Yield (yd^3/yr)	Net Yield (yd^3/yr)
Salmon River[1]	X	4,850	X	-990	3,860
Siletz River[1]	X	24,780	X	-9,630	15,150
Cliff Erosion[2]	X	11,000 [18,040]		na	11,000 [18,045]
Offshore/Bypass[3]	?	+ ?	?	- ?	- ?
Dunes[3]		na	X	- ?	- ?
Total		40,630 [47,670]		-10,620	30,010[3] [37,050]

[1]Calculated using data from OSWRB (1965), Karlin (1980), Peterson et al. (1984), and Peterson (per. comm. 1992).

[2]Calculated using Siletz cell database for presently-unprotected sea cliff lots (no SPSs); erosion rates from table 4-15; yields assume only 68% of cliff-supplied sediments are of sufficient size to remain on beaches (Shih 1992); values in brackets represent potential cliff-supplied sand if there were no erosion-blocking SPSs.

[3]Yields from possible offshore, headland bypass, and dune sinks are indeterminate; however, if sand budget in balance, these represent a net sink of about -36,000 yd^3/yr; if yield is smaller, sand volumes are decreasing; if yield is larger, sand volumes are increasing.

of the cell, and, as discussed above, sea cliff erosion. Probable sinks for beach sand include the offshore; dune building associated with beachgrass stabilization on the Salmon and Siletz spits and other minor dune systems in the cell; and tidal flood current-driven bottom transport into Siletz Bay and, to a much lesser extent, the Salmon River estuary. Whether the Siletz River system and estuary are a net source or sink of sand is still an open question. Komar (1983) suggests that it is likely a sink overall, whereas Peterson et al. (1984) and Peterson et al. (1991) suggest that it is bypassing sand to the littoral zone, based on the relatively low hydrographic factor and the predominance of river sand over beach sand in the estuary. Peterson (pers. comm. 1992) also suspects that there might be a limited amount of sand bypassing around Cascade Head to the north into the sand-rich, but sand source-poor Neskowin cell. Another temporary but important sand loss factor in this cell was the approximately 12,000 yd^3/yr of sand mining that took place from 1965-1971 at the mouth of Schoolhouse Creek in Gleneden Beach (Komar and Rea 1975). This sand mining halted when it was identified as a contributing factor to severe erosion along Siletz Spit in late 1972. Mining as a sand sink was not included in table 4-20.

Salmon and Siletz River sand supply estimates in table 4-20 were calculated from data on basin size (SWRB 1965); suspended sediment yield (Karlin 1980); an estimate of bedload as a percent of total sediment discharge—20% was selected, based on a range of 10-30 % suggested by Karlin (1980) and Tillamook Bay Task Force (1978); an average beach sand:river sand ratio of 1:4.9 for sediments in the Salmon River estuary and 1:2.8 for Siletz Bay (Peterson et al. 1984); and appropriate conversion factors.

Assuming the sand budget is approximately balanced, as suggested by Shih (1992), sea cliffs presently provide approximately 37% of the available sand supply annually (table 4-20). Prior to installation of SPSs (assuming the erosion rates from table 4-15), sea cliffs in the cell had the potential of supplying 49% of the littoral cell sand supply. Installation of SPSs has thus reduced the overall supply of new sand to the beach from 37,050 to 30,010 yd^3/yr, a decrease of 19%. If the Siletz River and estuary are neutral in the supply versus sink equation (Komar 1983), sea cliff erosion is relatively much more important on the supply side. Shih (1992), however, suggests caution in assigning too much importance to the role of sea cliff erosion in the overall sand budget, pointing out that the seasonal onshore-offshore exchange of beach sands in a single 150 m longshore beach section at Gleneden Beach was comparable to the estimated annual cliff supply of sand for the entire cell. Proceeding with this caveat in mind, what are some of the possible implications of cumulative loss of cliff-supplied sand to the beach system?

Implications of lost sand supply from cliffs. The gradual, cumulative loss of cliff-supplied beach sand to the Siletz cell over the long term is of concern because it likely decreases the erosion-buffering capacity of the beach. The beach and adjacent shorelands thus become more vulnerable to episodes of erosion caused by severe winter storms; raised sea levels and more frequent and intense storms during periodic El Niños (see figure 4-23); and long-term relative sea level rise.

The clear correlation between the rate of SPS construction and periodic El Niños was discussed and illustrated earlier (figure 4-23). The relatively predictable El Niños and the erosion they indirectly cause will likely increase the rate of SPS construction over time, locking up still more of the cliff-supplied sand.

The implications of long-term relative sea level rise on the central coast are more problematic. Based on geodetic leveling (Weldon 1991; Mitchell et al. 1991) and analysis of tide gauge records (Shih 1992), relative sea level rise (RSLR) along the central Oregon coast is about 1.3 mm/yr. Assuming global sea level rise is 2.0 mm/yr, tectonic uplift due to accumulation of interseismic strain along the Cascadia Subduction Zone (CSZ) is about 0.7 mm/yr.

Assuming accelerated rates of global sea level rise (6 mm/yr eustatic SLR between 1990 and 2050, and 12 mm/yr between 2050 and 2100) based on the National Research Council's mid-range scenario of a 1 m SLR by 2100, tectonic uplift continuing at its present rate for the next 110 years, and that there is no CSZ earthquake, a central Oregon coast RSLR scenario can be constructed. If these assumptions hold, RSLR along the central Oregon coast will be 1.0 ft (0.3 m) by year 2050 and 2.9 ft (0.9 m) by year 2100. RSLR along the north and south coasts, where interseismic strain is building at a more rapid rate than the central coast, will be less.

Unless there is an available supply of sand, the most likely impact of this RSLR along the central coast will be a gradual narrowing of beaches. This narrowing will likely be exacerbated by ever more frequent episodes of severe erosion and sea cliff retreat because the buffering capacity of the beach will be reduced. This will likely result in increased SPS construction and, as a result, increased loss of sand supply. Applying the Bruun rule (Bruun 1962, 1983), which predicts how the beach and offshore profile might respond to increased sea level, the shoreline will retreat approximately 100 units horizontally for every unit of SLR, with the sand eroded from the beach replenishing the nearshore zone to reestablish the equilibrium profile. Shih (1992) estimated that given the present rate of RSLR on the central coast (1.3 mm/yr), sand needed to reestablish the offshore equilibrium profile is about 40,000 yd^3/yr, not much greater than the volume of sand needed to balance the estimated sand budget in table 4-20.

Ocean Shore Protection Policy in Oregon:
Are Conditions for Effective Implementation Met?

The evaluation framework for this study was derived in part from a set of "conditions for effective implementation" postulated by Sabatier and Mazmanian (1981; 1983) and discussed in Chapters 2 and 3. In a nutshell, Sabatier and Mazmanian state that a statute or other policy is more likely to be well-implemented if it meets six conditions: (1) clear goals and objectives; (2) an underlying causal theory about the kinds of actions needed to affect implementation, and sufficient implementation authority; (3) a structured implementation process; (4) committed and skilled implementing officials; (5) continued support from key political figures and constituency groups; and (6) ongoing relevance in the changing society and economy.

In this study, the first two conditions have received the bulk of the attention, though implementation processes and the roles of implementors have also been discussed, often at length. Another important part of this assessment has been the evaluation of policy with respect to new developments in science and engineering related to coastal processes and the impacts of human intervention in these processes.

A question that merits examination is how well the Sabatier and Mazmanian conditions for effective implementation have been met. To conclude this chapter, some general comments are offered regarding each of the conditions, focusing on the set of statutes and administrative laws examined in detail in preceding sections.

Clear Goals and Objectives

The first condition is whether or not there is a clear and consistent set of policy goals and objectives in the shore protection "management regime," or, if not, at least a means for resolving conflicts among them.

The three overarching goals derived from the statutes and rules that make up the shore protection management regime are clear and unambiguous (see p. 72-75). These are

(1) to protect the beach for public recreational use and enjoyment; (2) to conserve, protect, and where appropriate, develop or restore oceanfront lands; and (3) to protect human life and property from natural or human-caused hazards.

A superficial examination of these goals and the policies on which they are based might lead to the conclusion that they are both clear and consistent, with few conflicts between them. However, when specific objectives from the detailed statutory and rule language are isolated and their measures of achievement examined, conflicts are more apparent. For example, protecting scenic and recreational values of the beach implies visual resource management of the beach area, yet the visual impacts of upland development are not an important part of the local development process. The link is simply not made. In part, this is because the state agencies charged with beach management have little say in the oceanfront land development process. However, the state has not articulated their interests by developing beach or scenic resource management plans or policies.

The hazard mitigation goal, as implemented, is also in conflict with both the beach recreation and the oceanfront development goals. The visual, scenic, and recreational impacts of SPSs on the beach, even adjacent to state parks, are generally given little or no weight compared to private interests in protecting upland property, even when buildings or other improvements are not threatened. There is no structured process for considering alternatives that would have less impact on scenic and recreational values of the beach. Long-term impacts of upland development and shore protection decisions are given little consideration, and suggested policy improvements to address them have been largely ignored (e.g., see SSWCD 1978).

These conflicts and similar conflicts between the recreation, development, and hazard mitigation goals result from a lack of recognition of their many linkages. Given the overall coastal management strategy Oregon has adopted——establishing networked "management regimes" (e.g., shore protection) that link together a variety of separate state and local authorities——a better means of coordinating decisions and resolving conflicts among competing goals is essential. There has been progress, but a detailed examination of shore protection decisions suggests that much better coordination is needed to achieve beachfront management goals. The "clear and consistent goals and objectives" criterion is thus only partially met. While the goals are clear, there are inherent inconsistencies and few means for resolving the conflicts that result.

Underlying Causal Theory and Implementation Authority

Each of the three goals above has its own underlying causal theory. The inadequacy of these theories, from technical, political, and comparative perspectives, is the source of many of the conflicts inherent in the shore protection management regime.

The underlying causal theory about the kinds of actions that will protect the beach for public recreational use and enjoyment is simply to regulate uses that would encroach on the beach. This would seem to cover the kinds of actions and provide the authority needed to achieve this goal, but in practice, gaps in jurisdiction and other shortcomings have resulted in gradual degradation of the beach resource. First, the underlying causal theory did not anticipate that upland development practices would drive the demand for hard SPSs as much or more than actual erosion or other hazards. As a result, beachfront SPS permitting decisions have focused primarily on keeping structures east of the BZL. While these decisions may be consistent with the intent of the law, they do not go far enough because they do not address upland development practices and they discount beach-related impacts of SPSs. Long-term loss of beach sand supply, narrowing of recreational beaches as sea level rises, and increased erosion and property loss are all threats that are increased by the proliferation of hard SPSs. Our increased understanding of the coastal processes and the impacts of human intervention in those processes has thus undermined the causal theory for the beach recreation goal. This fact argues for increased regulatory jurisdiction and consideration of these effects in decision-making. It also argues and greater involvement of state beach and coastal managers in land use and administrative decisions.

The oceanfront development goal anticipates that land use planning and siting decisions that are consistent with statewide planning guidelines will direct development away from hazardous areas and promote land use management and non-structural approaches to shore protection. In practice, this causal theory often breaks down, especially in areas already largely committed to development. Strong market demand drives development along the oceanfront. With the promise of tax revenues generated by high-value land and improvements, local officials are usually supportive of such development. The development siting process is much more sensitive to private property and economic interests than to relatively difficult-to-quantify public interests in beach recreation or the scenic, visual, and aesthetic character of the shore. Even more obscure is the need to protect sand sources for the beaches of the future.

The causal theory underlying the hazard mitigation goal is simple: avoid the hazard or use the appropriate safeguard to reduce or eliminate the hazard. This causal theory is sound as far as it goes. However, the mechanisms to implement the implied avoidance strategy are few and weak. Whatever the case, avoidance of hazards (e.g., building setbacks) often conflicts with short-term private and local public financial gains. As a consequence, avoidance and other non-structural techniques for hazard mitigation are used less often than hard shore protection, at least in the Siletz cell.

At least part of the policy implementation problem described above is due to the limits placed by statutory authority. Because oceanfront land use decisions are the province of local governments, the state is not routinely involved in such decisions. To get involved, a state agency must have a major stake in the outcome and be willing to expend the political capital needed to press their case. As a consequence, such intervention is uncommon.

Structured Implementation Process

In the Sabatier and Mazmanian framework, the likelihood of implementing agencies and target groups performing as desired is enhanced if legislation assigns responsibilities to sympathetic agencies, provides them adequate resources, and provides for appropriate rewards and sanctions to ensure compliance.

In the case of the shore protection management regime, this condition is better met for some elements than others. With respect to beach management and regulation, the initial assignment of Beach Law implementation to the State Highway Division met the condition well. The Highway Division had both the parks management authority and the engineering expertise to quickly establish an effective, well-administered permit program. To a large extent, that tradition carries on under SPRD jurisdiction, but relatively few resources are devoted to the program. As for DSL's role in the process, beachfront revetments are clearly a minor and relatively low priority part of their overall regulatory program, which focuses mainly on wetlands and waterways. Decision-making by DSL is based mainly on comments received from outside the agency; if there are no objections, permits are generally issued and findings to support the decisions are rare. A shortage of financial and human resources has relegated the DSL permit process to little more than an accounting function. The state coastal management agency (DLCD) reviews each of the permits, but its recommendations have little authority behind them and are often ignored.

Turning to oceanfront development, with decision-making authority largely in the hands of local governments and ultimately locally-elected officials, there is little distance between the regulated and the regulators. For example, the real estate and development industry is historically well-represented on local planning commissions. State beach managers have little involvement in the local development process in Oregon, and although state coastal managers do provide some oversight, they have no ultimate approval authority or other direct role in the siting process. Local officials are generally more sympathetic to development interests than to the broader public interest or to technical concerns. Geotechnical and hazard issues, for example, are left primarily to developers and their consultants. At the local decision-making level, there are few incentives and numerous disincentives to declare particularly hazardous land unbuildable or push for construction setbacks sufficient to negate the need for structural shore protection.

Committed and Skilled Implementing Officials.

Based on the present research, it is difficult to assess the managerial and political skills of local government and state agency leaders, or to evaluate their commitment to shore protection policy objectives. Generally, support is strong for "protecting the public shore." However, often-conflicting policies and other implementation problems that are recognized and tolerated by those who work close to the action are often invisible to higher level officials who are in a position to initiate effective corrective measures. So the problems persist while minor adjustments are made. For example, gaps in geographic area jurisdiction have led to an awkward, dual-agency permit system. In another example, beach management staff have long been frustrated with the upland development process that drives their permit workload. Yet the problem and its significance from a long-term, cumulative impacts perspective has not been easily documented.

The technical skills of staff involved in the implementation process are also wanting, at both the local and state level. Each local government, or course, cannot be expected to have a resident geotechnical engineer or coastal geologist on staff, but this sort of expertise does exist at the state level; unfortunately, it is not tied into the development or shore protection review process. There has been little training designed to upgrade staff expertise with useful technical information and few applied research projects to examine or demonstrate the "preferred" alternatives to hard SPSs. For example, development and testing of a variable oceanfront construction setback formula based on the common coastal hazard factors would be a relatively simple undertaking and provide a more consistent means of implementing hazard avoidance policies.

Overall, this condition is only partly met. The shore protection management regime, while supported in concept, suffers from benign neglect and too few resources. Agency leaders are relatively isolated from hazard mitigation decisions—be it a local planning office administrative decision or a state SPS permit. There is also a need to make use of available state-level expertise not currently in the decision-making loop and provide additional training to those who are.

Political, Constituent, and Court Support

The protection of Oregon's beaches for public use and enjoyment under the Beach Law has been likened to the "preservation of a birthright" (Straton 1977). It has enjoyed strong support by organized constituencies such as the Oregon Shores Conservation Coalition, founded in 1971 to be a watchdog over beaches, estuaries, and other valued coastal resources; and 1000 Friends of Oregon, a land use-oriented environmental organization. Both groups, and other more local groups formed to fight particular battles (e.g., Friends of Lincoln County in the case of development of the Jump-off Joe landslide area in Newport), have made substantial financial investments to counter legal challenges to shore protection laws.

Some of those legal challenges bear mention. The legal theory on which the Beach Law was founded was that of "implied dedication," a common law principle that had been used for similar purposes in other states (Straton 1977, 24). Several landowners challenged the new Beach Law immediately after it was signed. Fultz, who owned a large stretch of beach at Neskowin on the north central coast, applied for a permit for a beach road that was in progress. The permit was denied; he continued his work and was sued by the state. In the resulting decision, State v. Fultz and LEW Engineering (261 Or. 261, 289; 491 P.2d 1171 [1968]), the court ruled that the state did have the right to regulate beach construction and that the public had an implied right of use and access up to the BZL, but no further. In the Oregon Supreme Court appeal of a subsequent case, Thornton v. Hayes (254 Or. 584, 462 P.2d 671 [1969]), the court again held that the public did have the right to use the beach, but founded their decision on the English common law doctrine of Custom, rather than the more limited one of implied dedication. In that case, the public rights were deemed to extend to the line of vegetation, wherever it may be, rather than just to the BZL. In each of the court decisions, the constitutionality of the law with respect to the "taking of private property for public use" (Fifth and Fourteenth Amendments of the U. S. Constitution) was upheld. In a contemporary legal case in Cannon Beach, where the state denied a seawall and fill permit for purposes of motel construction on the beach (coincidently adjacent to the site contested in Thornton v. Hays), the property owner is seeking to test the constitutionality question on takings grounds once again.

For Oregon, this condition has been well met, though new challenges periodically threaten the integrity of the law. If those challenges appear to seriously threaten the "birthright" so cherished by Oregonians, the public outcry and political response will be great.

Ongoing Relevance in A Changing Society and Economy

This final condition asks whether or not the policies and their goals are still relevant, given changes in the social and economic makeup of our society. While this issue has not been a focus of this report, the answer to this question is probably that they are even more relevant today than in the past, yet threatened in some respects.

Oregon's coastal economy is becoming increasingly dependent on the retirement and tourism/recreation sectors for its growth (Radtke and Davis undated). Both of these sectors are heavily dependent on quality-of-life factors, and a prominent factor is accessible public beaches. Because of these trends, the public nature of beaches has continued to be a high priority. However, the increased emphasis on private property rights by some in our society contributes to an increasing tension at the shoreline, where these private rights collide with public rights associated with beach use and preservation. As already mentioned, the demand for SPSs and resulting impacts on the beach system argues for increased regulatory oversight by state beach managers over beachfront development. This relationship between beachfront development siting, shore protection decisions, and the long-term integrity of the beach resource needs to be acknowledged and addressed in public policy.

In summary, Sabatier and Mazmanian's conditions for effective implementation are partly met by the policies that make up the shore protection management regime. There has been some policy evolution and learning over time, but nearly all of it within the structural confines of existing statutes and administrative rules. More substantial structural changes are needed to address the increasing public beach rights-private upland rights conflicts emerging from the ongoing boom in oceanfront development. These are addressed in the conclusions that follow.

CHAPTER 5
CONCLUSIONS

Two interrelated questions have been examined in this evaluation of ocean shore protection policy in Oregon. First, how well are present policies being implemented, and second, are present policies still valid from a scientific perspective, given the recent advances in our understanding of coastal processes and engineering? The approach to these questions has focused principally on the structural features of relevant statutes and rules—their goals and objectives, their "underlying causal theories" about what kinds of actions are needed to achieve objectives, and their process and coordination structures. The results, based principally on an analysis of shore protection and development decisions made over the past 25 years in the Siletz littoral cell, lead to a number of conclusions and possible improvements that can be fit into two broad categories: upland development policy and practices and ocean shore protection policy and practices.

Upland Development Policy and Practices

Land use and related administrative decisions are driving the demand for hard shore protection structures (SPS) in the Siletz littoral cell. Intuitively understood by planners and coastal managers close to the decision-making processes, this fact is borne out by the number of recently-built oceanfront homes that soon after construction require a revetment or seawall to prevent property damage, and by local policies that require a property owner to install a hard SPS in order to get a building permit. The problem is exacerbated by the large number of vacant oceanfront lots that are very shallow and virtually unbuildable, based on present building setback formulas and absent a SPS. This problem continues because subdivision and lot partition rules do not factor in natural hazard concerns along the oceanfront. The result is continued creation of shallow lots that by design will need shore protection in the future.

There are a number of underlying reasons for this situation. First, despite having one of the most far-sighted set of state land use policies in the United States (DeGrove 1984), including three land use goals that focus on natural hazards, the hazard management strategies actually employed depend more on structural mitigation than on hazard avoidance. Along the Siletz cell oceanfront, the result has been the proliferation of SPSs. Structural hazard mitigation is promoted by interpretations of planning goal language. For example, Goal 7 emphasizes that hazardous sites shall not be developed without "appropriate safeguards." Local land use policy, approved by the state planning agency, interprets this language to mean "adequate safeguards." And hard structures are usually deemed "more adequate" than non-structural mitigation. While this outcome is consistent with the central language in all three hazard-related land use goals, which focus on the need to protect life and property, the net result is more SPSs. Other policy language that implicitly seeks to promote avoidance of hazards and avoidance of hard SPSs ("land use management practices and non-structural solutions ... shall be preferred") is relegated to secondary status. The "hard structure solution" is further institutionalized by the largely uncritical acceptance by local officials of required geotechnical site reports that are based on variable standards and not subject to quality assurance measures or scrutiny by peers. Revetments and seawalls have simply become the norm. And, as one permit administrator put it, "revetments beget revetments."

Another reason land use practices are driving the demand for SPSs has to do with where the decision-making responsibility lies—almost solely in the hands of local officials. There is a great deal of pressure on these officials to encourage and facilitate growth. Access to the local development decision-making process by state agencies with broader or somewhat different missions is often non-existent (in the case of local administrative decisions) or limited and costly (through the land use decision appeals process). While local officials are unlikely to invite greater state oversight and access to land use decisions generally, having such oversight for these few decisions (i.e., the siting of oceanfront development) would at least shift the political burden of unpopular decisions to the somewhat more insulated state level. While this would not remove political and economic influences from the oceanfront siting process, it would provide a buffer for local officials and likely yield better and more consistent hazard avoidance decisions. Analogies can be drawn with the wetland regulatory process, where development conditions are largely determined through the state and federal permit process. Many local governments have been more than willing to leave these decisions with the state because they lack the requisite expertise for assessment and because it puts often difficult decisions at a more distant level.

Another contributor to problems of oceanfront development siting with respect to hazards is the relatively uncoordinated planning for beachfront areas. Virtually every foot of private beachfront land in the Siletz cell is zoned for residential or commercial development, with little regard for hazards. There are also few effective controls on development practices that threaten the values, resources, and even long-term viability of the adjacent public beach. There is little or no regard given to beach stability factors or wave runup potential when planning development. Finally, plans for adjacent jurisdictions within the same littoral cell are uncoordinated with respect to hazards.

There is a critical need for a more coordinated beachfront development planning process for littoral cells along the coast where private ownership is dominant. Private interests, local governments, state officials charged with hazard assessment, beach management, and coastal planning should work together to develop special area management plans for littoral cells. The "special area planning" model is a well-developed and familiar one in Oregon, having been used to develop coordinated plans for each of Oregon's 17 estuaries in the late 1970s and early 1980s (Davis 1980; Gusman and Huser 1984). The model is also the foundation for the wetland conservation planning process the state legislature put in place in 1989 (ORS 196.678-196.681). Beachfront management plans for littoral cells, based on hazard and sand supply assessments, scenic/visual resource inventories, public recreation needs, and upland development interests and plans, might remove many of the shortcomings of present local plans or at least facilitate decisions that explicitly recognize the many factors involved.

In terms of an overall management strategy, *hazard avoidance should be a fundamental principle* guiding the siting of new oceanfront development along the Oregon coast. This should be the rule for undeveloped raw land, for infill development, or for redevelopment or improvement of existing upland buildings or infrastructure. If, as is often the case, hazards cannot be completely avoided, then the adverse impacts of hazard mitigation should be minimized as much as possible, mainly by use of alternatives to hard SPSs. If for some reason hard SPSs cannot be avoided, compensation for unavoidable adverse impacts—individual and cumulative—should be required. Again, the wetland regulation and compensation scheme serves as a possible model. This hazard mitigation model—first, avoid hazards; next, minimize impacts; and finally, compensate for unavoidable impacts—could be implemented through the beachfront management plans suggested above. As part of such a model, there might be a more structured site assessment and reporting process (with peer review) and establishment of a coastwide building setback procedure. Applied on a site-by-site basis as a function of applicable upland, beach, and ocean-related risk factors, such a setback procedure would recognize the unique situation present at each location (beach, dune, ocean, cliff, and other factors), but provide overall consistency of siting decisions with respect to erosion, flooding, landslide, and other chronic hazards.

Ocean Shore Protection Policy and Practices

While preparation of beachfront management plans and an overall hazard avoidance strategy for upland development would do much to lessen the demand for revetments and seawalls in the future, the need for shore protection for existing development will not go away. The certainty of future episodic coastal erosion, flooding, and other hazards supports this conclusion. Given that future reality, how well has the shore protection process worked in the past, what have been the impacts or outcomes of shore protection decisions, and what might be done to improve the process to better achieve existing and possibly more informed policy goals?

The starting point for most discussions about shore protection measures to mitigate actual or perceived hazards is the SPRD/DSL joint permit process. With some exceptions, the shore protection process is still basically a reactive process—property owners, or their contractors, fill out and submit a joint SPS permit application (Appendix C).

A first observation about the SPS permit process is that it has numerous jurisdictional gaps and overlaps that limit its effectiveness and create needless duplication of government effort. As a result of jurisdictional gaps in SPS regulation in the Siletz cell, 3 of 10 oceanfront SPSs built since 1967 have not required a state permit. Because of overlapping jurisdiction, 63% of the SPS permits processed since 1977 have been processed by both SPRD and DSL. Some of the waste and duplication has been eliminated by a joint application form and a jointly signed permit, but there is more that could be done. The plethora of regulatory agencies increases public confusion and perpetuates the stereotype of government duplication and waste.

Reflecting on Sabatier and Mazmanian's conditions for effective implementation, it would make sense to consolidate the SPRD/DSL permit process into a single agency process. The responsibility for that single process should be given to SPRD because it fits well with their overall beach management responsibilities, because of their historical emphasis and expertise in evaluating beachfront protection proposals for recreational and access-related impacts, and because they have a regular field presence. The latter point is particularly important if the state is to take a more active role in beach management, field testing and evaluating alternative shore protection measures, promoting successful techniques, and working with landowners to find suitable solutions for their shore protection problems. DSL's present role in the beachfront permit process is a small one. Their program focus and expertise is clearly in the wetlands and waterways arena, not beaches, and their workload is such that beachfront protection issues would not receive the needed attention.

If SPRD is designated as the single permit authority for beachfront protective structures, several jurisdictional gaps will have to be closed. First, SPRD jurisdiction should be extended to all oceanfront SPSs, not just ones that extend west of the BZL. Second, they should be given the enforcement authority needed to ensure compliance. SPS repairs should also be more carefully monitored to ensure cumulative impacts are not exacerbated.

Another flaw in approval procedures is that there are no consistent criteria for when "emergency" permits are warranted. Criteria suggested by DLCD (see p. 96-97) would serve as a useful starting point. The eligibility of oceanfront lands that were not "developed" as of January 1, 1977 for emergency riprap also needs to determined.

Wherever the oceanfront permit program is housed, one gaping hole in the permit review process must be plugged. Improvements are needed in technical assessment of hazards, alternative shore protection measures, and, if a hard SPS is actually needed, what the design criteria are vis a vis the threat. That hole could be partially filled by a legislatively mandated geologic and engineering review by the state agency with that expertise—the Department of Geology and Mineral Industries (DOGAMI).

Jurisdictional gaps and overlaps aside, the permit process for SPSs has serious flaws, beginning with the permit application form itself (Appendix C). The form provides little of the information needed to make an thorough evaluation of the need and justification for the structure, the alternatives to hard shore protection that might be substituted, the proposed design and how it relates to the severity of the hazard or threat, and expected impacts. While SPRD does conduct a limited assessment of proposed SPSs (and DSL less so), the lack of criteria or structured process for assessing need, alternatives, design, and impacts results in less than satisfactory decisions. Some examples illustrate this general point.

With regard to need and justification for a hard SPS, there are few if any criteria or consistent means by which to make this evaluation. For example, it is unclear if the loss of only a few feet of bank is sufficient to warrant a permit for a revetment, or whether an upland improvement must be threatened. Absent such a policy, the record in the Siletz cell suggests that in some cases, SPSs are installed in anticipation of future erosion, whereas in others, the state has been very insistent regarding the need to show a real threat. The erratic record of permit denials over time is further evidence of the lack of consistent decision-making criteria.

Similarly, there is no process for systematically evaluating alternatives to hard SPSs, even though both SPRD and DSL regulations assert that such alternatives are

Furthermore, the lack of report standards and provisions for peer review lessen the usefulness of these documents.

Consideration of the long-term impacts of SPSs, required by state policy, is simply not a high priority for SPRD or DSL given the many more immediate problems with the process and the decisions that must be made. Nevertheless, this study suggests that long-term, cumulative impacts are potentially among the most serious concerns, especially in a cell like the Siletz where cliff-supplied sand is an important contributor to the sand budget. The gradual loss of cliff-supplied sand to the sand budget due to SPS installation may eventually lead to beaches that are narrower and less effective as erosion buffers. With the gradual loss of buffering beaches, episodic erosion will likely threaten more and more upland development and result in an increasing rate of SPS installation. Recreational values of the beach will be much diminished.

In conclusion, the ocean shore protection management regime for Oregon is in need of overhaul. The Siletz cell and the beachfront development and shore protection decisions made there over the past 25 years are a bellwether for other rapidly-developing stretches of the Oregon coast. Addressing policy and management issues now will reduce problems later and help preserve Oregon's beaches for the enjoyment of future generations.

BIBLIOGRAPHY

Adams, J. 1990. Paleoseismicity of the cascadia subduction zone: evidence from turbidites off the Oregon-Washington margin. *Tectonics* 9:569-583.

Ahrens, J. P. 1990. *Recommendations for updating EM 1110-2-16134, design of coastal revetments, seawalls, and bulkheads*. Unpublished manuscript.

Ahrens, J. P. and M. S. Heimbaugh. 1989. Dynamic stability of dumped riprap. In *Coastal Zone '89*, Proceedings of the Sixth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Doumarat, 3377-3389. New York: American Society of Civil Engineers.

Ando, M. and E. I. Balazs. 1979. Geodetic evidence for aseismic subduction of the Juan de Fuca plate. *Journal of Geophysical Research* 84(B6):3023-3028.

Archer, J. H. and R. W. Knecht. 1987. The U. S. national coastal zone management program—problems and opportunities in the next phase. *Coastal Management* 15:103-120.

Atwater, B. F. 1987. Evidence for great Holocene earthquakes along the outer coast of Washington State. *Science* 236:942-944.

Bardach, E. 1977. *The implementation game: what happens when a bill becomes law*. Cambridge: MIT Press.

Barnett, T.P. 1990. Recent changes in sea level: a summary. In *Sea level change*, 37-51. Geophysics Study Committee, National Research Council. Washington, DC: National Academy Press.

Benkendorf Associates. 1989. *Inventory of Oregon coastal beach access sites*. Salem: Oregon Department of Land Conservation and Development and Oregon State Parks and Recreation Division.

Beckham, S. D. 1973. *Historical and archeological site inventory*. Florence, OR Oregon Coastal Conservation and Development Commission.

Born, S. M. and A. H. Miller. 1988. Assessing networked coastal management programs. *Coastal Management* 16:239-243.

Broome, S. W., E. D. Senaca, and W. W. Woodhouse. 1982. *Building and stabilizing coastal dunes with vegetation*. UNC-SG-82-05. Raleigh: University of North Carolina Sea Grant Program

Brower, D. J., J. H. Archer, D. C. Coates, D. R. Godschalk, M. I. Lugar, D. W. Owens, N. Armingeon, N. Grossman, B. Henderson, and A. K. Schwab. 1991. *Evaluation of the national coastal zone management program.* Newport, OR: National Coastal Resources Research and Development Institute. NCRI-W-91-003.

Browne, A. and A. Wildavsky. 1984. "Implementation as mutual adaption." In *Implementation*, edited by J.L. Pressman and A. Wildavsky. Berkeley: University of California Press.

Bruun, P. 1962. Sea level rise as a cause of shore erosion. *Journal of Waterway, Port and Coastal Engineering* 88:117-130.

———. 1983. Review of conditions for use of the Bruun Rule. *Coastal Engineering* 7:77-89.

———. 1988. Profile nourishment: its background and economic advantages. *Journal of Coastal Research* 4:219-228

Bureau of Governmental Research and Service (BGRS). undated. *Evaluation Proposal for Oregon's Land Conservation and Development Program.* Eugene: University of Oregon.

Burley, B. 1979. *Critical species and habitats of Oregon's coastal beaches and dunes.* Newport: Oregon Coastal Zone Management Association.

Byrne, J. V. 1964. An erosional classification for the northern Oregon coast. *Annals of the Association of American Geographers* 54:329-335.

Carlson, J. F. Reckendorf, and W. Terniyk. 1991. *Stabilizing coastal sand dunes in the Pacific Northwest*. Agriculture Handbook 687. Soil Conservation Service, U.S. Department of Agriculture.

Chisholm, T. A. 1990. Hopper dredge direct pumpout for beach placement. *Dredging Research Information Exchange Bulletin*, DRP-90-2. Vicksburg: Waterways Experiment Station, U. S. Army Corps of Engineers.

City of Lincoln City Planning Commission. 1990. *Findings of fact, conclusions of law and decision of approval with conditions #90-06.* In the matter of: the application by Lincoln Hills Partners for final master plan approval of a planned unit development.

Clayton, T. D. 1989. Artificial beach replenishment on the U.S. Pacific shore: a brief overview. In *Coastal Zone '89*, Proceedings of the Sixth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Doumarat, 2033-2045. New York: American Society of Civil Engineers.

Clemens, K. E. and P. D. Komar. 1988. Oregon beach sand compositions produced by the mixing of sediments under a transgressive sea. *Journal of Sedimentary Petrology* 58:519-529.

Collier, C. A. Undated. *Building construction on shoreline property: checklist.* Gainesville: Marine Advisory Program, Florida Cooperative Extension Service.

Cooper, W. S. 1958. *Coastal dunes of Oregon and Washington.* Geological Society of America Memoir 72.

Darienzo, M. E. and C. D. Peterson. 1990. Episodic tectonic subsidence of late Holocene salt marshes, northern Oregon central Cascadia margin. *Tectonics* 9(1):1-22.

Davis, G. E. 1980. Special area management—resolving conflicts in the coastal zone, *Environmental Comment* No. 10:4-7

Dean, R. G. 1983. Principles of beach nourishment. In *CRC Handbook of Coastal Processes and Erosion*, edited by P. D. Komar. Boca Rotan: CRC Press.

DeGrove, J. M. 1984. Oregon: a blend of state and local initiatives. In *Land, Growth and Politics*, edited by J. M. DeGrove. Washington: American Planning Association.

Department of Land Conservation and Development (DLCD). 1985. *Oregon Coastal Management Program*. Salem.

Dicken, S. N., C. L. Johannessen and B. Hanneson. 1961. *Some recent physical changes of the Oregon coast.* Eugene: Department of Geography, University of Oregon.

Dixon, K. and O. H. Pilkey. 1989. Beach Replenishment along the U.S. coast of the Gulf of Mexico. In *Coastal Zone '89*, Proceedings of the Sixth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Doumarat, 2007-2020. New York: American Society of Civil Engineers.

Division of State Lands (DSL). 1973. *Oregon estuaries*. Salem: Oregon State Land Board.

——. 1985. Unpublished annotated ocean shore maps showing DSL-permitted shore protection structures.

Domurat, G. W. 1987. Beach nourishment—a working solution. *Shore and Beach* 55:92-95.

Economic Consultants Oregon, Ltd. 1980. *Evaluating the performance of the Oregon coastal management program: an analytical and administrative framework*. Salem: Oregon Department of Land Conservation and Development.

Emery, K. O. 1980. Relative sea levels from tide gauge records. *Proceedings Of the National Academy of Science* 77:6968-6972.

Fischer, D. W. 1985. Shoreline erosion: a management framework. *Journal of Shoreline Management* 1:37-50.

Fulton-Bennett, K. and G. B. Griggs. 1987. *Coastal protection structures and their effectiveness*. State of California Department of Boating and Waterways and the Marine Sciences Institute, University of California at Santa Cruz.

Gentile, J. R. 1978. *The delineation of landslides in northern Oregon*. Master's thesis, Oregon State University, Corvallis.

——. 1982. The relationship of morphology and material to landslide occurrence along the coastline in Lincoln County, Oregon. *Oregon Geology* 44(9):99-102.

Gornitz, V., S. Lebedeff and J. Hansen. 1982. Global sea level trend in the past century. *Science* 215:1611-1614.

Godschalk, D. R., D. J. Brower, T. Beatley. 1989. *Catastrophic coastal storms: hazard mitigation and development management*. Durham: Duke University Press

Griggs, G. B. 1986. Relocation or reconstruction: viable approaches for structures in areas of high coastal erosion. *Shore and Beach* 54(1):8-16.

Griggs, G. B. and K. Fulton-Bennett. 1988. Rip rap revetments and seawalls and their effectiveness along the central California coast. *Shore and Beach* 56(2):3-11.

Griggs, G. B. and J. F. Tait. 1988. The effects of coastal protection structures on beaches along the Northern Monterey Bay, California. *Journal of Coastal Research,* Special Issue 4:93-111.

Gusman, S. and V. Huser. 1984. Mediation in the estuary. *Coastal Zone Management Journal* 11(4):273-295.

Gutman, A. L. 1979. Low-cost shoreline protection in Massachusetts. In *Coastal Structures '79,* Proceedings of a Specialty Conference on the Design, Construction, Maintenance and Performance of Port and Coastal Structures, 373-387. New York: American Society of Civil Engineers.

Guy, W. E. Jr. 1983. Florida's costal management program: a critical analysis. *Coastal Management* 11(3):219-248.

Hallermeir, R. J. 1981. A profile zonation for seasonal sand beaches from wave climate. *Coastal Engineering* 4:253.

Herdendorf, C. E. (ed.). 1984. *Guide to Lake Erie bluff stabilization.* OHSU-GS-7. The Ohio State University

Herman, P. S. 1971. The public trust doctrine in Oregon. In *Laws for a Better Environment.* Corvallis: Water Resources Research Institute, Oregon State University.

Hearn, J. 1987. Oregon Shores Conservation Coalition. Letter to Marge Akers, Division of State Lands permit administrator, 13 April 1987.

Houlahan, J. M. 1989. Comparison of state construction setbacks to manage development in coastal hazard areas. *Coastal Management* 17:219-228

Huyer, A., W. E. Gilbert, and H. L. Pittock. 1983. Anomalous sea levels at Newport, Oregon during the 1982-83 El Niño. *Coastal Oceanography and Climatology News* 5:37-39.

Ingram, H. M. 1977. Public policy through bargaining: the case of federal grants-in-aid. *Public Policy* 25:499-526.

———. 1990. Implementation: a review and suggested framework. In *Public administration: the state of the discipline*, edited by N.B. Lynn and A. B. Wildavsky, 462-480. Chatham: Chatham House.

Inman, D. L. and C. E. Nordstrom. 1971. On the tectonic and morphologic classification of coasts. *Journal of Geology* 79:1-21.

Intergovernmental Panel on Climate Change (IPPC). 1990. *Scientific assessment of climate change*. Blacknell, UK: UK Meteorological Office.

Jackson, P. L. and C. L. Rosenfeld. 1987. Erosional changes at Alsea Spit, Waldport, Oregon. *Oregon Geology* 49(5):55-59

Jacobsen, S. 1988. *Use of European beach grass (Ammophila arenaria)*. Letter to Robert Cortright, Department of Land Conservation and Development, April 13, 1988.

Johnson, R. 1991. Telephone interview, Regulatory Functions Branch, U.S. Army Corps of Engineers, Portland District

Karlin, R. 1980. Sediment sources and clay mineral distributions off the Oregon coast. *Journal of Sedimentary Petrology* 50:543-560.

Keillor, J. P. 1986. *How to use fill material in stabilizing shoreline bluffs or banks*. WIS-SG-86-428-5. Madison: University of Wisconsin Sea Grant Advisory Services.

Keillor, J. P. and A. H. Miller. 1987. *Coastal processes workbook: evaluating the risks of flooding and erosion for Great Lakes coastal property*. WIS-SG-87-431. Madison: University of Wisconsin Sea Grant Institute.

Komar, P. D. 1976. *Beach processes and sedimentation*. Englewood Cliffs: Prentice Hall.

———. 1978. Wave conditions on the Oregon coast during the winter of 1977-78 and the resulting erosion of Nestucca Spit. *Shore and Beach* 46:3-8.

———. 1983. The erosion of Siletz Spit, Oregon. In *Handbook of Coastal Processes and Erosion*. Boca Rotan: CRC Press.

———. 1986. The 1982-83 El Niño and erosion on the coast of Oregon. *Shore and Beach* 54(2):3-12.

Komar, P.D. and J. W. Good. 1989. The Oregon coast in the twenty-first century: a need for wise management. In *Ocean agenda 21: Passages to the Pacific century*, edited by C. L. Smith, 73-79. ORESU-B-89-001. Corvallis: Oregon Sea Grant, Oregon State University.

Komar, P. D. and R. A. Holman. 1986. Coastal processes and the development of shoreline erosion. *Annual Review of Earth and Planetary Science* 14:237-265.

Komar, P. D., J. W. Good, and S. Shih. 1989. Erosion of Netarts Spit, Oregon: continued impact of the 1982-83 El Niño. *Shore and Beach* 57(1):11-19.

Komar, P. D., J. R. Lizarraga-Arciniega and T.A. Terich. 1976. Oregon coast shoreline changes due to jetties. *Journal of Waterway, Harbor, and Coastal Engineering* 102:13-30.

Komar, P. D. and W. G. McDougal. 1988. Coastal erosion and engineering structures: the Oregon experience. *Journal Coastal Research*, Special Issue 4:77-92

Komar, P. D. and B. A. McKinney 1977. The spring 1976 erosion of Siletz Spit, Oregon with analysis of the causative conditions. *Shore and Beach* 45(3):23-30.

Komar, P. D. and C. C. Rea. 1975. *The causes of erosion of Siletz Spit, Oregon*. Publication no. ORESU-75-001. Oregon State University Sea Grant College Program.

———. 1976. Erosion of Siletz Spit, Oregon. *Shore and Beach* 44:9-15.

Komar, P. D. and S. M. Shih. 1991. Sea cliff erosion along the Oregon coast. p. 1558-1570 In *Coastal Sediments '91*. Washington, DC: American Society of Civil Engineers.

Kraus, N. C. 1988. The effects of seawalls on the beach: an extended literature review. *Journal of Coastal Research*, Special Issue 4:1-28

Kraus, N. C. and W. G. McDougal. 1991. Shore protection and engineering with special reference to the Oregon coast. Paper presented at *Coastal Natural Hazards: Science, Engineering, and Public Policy*, October 1-3, 1991. Newport, Oregon.

Kulm, L. D. and J. V. Byrne. 1966. Sedimentary response to hydrology in an Oregon estuary. *Marine Geology* 4:85-118.

Lieberman, A. S. and C. R. O'Neill, Jr. 1988. *Vegetation use in coastal ecosystems*. Information Bulletin 198. Ithaca: Cornell Cooperative Extension.

Lincoln County Board of Commissioners. 1978. *Order in the matter of the issuance of building permits for lots on Salishan spit*. 12 April 1978.

Lorang, M. S. 1991. An artificial perched-gravel beach as a shore protection structure. In *Coastal Sediments '91*, Proceedings of a Specialty Conference/Water Resources Division, 1916-1925. New York: American Society of Civil Engineers.

Lowry, G. K. 1985. Assessing the implementation of federal coastal policy. *Journal of the American Planning Association* 51(3):288-298.

Lowry, G. K. and N. H. Okamura. 1980. Evaluation and intergovernmental relations in CZM. In *Coastal Zone '80*, Proceedings of the Second Symposium on Coastal and Ocean Management, edited by B. L. Edge, 429-443. New York: American Society of Civil Engineers.

Lund, E. H. 1971. Coastal landforms between Florence and Yachats, Oregon. *Ore Bin* 33(2):21-44.

———. 1972a. Coastal landforms between Yachats and Newport, Oregon. *Ore Bin* 34(5):73-92.

———. 1972b. Coastal landforms between Tillamook Bay and the Columbia River. *Ore Bin* 34(11):173-194.

———. 1973a. Oregon coastal dunes between Coos Bay and Sea Lion Point. *Ore Bin* 35(5):73-92.

———. 1973b. Landforms along the coast of southern Coos County, Oregon. *Ore Bin* 35(12):189-210.

———. 1974. Rock units and coastal landforms between Newport and Lincoln City, Oregon. *Ore Bin* 36(5):69-90.

Madin, I. 1991. Seismic hazards on the Oregon coast. Paper presented at *Coastal Natural Hazards: Science, Engineering, and Public Policy*, October 1-3, 1991. Newport, Oregon.

Martin, C. 1978. *Oregon beach permits—a reference summary*. Unpublished Report. Salem: Oregon State Parks and Recreation Branch.

Mauriello, M. N. 1989. Dune maintenance and enhancement: a New Jersey example. In *Coastal Zone '89*, Proceedings of the Sixth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Doumarat, 1023-1037. New York: American Society of Civil Engineers.

McGilvray, L. J. 1987. CZM: evaluation of state and local power-sharing. In *Coastal Zone '87*, Proceedings of the Fifth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Doumarat, 2773-2782. New York: American Society of Civil Engineers.

McLaughlin, W. T. and R. L. Brown. 1942. *Controlling coastal sand dunes in the Pacific Northwest*. Circular No. 660. Washington: U. S. Department of Agriculture.

Meier, M. F. 1990. Reduced rise in sea level. *Nature* 343:115.

Milliman, J. D. and K. O. Emery. 1968. Sea levels during the past 35,000 years. *Science* 162:1121-1123.

Mitchell, B. 1989. *Geography and resource analysis*. 2d ed. Essex: Longman Scientific & Technical.

Mitchell, C. E., R. J. Weldon, P. Vincent, and H. L. Pittock. 1990. Active uplift in the Pacific Northwest margin. *EOS* 72(44):314.

Mulvihill, E. L., C. A. Francisco, J. B. Glad, K. B. Kaster, and R. E. Wilson. 1980. *Biological impacts of minor shoreline structures on the coastal environment: state of the art review*. U.S. Fish and Wildlife Service, Biological Services Program. FWS/OBS-77/51.

Nakamura, R. T. and R. Smallwood. 1980. *The politics of policy implementation*. New York: St Martin's Press.

National Oceanic and Atmospheric Administration (NOAA). 1981. *The federal coastal programs review: a report* *to the President*. Washington, DC: National Oceanic and Atmospheric Administration.

National Research Council (NRC). 1983. Probable future changes in sea level resulting from increased atmospheric carbon dioxide. In *Changing climate*. Washington, DC: National Academy Press.

——. 1987. *Responding to changes in sea level: engineering implications*. Washington, DC: National Academy Press.

——. 1990. *Managing coastal erosion*. Committee on Coastal Erosion Zone Management. Washington: National Academy Press.

North, W. B. 1964. *Coastal landslides in northern Oregon*. Master's thesis, Oregon State University, Corvallis. 85 p.

Office of Coastal Zone Management (OCZM). 1979. *The first five years of coastal zone management: an initial assessment*. Washington, DC: National Oceanic and Atmospheric Administration.

Office of Ocean and Coastal Resources Management (OCRM). 1989. *Proceedings of the national coastal and estuarine program managers' meeting*. Washington, DC: National Oceanic and Atmospheric Administration.

Owens, D. W. 1985. Coastal management in North Carolina. *Journal of the American Planning Association* 51(3):322-329.

Peterson, C. D., M. E. Darienzo, D. J. Pettit, P. L. Jackson, and C. L.Rosenfeld. 1991. Littoral cell development in the convergent Cascadia margin of the Pacific Northwest, USA. In *From Shoreline to Abyss*, edited by R. Osbourne. SEPM Special Publication No. 46, Shepard Commemorative Volume, SEPM.

Peterson, C. D., P. L. Jackson, D. J. O'Neil, C. L. Rosenfeld, and A. J. Kimerling. 1990. Littoral cell response to interannual climatic forcing 1983-1987 on the central Oregon coast USA. *Journal of Coastal Research* 6(1):87-110.

Peterson, C. D., K. Scheidigger and P. D. Komar. 1984. Sediment composition and hydrography in six high gradient estuaries of the Northwestern United States. *Journal of Sedimentary Petrology* 54(1):86097.

Pilkey, O. H., W. D. Pilkey, O. H. Pilkey, Jr., W. J. Neal. 1983. *Coastal design: a guide for builders, planners, and home owners.* New York: Van Nostrand Reinhold Company.

Pilkey, O. H. and H. L. Wright III. 1988. Seawalls versus beaches. *Journal of Coastal Research*, Special Issue 4:41-64.

Pressman, J. L. and A. Wildavsky. 1973. *Implementation.* Berkeley: University of California Press.

———. 1984. *Implementation.* 3d. ed. Berkeley: University of California Press.

Putt, A. D. and J. F. Springer. 1989. *Policy research: concepts, methods, and applications.* Englewood Cliffs NJ: Prentice Hall.

Quinn, W. H, V. T. Neal, and S. E. Antunez de Mayolo. 1987. El Niño occurrences over the past four and a half centuries. *Journal of Geophysical Research* 92(C13):14,449-14,461.

Radtke, H. and S. Davis. Undated. *The economic landscape of Oregon.* Newport: Oregon Coastal Zone Management Association.

Rogers Jr., S. M. 1991. Foundations and breakaway walls of small coastal buildings in Hurricane Hugo. In *Coastal Zone '91*, Proceedings of the Seventh Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, and D. Clark, 1220-1230. New York: American Society of Civil Engineers.

Ross, J. F. 1985. *Letter from James F. Ross, Director, Oregon Department of Land Conservation and Development to Dave Talbot, Administrator, Parks and Recreation Division, Oregon Department of Transportation, dated January 4, 1985.*

RNKR Associates. 1978. *Environmental hazard inventory: coastal Lincoln County, Oregon.*

Sabatier, P.A. 1991. Toward better theories of the policy process. *Journal of the American Political Science Association* 24:147-156.

Sabatier, P. A. and D. A. Mazmanian. 1981. Implementation of public policy: a framework of analysis. In *Effective policy implementation*, edited by D.A.

Mazmanian and P. A. Sabatier, 3-35. Lexington: Lexington Books.

———. 1983. *Can regulation work? The implementation of the 1972 California Coastal Initiative.* New York: Plenum Press.

Sauer, C. O. 1925. The morphology of landscape. *Publications in Geography* 2(2):19-53. Berkeley: University of California.

Saurenman, J. A. and J. Loeffler. 1989. "Who controls state coastal programs: lessons from California v. Evans." In *Coastal Zone '89*, Proceedings of the Sixth Symposium on Coastal and Ocean Management, edited by O. T. Magoon, H. Converse, D. Miner, L.T. Tobin, and D. Clark, 539-552. New York: American Society of Civil Engineers.

Sayre, W. O. and P. D. Komar. 1988. The Jump-off Joe landslide at Newport, Oregon: history of erosion, development and destruction. *Shore and Beach* 56(3):15-22.

Schlicker, H. G., R. J. Deacon, G. W. Olcott and J. D. Beaulieu. 1973. *Environmental geology of Lincoln County, Oregon.* Bulletin 74. Portland, OR: Oregon Department of Geology and Mineral Industries.

Shih, S. M. 1992. *Sea cliff erosion on the Oregon coast: from neotectonics to wave runup.* Ph.D. diss., College of Oceanography, Oregon State University, Corvallis.

Smith, E.C. 1978. *Determination of coastal changes, Lincoln County, Oregon.* Master's thesis, Department of Geography, Oregon State University, Corvallis.

Snavely, P. D. Jr. 1987. Tertiary geologic framework, neotectonics, and petroleum potential of the Oregon-Washington continental margin. In *Geology Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins,* edited by D. W. Scholl, A. Granz, and J. G. Vedder, V. 6, Earth Science Series, 305-335. Houston: Circum-Pacific Council for Energy and Mineral Resources.

Snavely, P. D., Jr. and N. S. MacCleod. 1971. Visitors guide to the geology of the coastal area near Beverly Beach State Park, Oregon. *Ore Bin* 33(5):85-105.

Snavely, P. D., Jr., N. S. MacCleod and W. W. Rau. 1969. Geology of the Newport area, Oregon. *Ore Bin* 31(2-3):25-71.

State Soil and Water Conservation Commission (SSWCC). 1978. *Oregon coastal management program: shoreline erosion management policies and procedures*. Salem.

State Water Resources Board (SWRB). 1965. *Mid-Coast Basin*. Salem.

Stembridge, J. E. 1975. *Shoreline changes and physiographic hazards on the Oregon coast*. Ph.D. diss., Department of Geography, University of Oregon, Eugene.

———. 1978. *Memorandum to Pete Bond regarding Beach Permit Applications 1395-1408*. May 22, 1978. Soil and Water Conservation Commission.

Straton, K. A. 1977. *Oregon's beaches: a birthright preserved*. Salem: Oregon State Parks and Recreation Branch.

Tainter, S. P. 1982. *Bluff slumping and stability: a consumer's guide*. MICHU-SG-82-902. Ann Arbor: Michigan Sea Grant

Talbot, D. 1985. *Letter from David G. Talbot, Administrator, Parks and Recreation Division, Oregon Department of Transportation to James F. Ross, Director, Oregon Department of Land Conservation and Development, dated January 18, 1985*.

Terchunian, A. V. 1988. Permitting coastal armoring structures: can seawalls and beaches coexist? *Journal of Coastal Research*, Special Issue 4:65-75.

Terich, T. A. and P. D. Komar. 1974. Bayocean Spit, Oregon: history of development and erosional destruction. *Shore and Beach* 42(2):3-10.

Terich, T. A. 1973. *Bayocean Spit, Tillamook, Oregon: early economic development and erosion history*. Ph.D. diss., Department of Geography, Oregon State University, Corvallis.

Terich, T. A. and M. L. Schwartz. 1990. *The effect of seawalls and other hard erosion protection structures upon beaches: an annotated bibliography and summary*. Western Washington University for Shorelands and

Coastal Zone Management Program, Washington Department of Ecology, Olympia.

Ternyik, W. E. 1979. *Dune stabilization and restoration*. Newport: Oregon Coastal Zone Management Association, Inc.

Tillamook Bay Task Force. 1978. *Tillamook Bay drainage basin erosion and sediment study, Oregon, Main Report*. Portland: Tillamook Bay Task Force, Oregon State Water Resources Board, and the Soil Conservation Service, U. S. Department of Agriculture.

Titus, J. G., R. A. Park, S. P. Leatherman, J. R. Weggel, M. S. Greene, P. W. Mausel, S. Brown, and C. Gaunt. 1991. Greenhouse effect and sea level rise: the cost of holding back the sea. *Coastal management* 19:171-204.

Travis, W. 1980. CZM evaluation from a state perspective. In *Coastal Zone '80*, Proceedings of the Second Symposium on Coastal and Ocean Management, edited by B. L. Edge, 451-469. New York: American Society of Civil Engineers.

Tutor, C. 1982. *Memorandum to Pete Bond, Ocean Shores Coordinator*. SPRD beachfront revetment permit application: Amacher-Boice, Bennett, Carlson, Runyan, Seely, Kirk, and Krall, BA-223-82.

U. S. Army Corps of Engineers (USACOE). 1975. *Oregon coastal harbors*. Portland: Portland District, USACOE.

———. 1981. *Low cost shore protection ... a guide for engineers and contractors*.

———. 1984. *Shore Protection Manual, Volumes I and II*. Vicksburg: Coastal Engineering Research Center, Waterways Experiment Station

———. 1985. *Engineering and design: design of coastal revetments, seawalls, and bulkheads*. Engineer Manual 1110-2-1614. Washington: U.S. Army Corps of Engineers.

———. 1986. *Geology and seismic investigations of Oregon offshore disposal sites*. Portland District, Portland, Oregon.

U. S. Department of Commerce (USDOC). 1981. *The federal coastal programs review: a report to the president*.

Washington, DC: National Oceanic and Atmospheric Administration.

U. S. Environmental Protection Agency (USEPA). 1983. *Projecting future sea level rise.* Washington, DC: U.S. Environmental Protection Agency.

U. S. General Accounting Office (USGAO). 1982. *National flood insurance: marginal impact on flood plain development: administrative improvements needed.* GAO/CED-82-105. Washington, DC: Comptroller General of the United States.

——. 1976. *The coastal zone management program: an uncertain future.* Report to the Congress. GCD-76-107. Washington, DC: Comptroller General of the United States.

——. 1980. *Problems continue in the federal management of the coastal zone management program.* Report to the Secretary of Commerce. CED-80-103. Washington, DC: Comptroller General of the United States.

Vincent, P. 1989. *Geodetic deformation of the Oregon Cascadia margin.* Master's thesis, University of Oregon, Eugene.

Weggel, J. R. 1988. Seawalls: the need for research, dimensional considerations, and a suggested classification. *Journal of Coastal Research*, Special Issue 4:29-39.

Weldon, R. J. 1991. Active tectonic studies in the United States, 1987-90. *In Reviews of Geophysics, Supplement*, 890-906, U.S. National Report to the IUGG 1987-1990, American Geophysical Union.

Wiedeman, A. M. 1984. *The ecology of Pacific Northwest coastal sand dunes: a community profile.* FWS/OBS-84/04. Washington, DC: U.S. Fish and Wildlife Service.

Wood, F. J. 1977. *The strategic role of perigean spring tides in nautical history and North American coastal flooding, 1635-1976.* Washington, DC: NOAA, U.S. Department of Commerce.

Woodward, J., J. White, and R. Cummings. 1990. Paleoseismicity and the archeological record: areas of investigation on the northern Oregon coast. *Oregon Geology* 52(3):57-65.

APPENDICES

APPENDIX A

COMMON ACRONYMS IN THE TEXT

BLM	Bureau of Land Management
BZL	Beach zone line
CBRA	Coastal Barriers Resources Act (federal)
CZMA	Coastal Zone Management Act (federal)
DLCD	Department of Land Conservation and Development (state)
DOGAMI	Department of Geology and Mineral Industries
DSL	Division of State Lands
FEMA	Federal Emergency Management Agency (federal)
LCDC	Land Conservation and Development Commission (state)
LCP	Local comprehensive plan
GIS	geographic information system
GPS	Global positioning system
MHW	Mean high water (same elevation as OHW)
MLLW	Mean lower low water (datum for tide level measurements)
MSL	Mean sea level (Sea Level Datum of 1929, adjusted in 1947)
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NWP	Nationwide permit (U. S. Army Corps of Engineers)
OAR	Oregon Administrative Rules
OCMP	Oregon Coastal Management Program

OCRM	Office of Ocean and Coastal Resources Management (federal)
OCZM	Office of Coastal Zone Management (federal)
OHW	Ordinary high water (same elevation as MHW)
ORS	Oregon Revised Statutes
OSWRB	Oregon State Water Resources Board
NAD	North American Datum
NGVD	National Geodetic Vertical Datum
PAT	polygon attribute table
PLSS	Public Lands Survey System
RSLR	Relative sea level rise
SLR	Sea level rise
SPRD	State Parks and Recreation Department (formerly Division)
SPS	shore protection structure
SSWCC	State Soil and Water Conservation Commission
USACOE	U. S. Army Corps of Engineers
USGAO	U. S. General Accounting Office

APPENDIX B

OREGON OCEAN SHORE PROTECTION DATA BASE

File List

TAXMAP.DBF--file containing locational cross-reference map numbers for all tax lot maps; contains township, range, section, subsection, and project-assigned map number

LOCAT.DBF--file with a variety of location data, both geographic and political.

ENVIR.DBF--physical and other environmental attribute data for the parcel and adjacent beach.

LANDUSE.DBF--attribute data on land use, ownership, upland improvements, construction setbacks, and other cultural characteristics.

SHORPRO.DBF--attribute data on structural and non-structural shore protection, including pre- and post-permit program structures.

PERMITS.DBF--information about seawalls, revetments, or other beach structures permitted under SPRD and/or DSL permit programs.

Detailed contents of each file are listed on the following pages. Included are the field number, field name, type of field (character, numeric, logical), width of field, description, and the key (in italics). Fields for which data was not available or available was not included in the database are marked with an asterisk (*). Following the field description list is a separate list of data sources used for each field.

Field Description for Files

TAXMAP.DBF FILE

Field	Name	Type	Width	Description
1	TWNSP	C	3	Tax map Township, e.g., 07N
2	RANGE	C	3	Tax map Range, e.g., 11S
3	SECT	C	2	Tax map Section, e.g., 23
4	SUBSEC	C	2	Tax map Subsection, e.g., AB or AX or XX, etc.
5	MAP_NUM	C	2	Project-assigned tax map number for each assessor map--used as cross reference to all other files, e.g., 11 to 70 for Siletz Cell

LOCAT.DBF FILE

Field	Name	Type	Width	Description
1	PARC_ID	N	7	Project-assigned MAP NUMBER for each assessor tax map combined with TAX LOT number--used as common field in other files, e.g., 1100400, 3499000, 7003100, etc. for Siletz Cell
2	NS_ORD	N	4	North-to-South order of parcels along the shore
3	ST_ADDR	C	25	Street address of oceanfront tax lot
4	OWNR_NAM	C	20	Name of property owner (from address list)
5	DEV_NAME	C	20	Common name of the development, subdivision, park, access, etc., e.g., Coronado Shores; Gleneden Beach St Wayside
6	CITY	C	4	City
	LICI *Lincoln City* *DEPO* *Depoe Bay* *GLEN* *Gleneden Beach* *LIBE* *Lincoln Beach*			
7	COUNTY	C	4	County
	LICO *Lincoln County*			
8*	SPC_X	C	7	Oregon State Plane Coordinate System, X-coordinate, of NW corner, e.g., 1,002,653 (ft)
9*	SPC_Y	C	7	Oregon State Plane Coordinate System, Y-coordinate, of NW corner, e.g., 1,002,653 (ft)
10	LIT_CELL	C	6	Littoral cell of this lot, e.g., Siletz cell
	SILETZ	*Siletz cell, Cascade Head to Government Point*		

11	ODOT_PHO84	C	14	Dept. of Transportation aerial photo number and year where this lot appears closest to photo center, e.g., OC-23-22-11-84
12	BZL_SHT67	C	8	Beach Zone Line 1967 photomosaic sheet where this tax lot appears, e.g., NB-16-39-67, meaning Nestucca Bay-Lincoln City sheet 16 of 39, 1967 photos.
13	BZL_SHT84	C	8	Beach Zone Line 1984 photomosaic sheet where this tax lot appears, e.g., LI-06-43-84, meaning Lincoln County sheet 6 of 43, 1984 photos.
14	COMMENTS	C	100	Comments about the location of this lot

ENVIR.DBF FILE

Field	Name	Type	Width	Description
1	PARC_ID	N	7	Project-assigned MAP NUMBER for each assessor tax map combined with TAX LOT number--used as common field in other files, e.g., 1100400, 3499000, 7003100, etc. for Siletz Cell
2	NS_ORD	N	4	North-to-South order of parcels along the shore
3	LANDFORM	C	4	The predominant landform type of this parcel

BEAC *This parcel entirely made up of beach*
HEAD *Erosion-resistant basalt/sandstone (often no beach present)*
CLIF *Sea cliff, bluff, or uplifted terrace (generally fronted by beach)*
DUNA *Active foredune*
DUNC *Conditionally stable dune form*
DUNS *Older stabilized dune form*
OTHR *Other landform type*

4	LF_HEIGHT	N	3	The height (feet above MSL) of the landform to the first logical break, such as foredune crest, bluff top, etc.
5*	SC_SLOPE	N	3	Slope of sea cliff landform: RUN:RISE (e.g., 1 = 45 degrees)
6	LF_MAT_BAS	C	4	The material making up the base strata (may be the only strata)

SAND *Loose sand deposits in dunes, spits of recent origin*
SEMI *Semi-consolidated sand/ancient dune deposits of Pleistocene age*
STON *Sandstone deposits of Tertiary age*
SILT *Silt/mudstone deposits of Tertiary age*
CONG *Conglomerate deposits*
BSLT *Basalt of Tertiary age*
INTR *Intrusive basalt dikes, sills, sheets*

7*	LF_MAT_TOP	C	4	If present, the material making up the top or upper strata
8	EROS_ACTL	N	4	Actual site-specific erosion rate in ft/yr
9	EROS_TERM	N	3	The number of years over which the erosion rate calculated

10*	VEGETA	C	4	Dominant vegetation type upland of beach--foredune, cliff face, etc.

ELMO *Elymus mollis (native American dunegrass)*
AMAR *Ammophila arenaria (European beachgrass)*
GASH *Gaultheria shallon (salal)*
PICO *Pinus contorta (lodgepole pine)*
PISI *Picea sitkchensis (Sitka spruce)*
OTHR *Other species dominant (first two letters of genus & species)*
NONE *No appreciable vegetation*

11	BEACH	L	1	There is (Y) or is not (N) a beach fronting the oceanfront landform, as defined by presence of BZL.
12*	BEACH_SLOP	C	4	The slope of the beach face or foreshore, roughly the zone between low and high water (wet sand beach), expressed as a ratio, e.g., 1:30, of the rise:run.
13	BEACH_MATL	C	4	Principal grain size class of beach sand

FINE *Fine sand*
COUR *Course sand*
GRAV *Gravel-sized material*
COBB *Cobble and boulder-sized material*
ROCK *Basement rock or consolidated material*

14*	BCH_WI_MHW	C	4	Width of the dry sand beach (roughly MHW to base of sea cliff or dune base) This is the area making up the public-easement, privately-owned portion of the "ocean shore."
15*	BCH_WI_MTL	C	4	Width of the active sand beach (roughly MTL to base of sea cliff or dune base) This is the areas estimated by Peterson et al. (1991)
16	SHOR_ORIEN	C	3	Orientation of the shoreline in degrees east or west of north; e.g., 30E
17	DRIFTWOOD	L	1	Driftwood is (Y) or is not (N) present in significant quantities at landward edge of backshore
18	STREAM	L	1	Stream outlet is (Y) or is not (N) present at this location
19	STREAM_NAM	C	15	Name of stream if any
20	HAZARD1	C	4	Principal hazards affecting upland property, listed (e.g., LGB)

EROS *Erosion of beach affecting upland*
SLID *Active or recent landslide*
CREE *Ancient landslide creeping topography*
GEOL *Unstable geological formation (e.g., seaward dipping bedrock)*
SLUM *Undercutting by wind/rain/waves causing bluff-top slumping*
RUNF *Surface or collected runoff causing rills/erosion*
NBCH *Narrow beach/minimal buffering*
RIPC *Rip current embayments, fixed or migrating*
FLOO *Ocean, river, or stream flood/erosion area*
DUNE *Unstable sand dunes or spit*

21	HAZARD2	C	4	
22	HAZARD3	C	4	

23*	HAB_VALU1	C	4	Significant habitat value to birds and other wildlife

THRT *Threatened and endangered species*
NEST *Nesting areas for waterfowl, other birds*
COVR *Area provides cover and resting area for birds and wildlife*
HAUL *Marine mammal haulout area*
OTHR *Other significant wildlife values*

24*	HAB_VALU2	C	4	Significant habitat value to birds and other wildlife
25*	VIS_AES1	C	4	The visual/aesthetic value of this parcel, either as a resource itself, or what can be seen from it.

OCVW *Ocean view from this parcel*
HEAD *Parcel is a headland with view values*
CLIF *Parcel is part of a scenic cliff area as viewed from the beach*
PKVW *Parcel is viewed from a public park or wayside*
PRIS *Parcel is in a pristine, wild, or undeveloped area*

26*	VIS_AES2	C	4	The visual/aesthetic value of this parcel, either as a resource itself, or what can be seen from it.
27*	OFFSH_CHAR	C	4	Offshore features related to storm wave hazard potential

OPEN *Unobstructed offshore zone with open wave approach*
SHEL *Partial shelter moderates wave attack potential*
PROT *Offshore or nearshore feature or character protects shore from severe wave attack*

28	COMMENTS	C	100	Comments about the environment of this lot

LANDUSE.DBF FILE

Field	Name	Type	Width	Description
1	PARC_ID	N	7	Project-assigned MAP NUMBER for each assessor tax map combined with TAX LOT number--used as common field in other files, e.g., 1100400, 3499000, 7003100, etc. for Siletz Cell
2	NS_ORD	N	4	North-to-South order of parcels along the shore
3	OCN_FRT	N	5	Front footage of oceanfront this lot occupies
4	DEVEL77	L	1	Was this lot "developed" before January 1, 1977 (for determining eligibility for hard shore protection structure installation) (Y/N). Developed areas have houses, commercial, or industrial buildings, or may be vacant subdivision lots that are physically improved through street construction and provision of utilities to the lot, or "excepted" areas.
5	BLT_UPON	L	1	If "developed," is there a habitable or functional permanent building on this lot? (Y/N)

6 BLT_YR C 2 If built upon and exact year known, the year that the present buildings were constructed.

7 BLT_YR_CL C 5 If built upon, the year class that the present buildings were constructed.

<67 *Before 1967*
67-73 *Between 1967 and 1973*
73-78 *Between 1973 and 1978*
78-84 *Between 1978 and 1984*
>84 *After 1984*

8 LAND_USE C 4 Existing land use of lot (1991)

RES-SF *Residential--low/medium density (single family)*
RES-MF *Residential-high density (multifamily, condominium, or planned development)*
RES-PD *Residential-planned development*
COMM-G *Commercial-general*
COMM-R *Commercial-recreational*
INDUS *Industrial*
PARK *Park or open space*
TIM-CV *Timber/conservation*
ACCESS *Public beach accessway, excepting road-ends*
ROAD *Road or street-end*
VACANT *Vacant or unbuilt land*

9 ACC_TYPE C 3 Type of access

PED *Pedestrian*
VIS *Visual*
VEH *Vehicle*

10 ACC_PROP C 5 If there is public access on this parcel, what type?

ESMNT *Public beach easement on private lot*
RDEND *Road or Street end public access (trail, stairs, etc.)*
PARCL *Entire parcel is public, with beach access*
RSIDE *Roadside turnout/viewpoint*
TRAIL *Trail or walkway*

11 ACC_ID_NUM C 7 Beach access inventory number (SPRD); e.g., LI-183B

12 OWNER_TYPE C 4 Ownership category of this lot.

PVT *Private ownership*
CIT *Public ownership, city*
COU *Public ownership, county*
STA *Public ownership, state government*
FED *Public ownership, federal government*
OTH *Other ownership*
UNK *Unknown*

13 TYPE_JURIS C 4 Local land use jurisdiction/types

CIT *City (w/in city limits)*
UGB *Urbanizable (unincorporated, but within a city's UGB)*
COU *County (outside UGB)*

14 ZONE C 4 Zoning classification by city or county

RES-SF *Residential--low/medium density (single family)*
RES-MF *Residential-high density (multifamily, condo, planned development)*
RES-PD *Residential-planned development*
COMM-G *Commercial-general*
COMM-R *Commercial-recreational*
INDUS *Industrial*
PARK *Park or open space*
TIM-CV *Timber/conservation*

15	ZONE77	C	3	If known, the zoning 1977 when OCMP adopted
16	EROS_CLASS	C	3	Erosion rate class based on land use plan inventory (RNKR for Lincoln County), measured in feet.
	SLT	*Slight < .25 ft/yr*		
	MOD	*Moderate .25 - 1.0 ft/yr*		
	SEV	*Severe > 1.0 ft/yr*		
17	STBK_PLAN	N	4	Required sea cliff or dune construction setback line from the beach, based on city/county ordinance, measured in feet.
18	STBK_ACTL	N	4	Actual setback required by city or county if a newly constructed project; or where that not determined, the ACTUAL on-the-ground setback, measured in feet.
19	STBK_LANDW	N	4	The setback from the first street (or eastern property line) to the house or major structure, measured in feet. This suggests how much space a house could be moved landward as a shore protection strategy).
20	FLOOD_ZONE	C	3	National flood insurance FIRM zone, if applicable.
	V__	*Velocity (wave action) flood zone, subdivided as appropriate by flood hazard factors*		
	A__	*100-year flood inundation area, subdivided by flood hazard factors, if data available*		
	B__	*Area between 100 and 50-year flood inundation*		
	C__	*Area of minimal flooding*		
21	BASE_FLOOD	N	3	1 Base flood elevation (tenths of feet MSL) from FIRMs
22*	FLD_POLICY	L	1	Is this property protected by a flood insurance policy? (Y/N)
23	GRAD_PLAN	L	1	Is this property covered by an approved dune grading plan? (Y/N)
24*	ASSESS_LD1	N	4	Most recent assessed value of the land (thousands of dollars)
25*	ASSESS_IM1	N	4	Most recent assessed value of the improvements (thousands $)
26*	YEAR_ASS1	C	2	Year of assessment 1
27*	ASSESS_LD2	N	4	Past assessed value of the land (thousands of dollars)
28*	ASSESS_IM2	N	4	Past assessed value of the improvements, buildings, etc.
29*	YEAR_ASS2	C	2	Year of assessment 2
30	HIS_ARC	C	4	Historical or archaeologically important parcel
	HIST	*Historical structure, site.*		
	NATV	*Native American Indian settlement, Midden, Trail, etc.*		
	WHIT	*Early white settlement area*		
31	COMMENTS	C	100	Comments about the human use/cultural character of this lot

SHORPRO.DBF FILE

Field	Name	Type	Width	Description
1	PARC_ID	N	7	Project-assigned MAP NUMBER for each assessor tax map combined with TAX LOT number--used as common field in other files, e.g., 1100400, 3499000, 7003100, etc. for Siletz Cell
2	NS_ORD	N	4	Order of parcels on a North-South basis for each tax map (e.g., 1401-1411; 1501-1523, etc.)
3	SPRD_PER	C	8	If permit was issued, the State Parks and Recreation Department permit #, e.g., BA-120-77
4	DSL_PER	C	8	If permit was issued, the Division of State Lands permit #, e.g., SP 3421
5	HARD_SP	L	1	Is this shore protection a hard structure, such as a seawall, bulkhead, rock revetment, etc. (Y/N)
6	TYPE_HARD1	C	3	The type of hard structure

Bw *Vertical timber pile, other wood, or sheet steel bulkhead.*
Cr *Reinforced concrete seawall, vertical or sloped*
Cb *Concrete block seawall, usually vertical*
Rr *Rip-rap rock revetment; engineered of not*
Rc *Concrete rubble structure*
Gu *Gunnite/sprayed concrete over wire*
As *Access stairs*
Ar *Access Ramp*
Pi *Pipeline*
Gr *Groin or jetty*
Oth *Some other type of hard structure to prevent erosion*

Field	Name	Type	Width	Description
7	YR_CON_HD1	C	2	Year the hard structure constructed (if more than one permit on a parcel, give latest one's data)
8	TYPE_HARD2	C	3	The type of hard structure
9	YR_CON_HD2	C	2	Year the hard structure constructed (if more than one permit on a parcel, give latest one's data)
10	SPS_IMPAC1	C	3	Principal impact of shore protection structure installation

ACl *Lateral Access along beach*
ACs *Beach access from the shoreland*
VEG *Vegetation removal*
HAB *Habitat loss*
SAF *Safety hazard*
ADJ *Erosion or other impacts on adjacent property*
SSU *Sand supply to the beach (SPS prevents erosion of sand supply source)*
VIS *Visual impacts as viewed from the ocean shore area*

Field	Name	Type	Width	Description
11	SPS_IMPAC2	C	3	Secondary impact of shore protection structure installation
12	SPS_MIT1	C	3	SPS impact mitigation used

SAV *Sand deposition on revetment w/ vegetation planting*
ACC *Access improvement/installation*

Field	Name	Type	Width	Description
13	SPS_MIT1	C	3	SPS impact mitigation used

14*	NONSTRU_SP	L	1	Is this non-structural shore protection? (Y/N)
15*	TYPE_NS1	C	3	The principal type of non-structural shore protection solution used
	BCH	*Beach/dune nourishment with sand from a non-littoral cell source*		
	VEG	*Planting of vegetation to stabilize dunes, cliff face, etc.*		
	FEN	*Sand fencing to build or stabilize dunes*		
	REL	*Relocation of building inland*		
	WOO	*Driftwood used to protect base of dune/cliff*		
	OTH	*Some other type of non-structural solution*		
16*	YR_CON_NS1	C	2	Year non-structural shore protection installed
17*	TYPE_NS2	C	3	The associated or secondary type of non-structural shore protection solution used
18*	YR_CON_NS2	C	2	Year this non-structural shore protection installed
19	SPS_LENGTH	N	4	Shore parallel length of the hard structure (ft).
20	SPS_WIDTH	N	3	Shore normal width of the hard structure (ft)
21	WIDTH_BZL	N	3	Width of the SPS extending west of the BZL (ft)
22	SPS_HEIGHT	N	3	Height (ft) of the hard structure from base to top
23	SPS_SLOPE	N	5	Slope ratio (V:H) of the structure, e.g., 2:1
24	SPS_VOLUME	N	6	Volume (cubic yards) of fill, rock, or other material used in the structure
25	OTHER_ALT1	C	4	Other alterations to this parcel
	GRAD	*Dune grading (legal or illegal) moving sand within system; usually lowering for view purposes*		
	REMV	*Sand removal from beach or dune system*		
	GROI	*Groin--shore normal rock/wood jetty/structure to trap sand*		
	VEGR	*Vegetation removal from bank, bluff, upland and related destabilization*		
26	OTHER_ALT2	C	4	Other alterations to this parcel
27	INFO_SOURC	C	3	Principal source of information about the shore protection structure or activity
	PER	*Permit files*		
	FLD	*Field work*		
	REP	*Reports, literature*		
	PHO	*Aerial photos*		
	OTH	*Other sources*		
28	COMMENTS	C	100	Comments about the shore protection of this lot

PERMITS.DBF

Field	Name	Type	Width	Description
1	PARC_ID	N	7	Project-assigned MAP NUMBER for each assessor tax map combined with TAX LOT number--used as common field in other files, e.g., 1100400, 3499000, 7003100, etc. for Siletz Cell
2	NS_ORD	N	4	Order of parcels on a North-South basis for each tax map (e.g., 1401-1411; 1501-1523, etc.)
2	SPRD_PER	C	8	If permit was issued, the State Parks and Recreation Department permit #, e.g., BA120-77
3	DSL_PER	C	8	If permit was issued, the Division of State Lands permit #, e.g., SP 3421
4	DATE_ACCPT	D	8	Date that the permit application was accepted for review by SPRD and/or DSL
5	APPROVED	L	1	Permit approved/not approved (Y/N)
6	DATE_DECIS	D	8	Date that the permit decision--issuance or denial--was made by SPRD and/or DSL
7	MULT_PARC		1	There are multiple parcels covered by this single permit
8	CONTIG	L	1	If more than one lot is covered by this permit, are the lots in question all contiguous (Y/N)
9	NUM_RE_PER	N	2	The number of separate, but related permits issued for this particular structure and/or tax lot (may occur when applicants are common property owners at condominiums, or band together for one structure, but separate permits)
10	PROJ_ID	C	30	Common name or identifier associated with the project (often the applicant name)
11	APPLICANT	C	20	Name of applicant (or principal applicant if more than one property)
12	APPL_ST_AD	C	20	Applicant's street address
13	APPL_CI	C	15	City of applicant, e.g., Portland
14	APP_ST	C	2	State of applicant, e.g., OR
15	APP_ZIP	N	5	5-digit zip code of applicant, e.g., 97431
16	APP_ZIP4	N	4	4-digit zip code extension
17	ENGIN	C	4	Abbreviation for name of structure design or consulting engineer (see AGENT.DBF file)
18	GEOLO	C	4	Abbreviation for name of geologist/engineering geologist (see AGENT.DBF file)
19	CONTR	C	4	Contractor employed to design and/or build the structure or project

20	PARC_N	C	7	The PARCEL (tax lot, accessway, street-end, etc) directly adjacent to and north of the project, e.g., 1402900
21	PARC_S	C	7	The PARCEL (tax lot, accessway, street-end, etc) directly adjacent to and south of the project, e.g., 1403100
22	NEED_HAZ1	C	4	The need/hazard problems justifying installation of a shore protection structure, listed and separated by commas (e.g., L,G,B)

ADJ *Adjacent property protected by SPS/groin/causing induced erosion*
ERO *Erosion of beach affecting upland*
SLD *Active or recent landslide*
CRP *Ancient landslide creeping topography*
GEO *Unstable geological formation (e.g., seaward dipping bedrock)*
SLM *Wave/wind/rain undercutting and bluff-top slumping*
RUN *Surface or collected runoff causing rills/erosion*
BCH *Narrow beach/minimal buffering*
RIP *Rip current embayments, fixed or migrating*
FLD *Ocean, river, or stream flood/erosion area*
DUN *Unstable sand dunes or spit*
SPF *Shore protection structure (existing) failure*
NON *None apparent*
PRV *Preventative*
REQ *Required for a city or county building permit*

23	NEED_HAZ2	C	4	The second need/hazard problems justifying installation of a shore protection structure
24	NEED_HAZ3	C	4	The third need/hazard problems justifying installation of a shore protection structure
25	PROP_THRT1	C	4	The principal upland property structure, development, value that is threatened, necessitating installation of an SPS

HOU *House*
GAR *Garage*
SEP *Septic*
UTL *Utilities*
STR *Street or road*
PUB *Other public facilities (campground, trails, picnic areas, public access points, etc.)*
MTL *Motel/Condos/Other multiple-unit dwelling*
LAN *Land*
NEW *In conjunction with new construction*
NON *None apparent*
OTH *Other structure/outbuildings (patio, gazebo,*
RVP *RV park*

26	PROP_THRT1	C	4	Another threat to the upland property necessitating installation of an SPS
27	SP_ALTERN1	C	4	Alternative non-structural shore protection alternatives that were or might have been available (relate to the list in NEED_HAZ & PROP_THRT above)

MOVE *Move/relocation of primary structure onsite*
UTIL *Relocation of secondary structure/utility*
RELO *Relocation of primary structure off-site*
STBK *Greater construction setback, if new construction on upland*
DUNE *Dune building/nourishment and vegetative stabilization*
NOUR *Beach nourishment with offsite material*
VEGE *Other bank/slope revegetation/stabilization*
SOFT *Soft shore protection structure (sandbags, etc.)*
NOAC *No action alternative*

28	SP_ALTERN2	C	4	Alternative non-structural shore protection alternatives that were or might have been available (relate to the list in NEED_HAZ & PROP_THRT above)
29	COMMENTS	C	100	Comments about the permit

Data Sources for Fields

TAXMAP.DBF

Field	Name	Type	Width	Data Source
1	TWNSP	C	3	Tax map
2	RANGE	C	3	Tax map
3	SECT	C	2	Tax map
4	SUBSEC	C	2	Tax map
5	MAP_NUM	C	2	Project-assigned tax map number

LOCAT.DBF

Field	Name	Type	Width	Data Source
1	PARC_ID	N	7	Unique parcel identifier--map # + tax lot #
2	NS_ORD	N	4	Tax maps
3	ST_ADDR	C	25	County Addressing records
4	OWNR_LAST	C	15	County Addressing records
5	OWNR_FIRST	C	15	County Addressing records
6	DEV_NAME	C	20	Tax maps; County addressing list
7	CITY	C	4	City
8	COUNTY	C	4	County
9	SPC_X	C	7	GIS
10	SPC_Y	C	7	GIS
11	LIT_CELL	C	6	Siletz
12	BZL_SHEET67	C	8	1967 BZL map comparison with tax maps
13	BZL_SHEET84	C	8	1967 BZL map comparison with Tax maps
14	COMMENTS	C	100	

ENVIR.DBF FILE

Field	Name	Type	Width	Data Source
1	PARC_ID	N	7	Unique parcel identifier--map # + tax lot #
2	NS_ORD	N	4	Tax maps
3	LANDFORM	C	4	Beaches and Dunes Inventory; DOGAMI/Ore Bin studies
4	LF_HEIGHT	N	3	Lincoln city topo maps/67 BZL maps
5*	SC_SLOPE	N	2	Field estimates
6	LF_MAT_BAS	C	4	Literature/field
7	LF_MAT_TOP	C	4	Literature/field
8	EROS_RATE	N	4	Permit applications, inventory studies, reports, etc.
9	EROS_TERM	N	3	Permit applications, inventory studies, reports, etc.
10	VEGETA	C	4	Field observations; permits; inventories
11	BEACH	L	1	BZL maps
12	BEACH_SLOP	C	4	Field estimates/crude measurements
13	BEACH_MATL	C	4	Field data/Komar/Peterson
14*	BCH_WI_MHW	C	4	BZL/1990 photos
15*	BCH_WI_MTL	C	4	Peterson et al. (1991); photos
16	SHOR_ORIEN	C	3	Tax maps; USGS quad sheets, AIR PHOTOS
17	DRIFTWOOD	L	1	Aerial photos; field observations
18	STREAM	L	1	USGS quad sheets; BZL maps; photos
19	STREAM_NAM	C	15	USGS quad sheets; city/county maps
20	HAZARD1	C	4	Hazard inventory; photos, field observations
21	HAZARD2	C	4	Hazard inventory; photos, field observations
22	HAZARD3	C	4	Hazard inventory; photos, field observations
23*	HAB_VALU1	C	4	
24*	HAB_VALU2	C	4	
25*	VIS_AES1	C	4	
26*	VIS_AES2	C	4	
27*	OFFSH_CHAR	C	4	NOAA charts
28	COMMENTS	C	100	

LANDUSE.DBF

Field	Name	Type	Width	Data Source
1	PARC_ID	N	7	Unique parcel identifier--map # + tax lot #
2	NS_ORD	N	4	Tax maps
3	OCEAN_FRT	N	5	Tax maps; GIS maps/measurements
4	DEVELOPED	L	1	"Developed lands" inventory maps
5	BLT_UPON	L	1	Aerial photos; assessor records
6	BLT_YR	C	2	Assessor records
7	BLT_YR_CLS	C	5	BZL/other photos
8	LAND_USE	C	4	Aerial photos; field observations
9	ACC_TYPE	C	3	SPRD Public Access Inventory
10	ACC_PROP	C	5	SPRD Public Access Inventory
11	ACC_ID_NUM	C	7	SPRD Public Access Inventory
12	OWNER_TYPE	C	4	Tax assessor records
13	TYPE_JURIS	C	4	City/county maps
14	ZONE	C	4	City/county zoning maps; interviews
15	ZONE77	C	4	Interviews/old zoning maps
16	EROS_CLASS	C	3	City/county hazards maps; RNKR study (1978)
17	STBK_PLAN	N	4	Calculated from bluff height/erosion class
18	STBK_ACTL	N	4	Aerial photos, field measurements
19	STBK_STR	N	4	Aerial photos, field measurements
20	FLOOD_ZONE	C	3	FIRM maps
21	BASE_FLOOD	N	3	FIRM maps
22*	FLD_POLICY	L	1	FEMA records
23	GRAD_PLAN	L	1	DLCD records
24*	ASSESS_LD1	N	4	Tax assessor records
25*	ASSESS_LD2	N	4	Tax assessor records
26*	YEAR_ASS1	C	2	Tax assessor records
27*	ASSESS_IM1	N	4	Tax assessor records
28*	ASSESS_IM2	N	4	Tax assessor records
29*	YEAR_ASS2	C	2	Tax assessor records
30	HIS_ARC	C	4	State parks/OCCDC inventories, SHIPO
31	COMMENTS	C	100	

SHORPRO.DBF

Field	Name	Type	Width	Data Source
1	PARC_ID	N	7	GIS
2	NS_ORD	N	4	Tax maps
3	HARD_SP	L	1	Permit records; photos; field check
4	TYPE_HARD1	C	3	Permit records; photos; field check
5	YR_CON_HD1	C	2	Permit records; photos
6	TYPE_HARD2	C	3	Permit records; photos; field check
7	YR_CON_HD2	C	2	Permit records; photos
8	SPS_IMPAC1	C	3	Permit records; photos; field check
9	SPS_IMPAC2	C	3	Permit records; photos; field check
10	SPS_MIT1	C	3	Permit records; photos; field check
11	SPS_MIT2	C	3	Permit records; photos; field check
12*	NONSTRU_SP	L	1	Interviews with SPRD; photos; field check
13*	TYPE_NS1	C	3	Interviews with SPRD; photos; field check
14*	YR_CON_NS1	C	2	Permit records; interviews
15*	TYPE_NS2	C	3	Interviews with SPRD; photos; field check
16*	YR_CON_NS2	C	2	Permit records; interviews
17	SPS_LENGTH	N	4	Permit records; field check; aerial photos
18	SPS_WIDTH	N	3	Permit records; field check; aerial photos
19	WIDTH_BZL	N	3	Permit records; field check; aerial photos
20	AREA_BZL	N	5	Width X length of SPS
21	SPS_HEIGHT	N	3	Permit records; field check; photos
22	SPS_SLOPE	N	5	Permit records; field survey
23	SPS_VOLUME	N	6	Permit records; estimates based on size
24	OTHER_ALT1	C	4	Permit records; field check; aerial photos
25	OTHER_ALT2	C	4	Permit records; field check; aerial photos
26	INFO_SOURC	C	3	
27	COMMENTS	C	100	

PERMITS.DBF

Field	Name	Type	Width	Data Source
1	PARC_ID	N	7	GIS
2	NS_ORD	N	4	Tax maps
3	SPRD_PER	C	8	Permit records--SPRD/DSL
4	DSL_PER	C	8	Permit records--SPRD/DSL
5	DATE_ACCPT	D	8	Permit records--SPRD/DSL
5	APPROVED	L	1	Permit records--SPRD/DSL
6	DATE_DECIS	D	8	Permit records--SPRD/DSL
7	MULT_PARC	L	1	Permit records--SPRD/DSL
8	CONTIG	L	1	Permit records--SPRD/DSL
9	NUM_RE_PER	N	2	Permit records--SPRD/DSL
10	PROJ_ID	C	30	Permit records--SPRD/DSL
11	APPLICANT	C	20	Permit records--SPRD/DSL
12	APPL_ST_AD	C	20	Permit records--SPRD/DSL
13	APPL_CI	C	15	Permit records--SPRD/DSL
14	APP_ST	C	2	Permit records--SPRD/DSL
15	APP_ZIP	N	5	Permit records--SPRD/DSL
16	APP_ZIP4	N	4	Permit records--SPRD/DSL
17	ENGINEER	C	4	Permit records--SPRD/DSL
18	GEOLOGIST	C	4	Permit records--SPRD/DSL
19	CONTRACTO	C	4	Permit records--SPRD/DSL
20	PARC_N	C	7	Permit records--SPRD/DSL
21	PARC_S	C	7	Permit records--SPRD/DSL
22	NEED_HAZ1	C	4	Permit records--SPRD/DSL
23	NEED_HAZ2	C	4	Permit records--SPRD/DSL
24	NEED_HAZ3	C	4	Permit records--SPRD/DSL
25	PROP_THRT1	C	4	Permit records--SPRD/DSL
26	PROP_THRT1	C	4	Permit records--SPRD/DSL
27	SP_ALTERN1	C	4	Analysis
28	SP_ALTERN2	C	4	Analysis
29	COMMENTS	C	100	Permit records/Analysis

APPENDIX C

JOINT PERMIT APPLICATION FORMS
1992 Version

JUN 18 1992

OREGON STATE PARKS
OCEAN BEACH PROGRAM

IN
Clatsop, Tillamook and
Lincoln Counties; contact:

Region 2 State Parks Office
3600 3rd St
Tillamook OR 97141
Phone: 842-5501

IN
Lane, Douglas, Coos and
Curry Counties; contact:

Region 3 State Parks Office
365 N 4th St Suite A
Coos Bay OR 97420
Phone: 269-9410

Dear Applicant:

Prior to making an improvement or removal of a natural product on the ocean shore, you may be required to obtain a permit from the Oregon Division of State Lands (Division) and/or the U.S. Army Corps of Engineers (Corps) and Oregon State Parks Department (Parks). The Corps of Engineers requires that you obtain a permit prior to placing any structure in navigable waters of the United States. **Accordingly, this joint application should be completed and sent to Parks at the appropriate address above.** Parks will forward the application to other agencies, as appropriate.

Attached are sample drawings, helpful information, and a joint application for permit. Your submitted application should be accompanied by plans and drawings which clearly illustrate the proposed project from a plan and cross section viewpoint. An application will **not be considered complete** if plans and drawings are omitted. Upon receipt of your application, Parks will review it for completeness and request additional information if needed.

Your city or county planning department has a land use permitting requirement, so you should start the local permit process immediately. The state will not issue a permit for a project which is inconsistent with the local land use plan.

Additional information regarding the joint permit program, including Parks Beach Improvement Standards, the Division's removal-fill statute and administrative rules are available on request from the appropriate agency.

If you need information or assistance regarding the application, you are encouraged to contact Oregon State Parks at the address or phone number noted above depending upon where the subject property is located.

PB:jn
OCEANBEA.TXT #2
6/1/92

GENERAL INSTRUCTIONS

Please type or legibly print the application. Use black ink or pencil. (Do not use blue ink.)

Answer each question thoroughly. Incomplete applications will be returned.

FORM COMPLETION INSTRUCTIONS

1. *Applicant Information*

   (a) Enter applicant's name and official mailing address, business and home phone numbers.

   (b) If agent or contractor is known, enter name and address, business and home phone numbers.

   (c) If property is owned by another party, enter their name, address, business and home phone numbers, and attach letter of authorization to do the proposed work.

2. *Project Location* - enter location of property where the project is to take place.

   (a) Site address, city, county.

   (b) Township, Range, Section(s), Sub-division or Plat, Lot No. If you are unsure of the legal description, see your county assessor's or planning office.

3. *Proposed Project Information*

   (a) Indicate the type of activity and write a brief project description, e.g., bank protection, sand removal, installation of conduit, cabl, or pipeline.

   (b) Estimate the volume of fill material proposed, and describe the type of fill material by checking the appropriate box. If more than one box applies, specify quantity for each type of material to be used as fill.

   (c) Estimate or measure the area of proposed fill.

   (d) Estimate the volume of removal material proposed, and describe the type of removal material by checking the appropriate box. If more than one box applies, specify quantity for each type of material to be removed.

   (e) Estimate or measure the area of proposed dredging or excavation and give the proposed dredge dimensions.

   (f) Dates you want to begin work and expect work to be complete.

   (g) Describe any discharges resulting from operation of the project, e.g., storm drains, sewer outfall, etc.

4. *Proposed Project Purpose and Description*

   (a) Describe the project purpose and the public need for the project.

(b) Describe the project and its proposed use, including: the construction method to be used; equipment to be used; the purpose(s) of the proposed facility; the size of the area to be filled or excavated; the type, quantity, and the source of fill material; and facilities for handling construction. Specify the amount and type of vegetation that will be disturbed, adjacent land uses, and any other pertinent information. USE A SEPARATE SHEET(S) OF PAPER, IF NECESSARY.

5. ***Project Impacts and Alternatives***

(a) Are other methods available to accomplish the same end result? If so, list alternatives considered.

(b) Describe what measures are being used to minimize impacts to the ocean shore. Please explain in detail your plans to restore the area to its natural condition.

6. ***Miscellaneous Information***

(a) Enter adjoining property owners' mailing address; list owners of all properties which abut the applicant's property.

(b) List other governmental authorizations that or which have been requested or received.

7. ***City/County Planning Department Information***

This section is to be completed by the local planning office. The application will not be accepted as complete without signature from the local planning official.

8. ***Coastal Zone Certification***

This certification must be signed by the applicant for all projects in the coastal zone (West of the Coast Range Summit). Assistance can be provided by your local planning official or the Department of Land Conservation and Development (telephone 373-0050).

9. ***Read carefully before signing.*** Should you have any questions, please contact the Oregon Department of Parks and Recreation in Tillamook, 842-5501 or Coos Bay, 269-9410 depending upon where the subject property is located.

PB:jn
OCEANBEA.TXT #2
5/21/92

U S Army Corps of Engineers
Portland District

JOINT PERMIT APPLICATION FORM

THIS APPLICATION WILL MEET THE REQUIREMENTS OF BOTH AGENCIES

STATE OF OREGON 1859

AGENCIES WILL ASSIGN NUMBERS

Corps Action ID Number ____________ Oregon Division of State Lands Number ____________

Date Received Date Received

District Engineer
ATTN: CENPP-PE-RP
P O Box 2946
Portland, OR 97208-2946
503/326-7730

OREGON STATE PARKS
OCEAN SHORE PERMIT
APPLICATION
BA ____________
DATE RECEIVED ____________

State of Oregon
Division of State Lands
775 Summer Street NE
Salem OR 97310
503/378-3805

① Applicant Name and Address — business phone # — home phone #

O Authorized Agent
O Contractor
Name and Address — business phone # — home phone #

Property Owner (if different than applicant) Name and Address — business phone # — home phone #

② PROJECT LOCATION

Street, Road or other descriptive location

Legal Description: Quarter Section Township Range

In or Near (City or Town) County

Tax Map # Tax Lot #

Waterway River Mile

Latitude Longitude

Is consent to enter property granted to the Corps and the Division of State Lands? O Yes O No

③ PROPOSED PROJECT INFORMATION

Activity Type: O Fill O Excavation (removal) O In-Water Structure O Maintain/Repair an Existing Structure

Brief Description: ____________

Fill will involve ____________ cubic yards annually and/or ____________ cubic yards for the total project

Fill will be O Riprap O Rock O Gravel O Sand O Silt O Clay O Organics O Other

Fill impact Area is ____________ Acres: ____________ length: ____________ width: ____________ depth

Removal will involve ____________ cubic yards annually and/or ____________ cubic yards for the total project

Removal will be O Riprap O Rock O Gravel O Sand O Silt O Clay O Organics O Other ____________

Removal impact Area is ____________ Acres: ____________ length: ____________ width: ____________ depth

Estimated Start Date ____________ Estimated Completion Date ____________

Will any material, construction debris, runoff, etc. enter a wetland or waterway? O Yes O No

If yes, describe the type of discharge and show the discharge location on the site plan.

④

Proposed Project Purpose & Description

Project Purpose and Need:

Project Description:

How many project drawing sheets are included with this application? ____________

NOTE: A complete application must include drawings and a location map submitted on separate $8^1/_2$ X 11 sheets.

⑤

Project Impacts and Alternatives

Describe alternative sites and project designs that were considered to avoid impacts to the waterway or wetland.

Describe what measures you will use (before and after construction) to minimize impacts to the waterway or wetland.

NOTE: If necessary, use additional sheets.

⑥

Miscellaneous Information

Adjoining Property Owners and Their Addresses and Phone Numbers

List all other approvals or certificates received, applied for, or denied that are related to this application.

Issuing Agency	Type of Approval	Identification Number	Dates of application / Approval / Denial

⑦

City / County Planning Department Affidavit

(to be completed by local planning official)

○ This project is not regulated by the local comprehensive plan and zoning ordinance.

○ This project has been reviewed and is consistent with the local comprehensive plan and zoning ordinance.

○ This project has been reviewed and is not consistent with the local comprehensive plan and zoning ordinance.

○ Consistency of this project with the local planning ordinance cannot be determined until the following local approval(s) are obtained:

○ Conditional Use Approval ○ Development Permit
○ Plan Amendment ○ Zone Change
○ Other ____________

An application ○ has ○ has not been made for local approvals checked above.

Signature (of local planning official) ____ Title ____ City / County ____ Date ____

⑧

Coastal Zone Certification

If the proposed activity described in your permit application is within the Oregon coastal zone, the following certification is required before your application can be processed. A public notice will be issued with the certification statement which will be forwarded to the Oregon Department of Land Conservation and Development for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program, contact the department at 1175 Court Street NE, Salem, Oregon 97310 or call 503/373-0050.

Certification Statement

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Applicant Signature ____ Date ____

⑨

Signature for Joint Application

(REQUIRED)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that local permits may be required before the state removal-fill permit is issued. I understand that payment of the required state processing fee does not guarantee permit issuance.

Applicant Signature ____ Date ____

I certify that I may act as the duly authorized agent of the applicant.

Authorized Agent Signature ____ Date ____

JOINT PERMIT APPLICATION FORMS
1989 Version

December 28, 1989

Mr. John Eggner
Surfrider Motel
P.O. Box 219
Depoe Bay, OR 97341

Dear Mr. Eggner,

Thank you for contacting State Parks to request an application to build a riprap revetment. Enclosed with the application form are a vegetative stabilization diagram, a riprap diagram, and a copy of the Beach Improvement standards used to evaluate a proposal.

If this proposal exceeds an addition of 50 cubic yards of material, it will also require approval from the Division of State Lands. The application I have sent will serve for both agencies.

Please complete the application thoroughly and carefully. In section 2. the numbers entered into the Ocean Shore Recreation Aerial Map Reference can be obtained from aerial photos which I have included. In Section 4., items a. - f. should be addressed with specific information. Included should be a description of the erosion occurring at the site; the type of adjacent revetments, if any; what alternatives have been considered; and what revegetation measures will be taken. The last segment of Section 4. requests documentation of ownership and a legal description of the property; these need to be part of the application. Section 6. should be completed by the Lincoln County Planning Department.

Please include an evaluation of the active and potential erosion rate of your property. Document the alternative solutions considered to alleviate your situation. Refer to the Beach Improvement standards when preparing your application.

As soon as a complete application is received by this office we will forward the request to the Division of State Lands. The proposed project site will be posted for Public Notice for 30 days, in accordance with State Law. The Division of State Lands will circulate the proposal to affected agencies and a joint decision will be made on your project. If no comments are received or problems develop, a permit could be issued within 45 days.

Please contact me at 842-5501 with any questions.

Sincerely,

Sallie Jacobsen
Region Coordinator

cc: Walker, Bond
3--EGGN.RIP

JOINT APPLICATION FOR PERMIT
OCEAN SHORE CONSTRUCTION
STATE OF OREGON

WHEREAS Parks and Recreation Department under the authority of ORS 390.605 through 390.770 requires a permit to construct any improvement in the ocean shore area and the Division of State Lands under the authority of ORS 196.800 through 196.990 requires a permit to place fill or remove materials from the bed and banks of the waters of the State. - THIS APPLICATION WILL MEET THE REQUIREMENTS OF BOTH AGENCIES.

Parks & Recreation Dept. 525 Trade Street SE Salem, OR 97310 (503) 378-5020 Permit No. ______ Date ______	Division of State Lands Environmental Permits 775 Summer St. NE Salem, OR 97310 (503) 378-3805 Permit No. ______ Date ______
1. APPLICANT (Mailing Address)	AGENT/CONTRACTOR
Name	Name
Address	Address
City State Zip	City State Zip
Telephone ( )	Telephone ( )
2. PROJECT LOCATION (Address)	Dept. of Parks and Recreation Ocean Shore Aerial Map Reference
Address	
City State Zip	Section Township Range
County	Lot Block
3. ADJACENT PROPERTY OWNERS	
Name	Name
Address	Address
City State Zip	City State Zip

4. PROJECT INFORMATION

a. Type of Project: ☐ Riprap ☐ Seawall ☐ Excavation ☐ Fill ☐ Outfall ☐ Other ______

b. Amount of Material
☐ Sand ______ cubic yards
☐ Riprap ______ cubic yards
☐ Other ______ cubic yards

c. Evidence of recent erosion (describe and show on drawings):

d. Adjacent shore conditions (describe conditions on adjacent properties):

e. Alternatives Considered (describe non-structural methods attempted):

f. Site Restoration (describe revegetation measures to be taken):

5. ADDITIONAL INFORMATION, DRAWINGS, REPORTS

The following items are to be included with the permit application on 8-1/2 X 11" paper:

a. Assessors map or copy of deeds or other documents showing ownership and legal description.
b. Plot plan showing detailed location of proposed project in relation to the owner's property boundaries and beach zone line.
c. Detailed plans or drawings, including cross sections with elevations, showing development proposed.
d. At the discretion of State Parks or State Lands staff, it may be necessary to submit additional materials or reports prepared by engineering geologists or others describing the need for the proposed project.

NOTE: Failure to provide the required information will delay permit evaluation. Data on beach zone line available from the Region Parks Office. This application will be reviewed for consistency with the Statewide Planning Goals and/or acknowledged local comprehensive plan and also against the Beach Improvement Standards and comments received from DSL notification review.

6. CONSTRUCTION SCHEDULE

Estimated date project to start __________________ Estimated date project to be completed __________________

7. CITY/COUNTY PLANNING DEPARTMENT AFFIDAVIT (to be completed by local planning official)

I CERTIFY THAT:

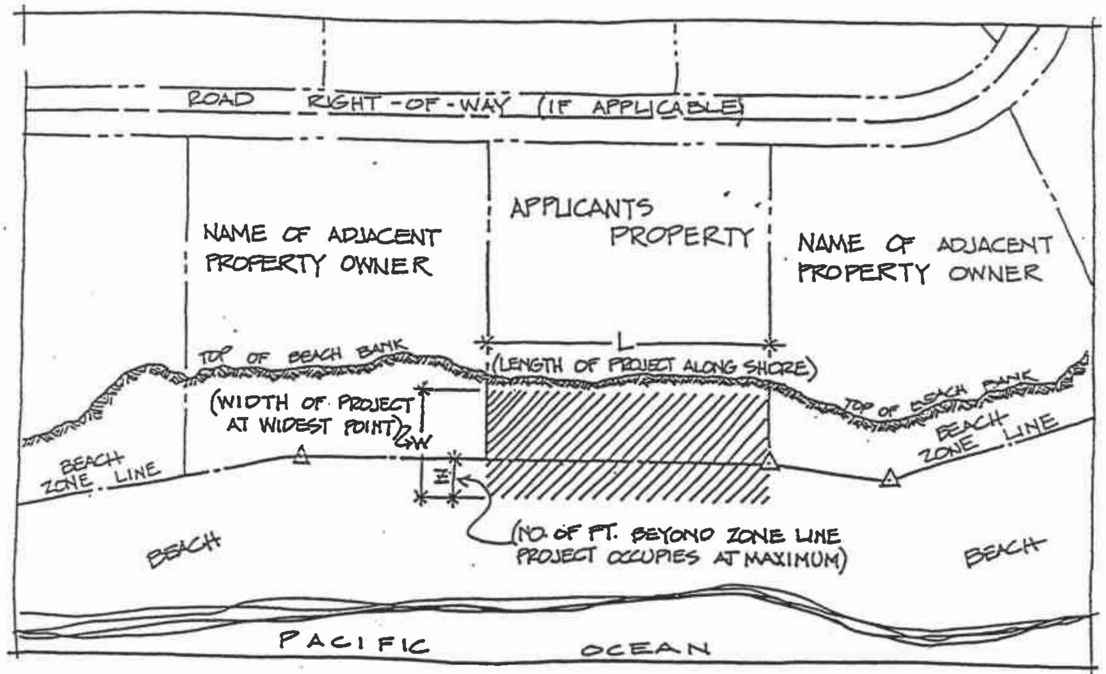
☐ This project is not regulated by the local comprehensive plan and zoning ordinance.
☐ This project has been reviewed and is consistent with the local comprehensive plan and zoning ordinance.
☐ This project has been reviewed and is not consistent with the local comprehensive plan and zoning ordinance.
☐ Consistency of this project with the local planning ordinance cannot be determined until the following local approvals are obtained:
☐ Conditional Use Approval ☐ Development Permit ☐ Plan Ammendment ☐ Zone Change ☐ Other __________
An application ☐ has ☐ has not been made for local approvals checked above.

____
Signature Title Date

8. SIGNATURE

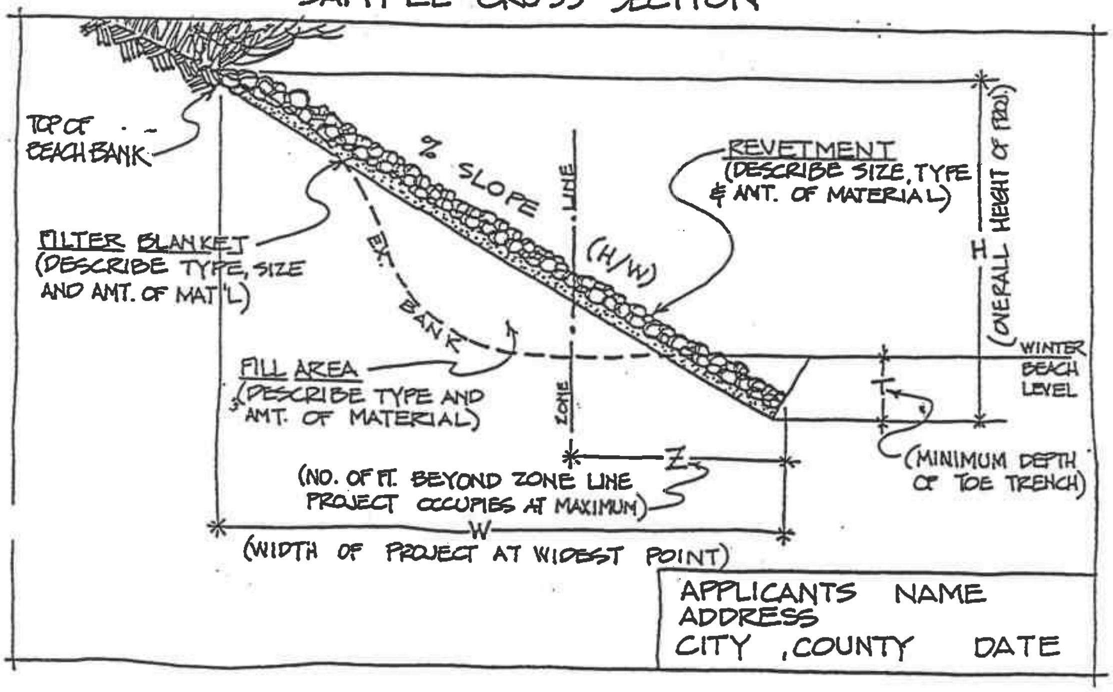
Application is hereby made for permit to authorize the activities described herin. I certify that I am familiar with the information contained in this application, and to the best of my knowledge and belief such information is true and accurate and in compliance with the Oregon Coastal Management Program. I certify that I have the authority to undertake the activities proposed in the application. I understand that the granting of other permits by local, state or federal agencies does not release me from the requirement of obtaining the permit requested herein before commencing the project.

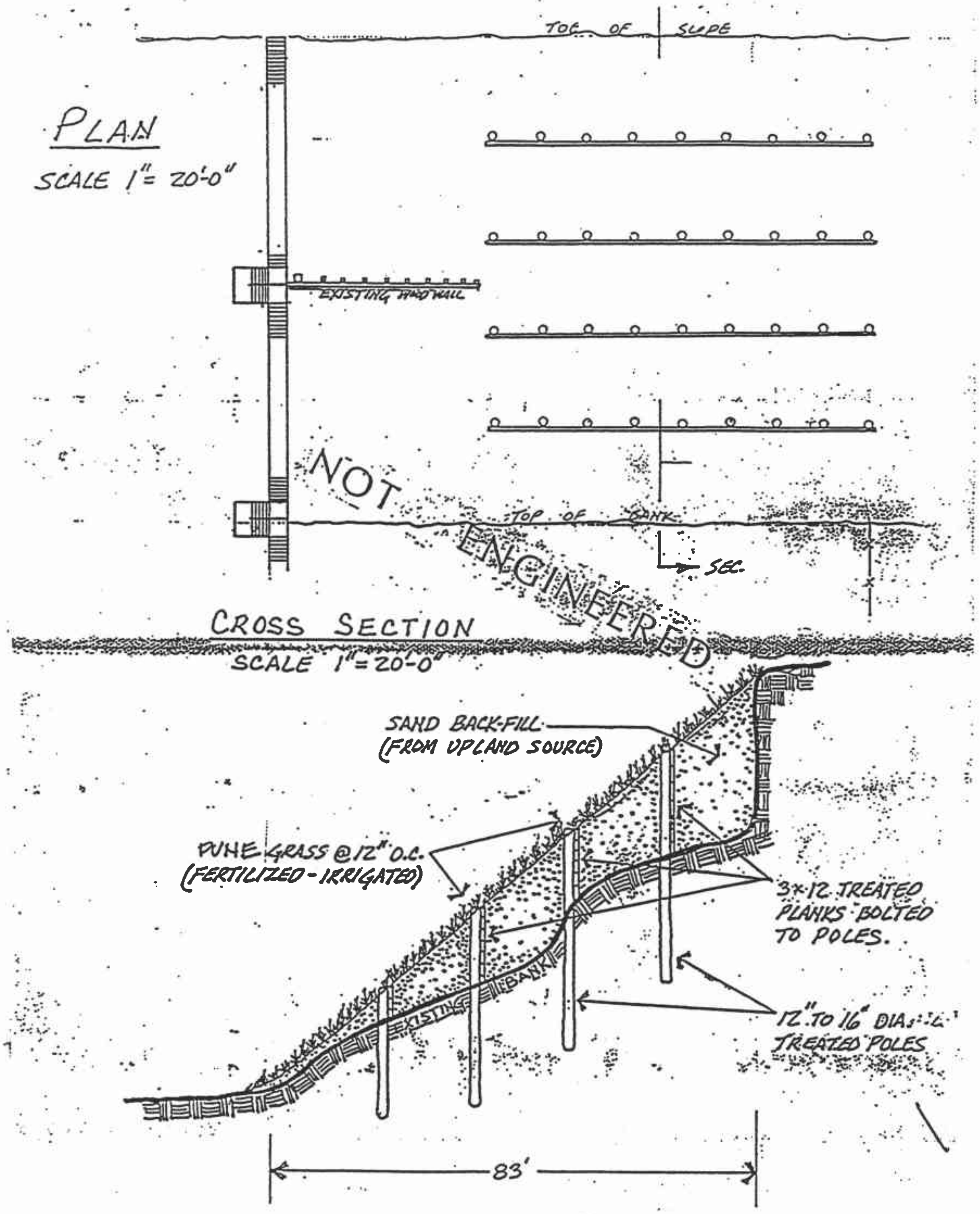
____
Applicant's Signature Date



SAMPLE PLAN VIEW

SAMPLE CROSS SECTION



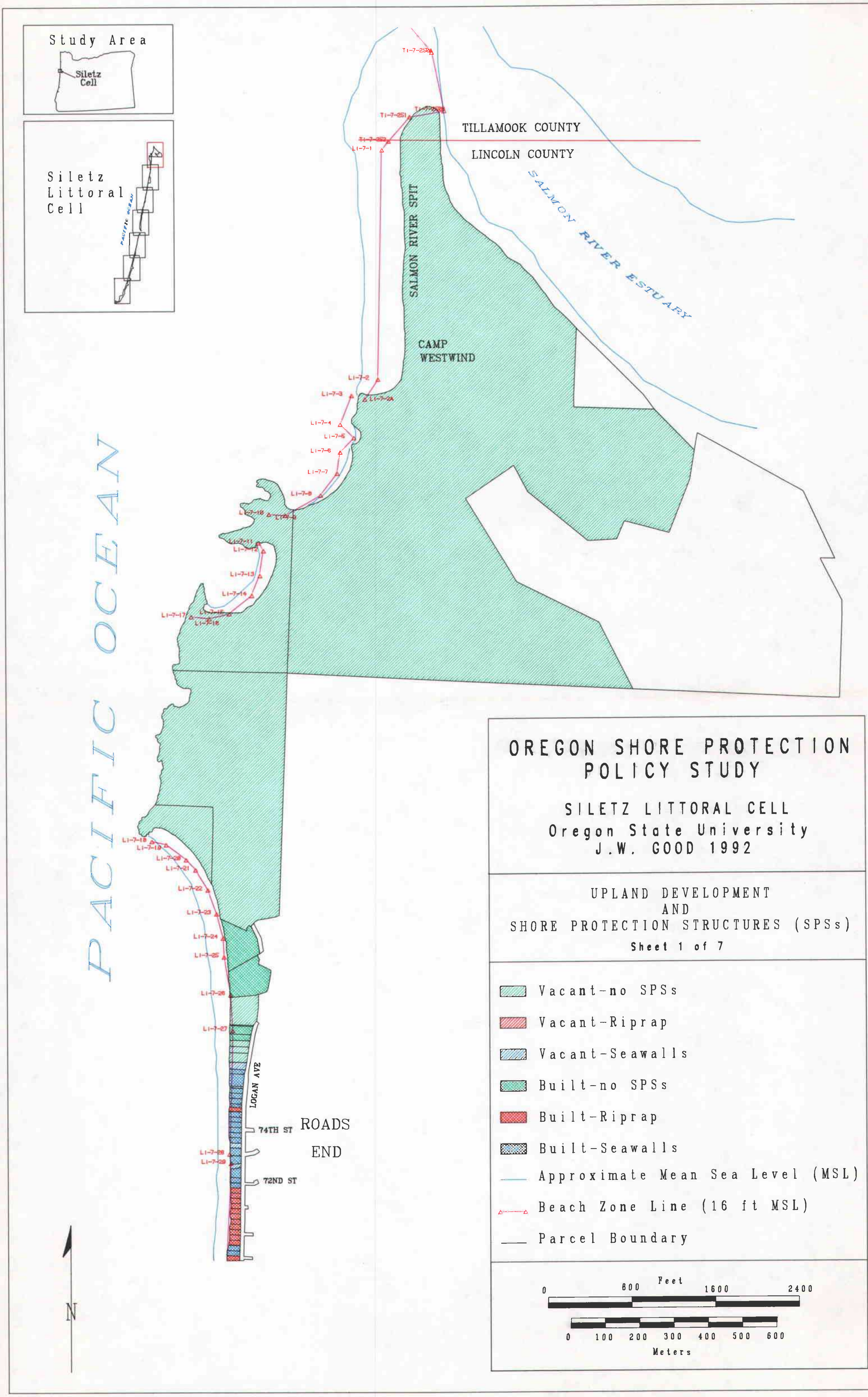


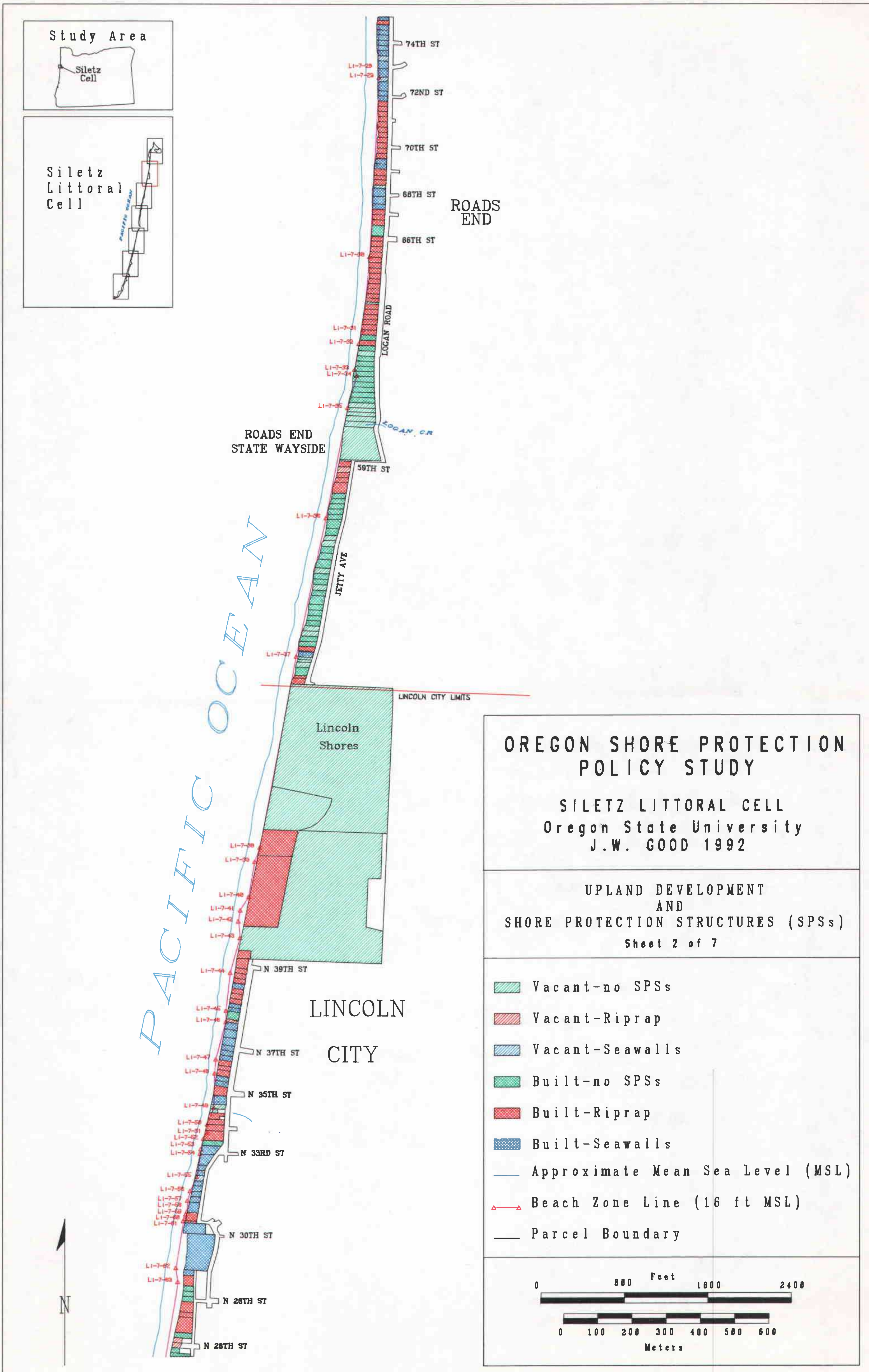
TOP OF SLOPE
PLAN
SCALE 1" = 20'-0"
EXISTING HEAD WALL
NOT ENGINEERED
TOP OF BANK
SEC.
CROSS SECTION
SCALE 1" = 20'-0"
SAND BACK-FILL
(FROM UPLAND SOURCE)
DUNE GRASS @12" O.C.
(FERTILIZED - IRRIGATED)
3×12 TREATED
PLANKS BOLTED
TO POLES.
EXISTING BANK
12" TO 16" DIA.
TREATED POLES
83'

APPENDIX D

UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (GIS MAP SHEETS 1-7 OF 7)

(see map envelope)


Study Area
Siletz Cell
Siletz Littoral Cell
PACIFIC OCEAN
TILLAMOOK COUNTY
LINCOLN COUNTY
SALMON RIVER SPIT
SALMON RIVER ESTUARY
CAMP WESTWIND
LOGAN AVE
74TH ST
ROADS END
72ND ST
N
OREGON SHORE PROTECTION POLICY STUDY
SILETZ LITTORAL CELL
Oregon State University
J.W. GOOD 1992
UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)
Sheet 1 of 7
Vacant-no SPSs
Vacant-Riprap
Vacant-Seawalls
Built-no SPSs
Built-Riprap
Built-Seawalls
Approximate Mean Sea Level (MSL)
Beach Zone Line (16 ft MSL)
Parcel Boundary
Feet
0
800
1600
2400
0
100
200
300
400
500
600
Meters



Study Area
Siletz Cell
Siletz Littoral Cell
74TH ST
72ND ST
70TH ST
68TH ST
66TH ST
ROADS END
LOGAN ROAD
LOGAN CR
ROADS END STATE WAYSIDE
59TH ST
JETTY AVE
PACIFIC OCEAN
LINCOLN CITY LIMITS
Lincoln Shores
N 39TH ST
LINCOLN CITY
N 37TH ST
N 35TH ST
N 33RD ST
N 30TH ST
N 28TH ST
N 26TH ST
N
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Oregon State University
J.W. GOOD 1992
UPLAND DEVELOPMENT
AND
SHORE PROTECTION STRUCTURES (SPSs)
Sheet 2 of 7
Vacant-no SPSs
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Vacant-Seawalls
Built-no SPSs
Built-Riprap
Built-Seawalls
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Parcel Boundary
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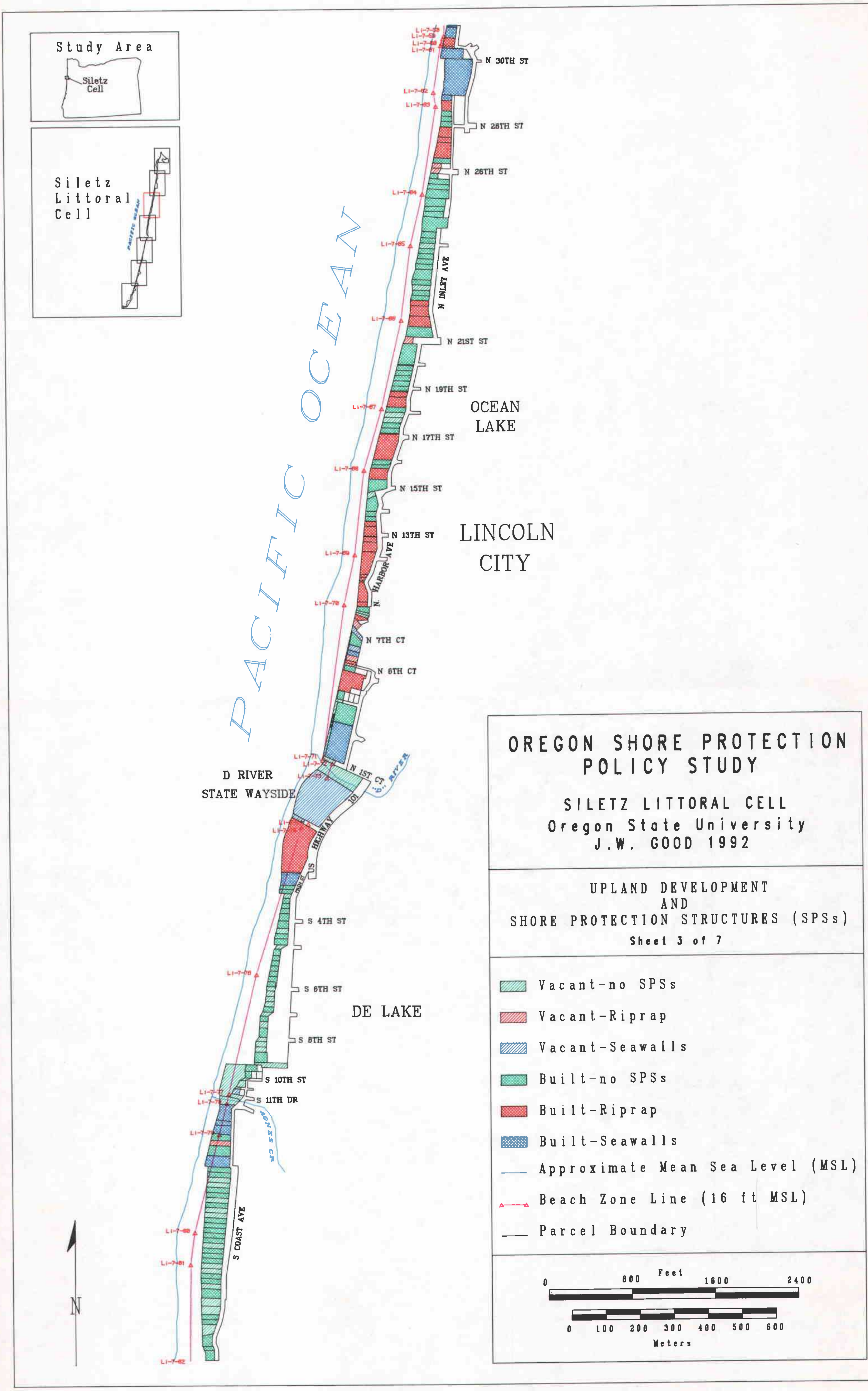
Meters


Study Area
Siletz Cell
Siletz Littoral Cell
PACIFIC OCEAN
N 30TH ST
N 28TH ST
N 26TH ST
N INLET AVE
N 21ST ST
N 19TH ST
OCEAN LAKE
N 17TH ST
N 15TH ST
N 13TH ST
LINCOLN CITY
N. HARBOR AVE
N 7TH CT
N 6TH CT
N 1ST CT
"D" RIVER
D RIVER STATE WAYSIDE
US HIGHWAY 101
S 4TH ST
S 6TH ST
DE LAKE
S 8TH ST
S 10TH ST
S 11TH DR
S COAST AVE
N
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UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)
Sheet 3 of 7
Vacant-no SPSs
Vacant-Riprap
Vacant-Seawalls
Built-no SPSs
Built-Riprap
Built-Seawalls
Approximate Mean Sea Level (MSL)
Beach Zone Line (16 ft MSL)
Parcel Boundary
Feet
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1600
2400
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100
200
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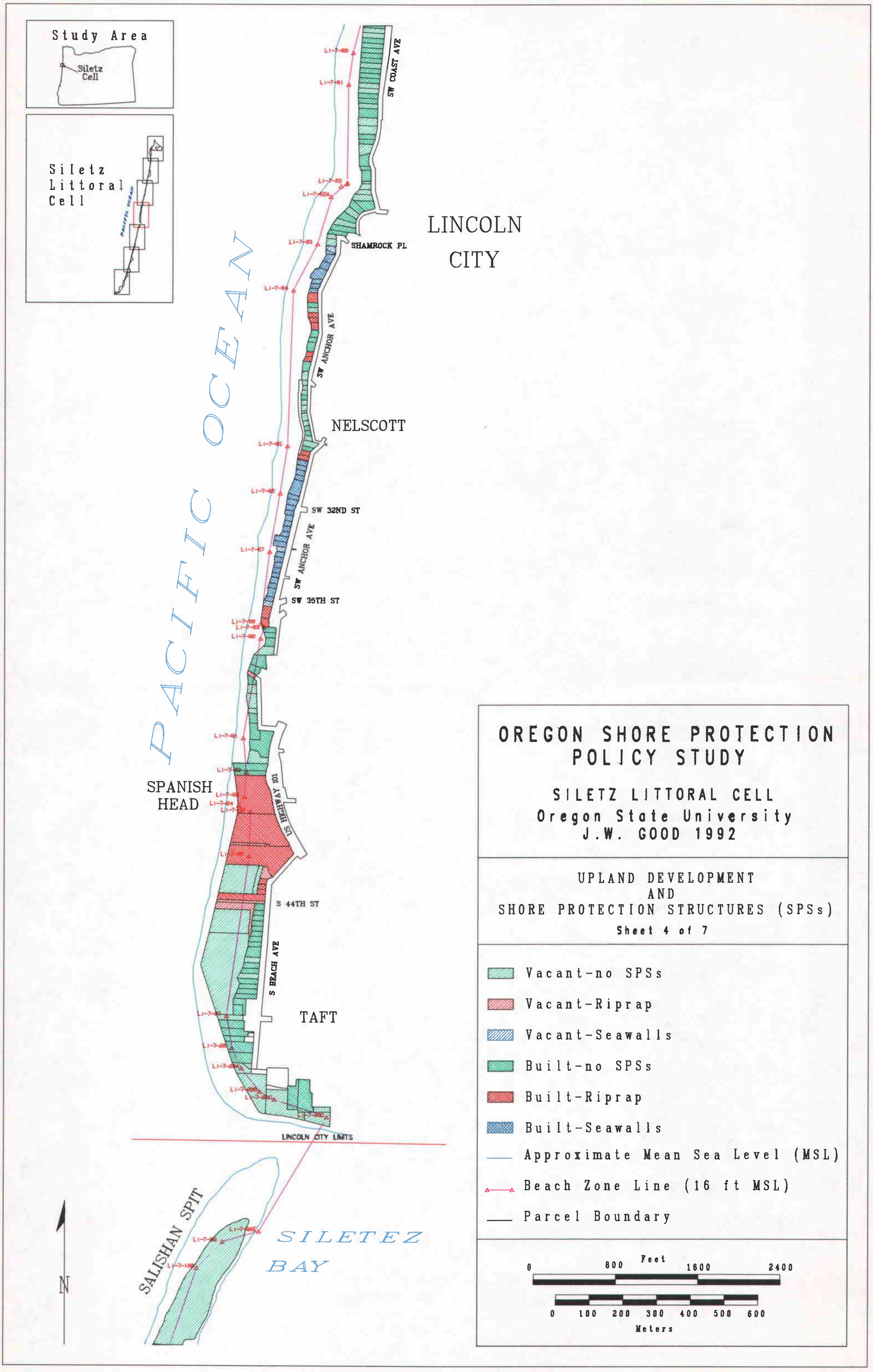
Meters


Study Area
Siletz Cell
Siletz Littoral Cell
PACIFIC OCEAN
LINCOLN CITY
SW COAST AVE
SHAMROCK PL
SW ANCHOR AVE
NELSCOTT
SW 32ND ST
SW ANCHOR AVE
SW 35TH ST
US HIGHWAY 101
SPANISH HEAD
S 44TH ST
S BEACH AVE
TAFT
LINCOLN CITY LIMITS
SALISHAN SPIT
SILETEZ BAY
N
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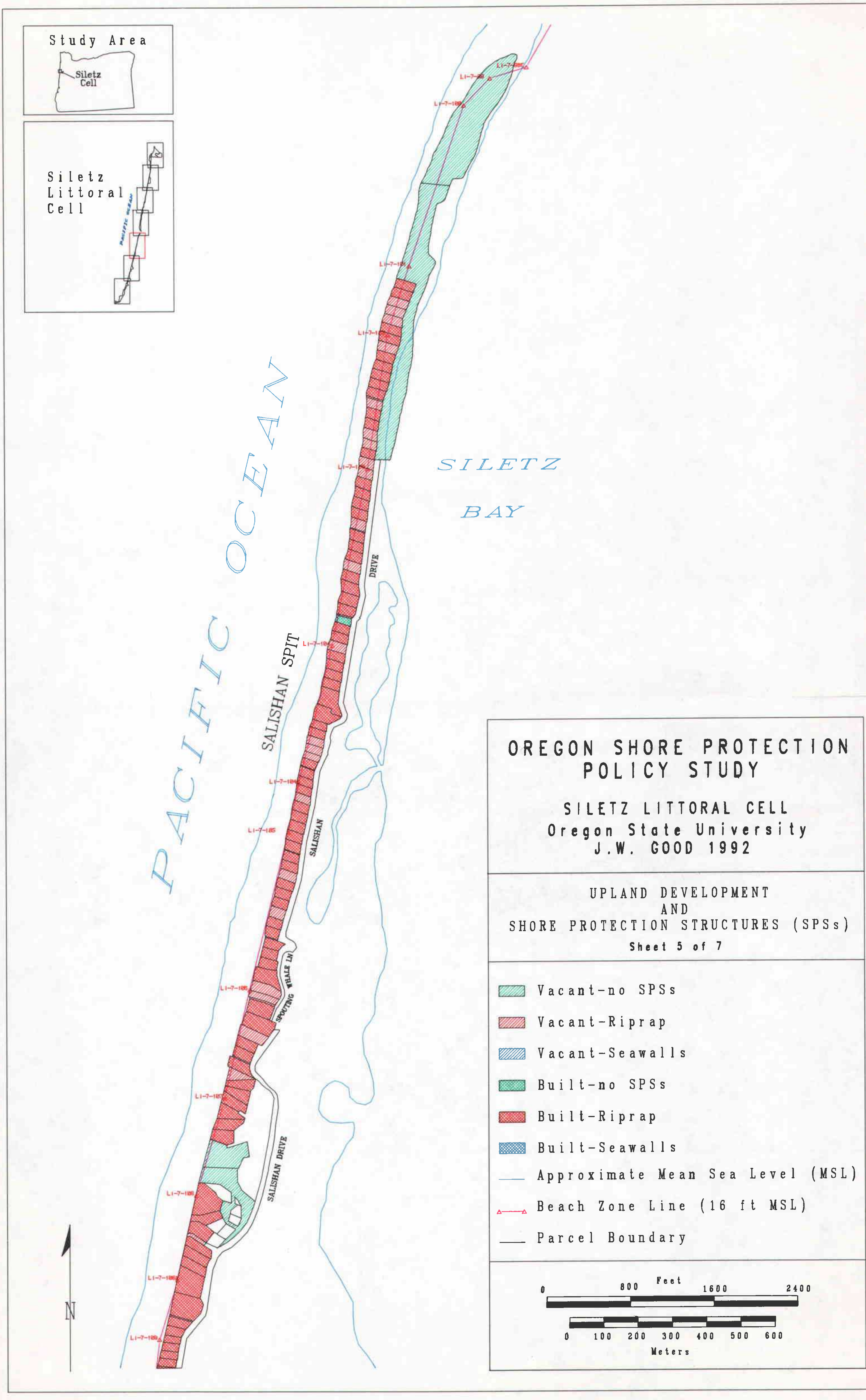
UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)
Sheet 4 of 7
Vacant-no SPSs
Vacant-Riprap
Vacant-Seawalls
Built-no SPSs
Built-Riprap
Built-Seawalls
Approximate Mean Sea Level (MSL)
Beach Zone Line (16 ft MSL)
Parcel Boundary
Feet
0 800 1600 2400
0 100 200 300 400 500 600
Meters


Study Area
Siletz Cell
Siletz Littoral Cell
PACIFIC OCEAN
PACIFIC OCEAN
SILETZ BAY
SALISHAN SPIT
SALISHAN DRIVE
SPOUTING WHALE LN
SALISHAN DRIVE
N
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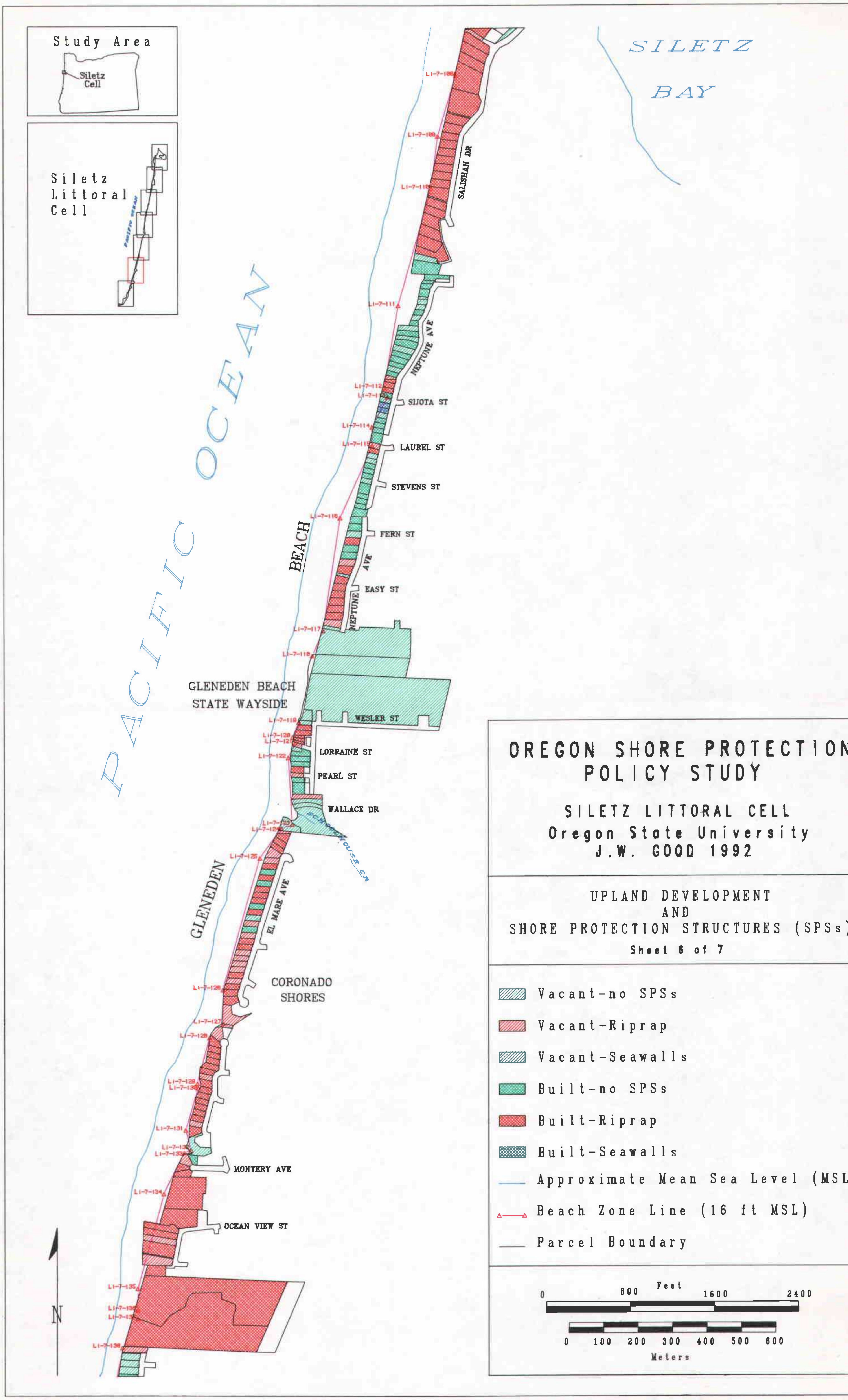
UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)
Sheet 5 of 7
Vacant-no SPSs
Vacant-Riprap
Vacant-Seawalls
Built-no SPSs
Built-Riprap
Built-Seawalls
Approximate Mean Sea Level (MSL)
Beach Zone Line (16 ft MSL)
Parcel Boundary
Feet
0 800 1600 2400
0 100 200 300 400 500 600
Meters



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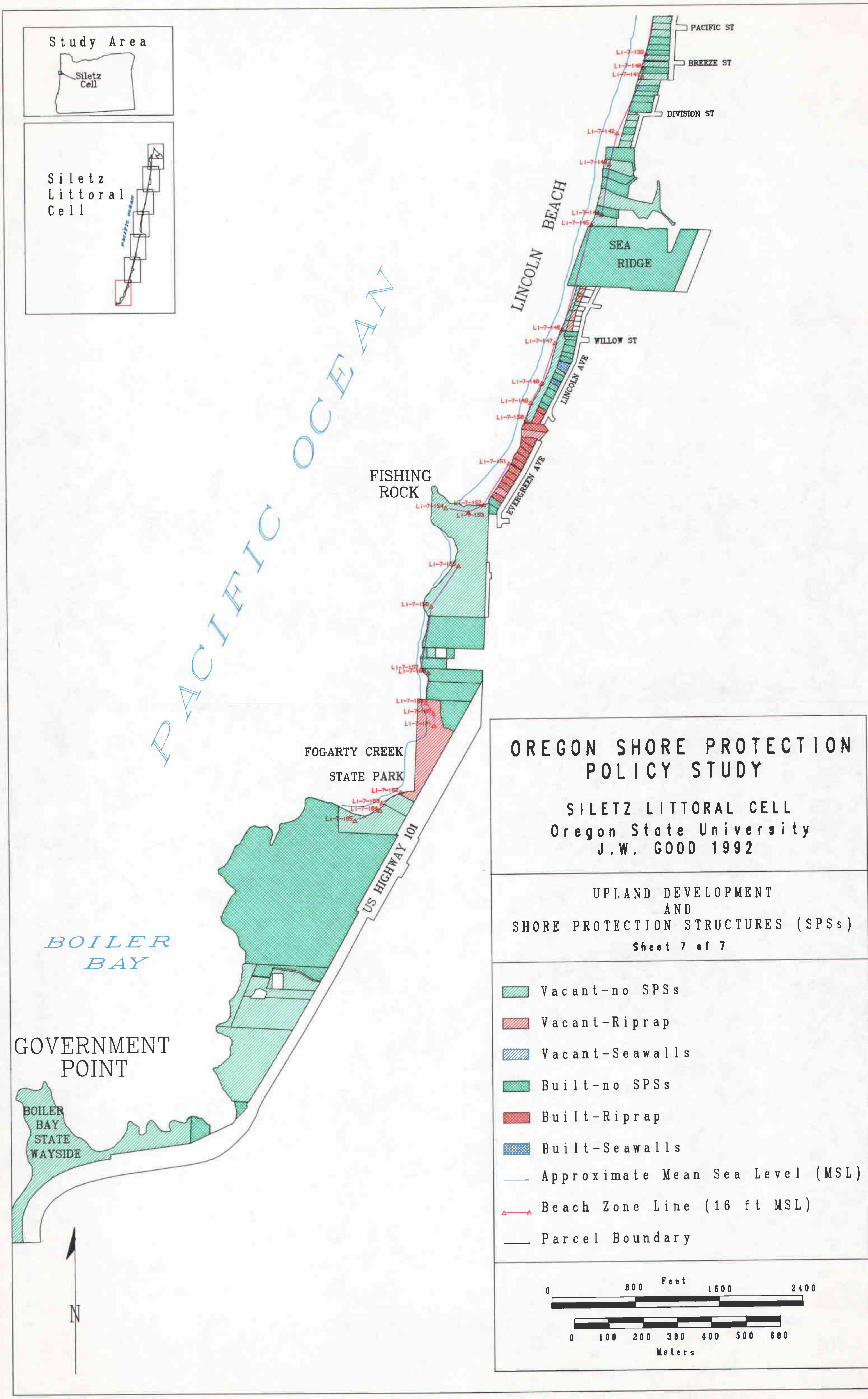
UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)

Sheet 6 of 7

- Vacant-no SPSs
- Vacant-Riprap
- Vacant-Seawalls
- Built-no SPSs
- Built-Riprap
- Built-Seawalls
- Approximate Mean Sea Level (MSL)
- Beach Zone Line (16 ft MSL)
- Parcel Boundary

Feet: 0 800 1600 2400

Meters: 0 100 200 300 400 500 600


Study Area
Siletz Cell
Siletz Littoral Cell
PACIFIC OCEAN
PACIFIC ST
BREEZE ST
DIVISION ST
LINCOLN BEACH
SEA RIDGE
WILLOW ST
LINCOLN AVE
EVERGREEN AVE
FISHING ROCK
FOGARTY CREEK STATE PARK
US HIGHWAY 101
BOILER BAY
GOVERNMENT POINT
BOILER BAY STATE WAYSIDE
N
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UPLAND DEVELOPMENT AND SHORE PROTECTION STRUCTURES (SPSs)
Sheet 7 of 7
Vacant-no SPSs
Vacant-Riprap
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Built-no SPSs
Built-Riprap
Built-Seawalls
Approximate Mean Sea Level (MSL)
Beach Zone Line (16 ft MSL)
Parcel Boundary
Feet
0
800
1600
2400
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100
200
300
400
500
600
Meters