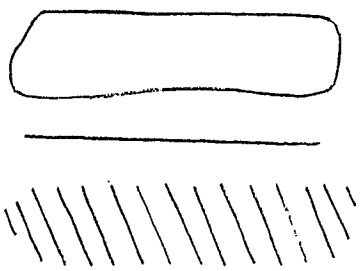
MAPS 1-25

Vehicle Status of the Ocean Shore,

Areas of Present ORV Use, and

Areas Potentially Suitable for ORV Designation by County

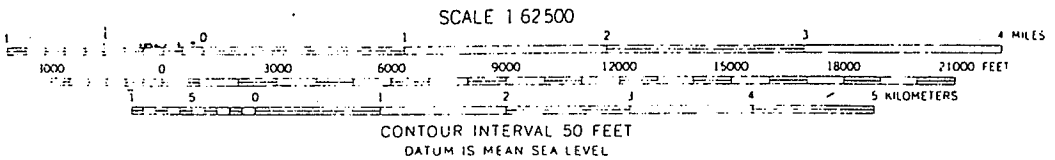
K E Y*



Enclosed areas indicate general ORV use

A single line indicates an ORV trail

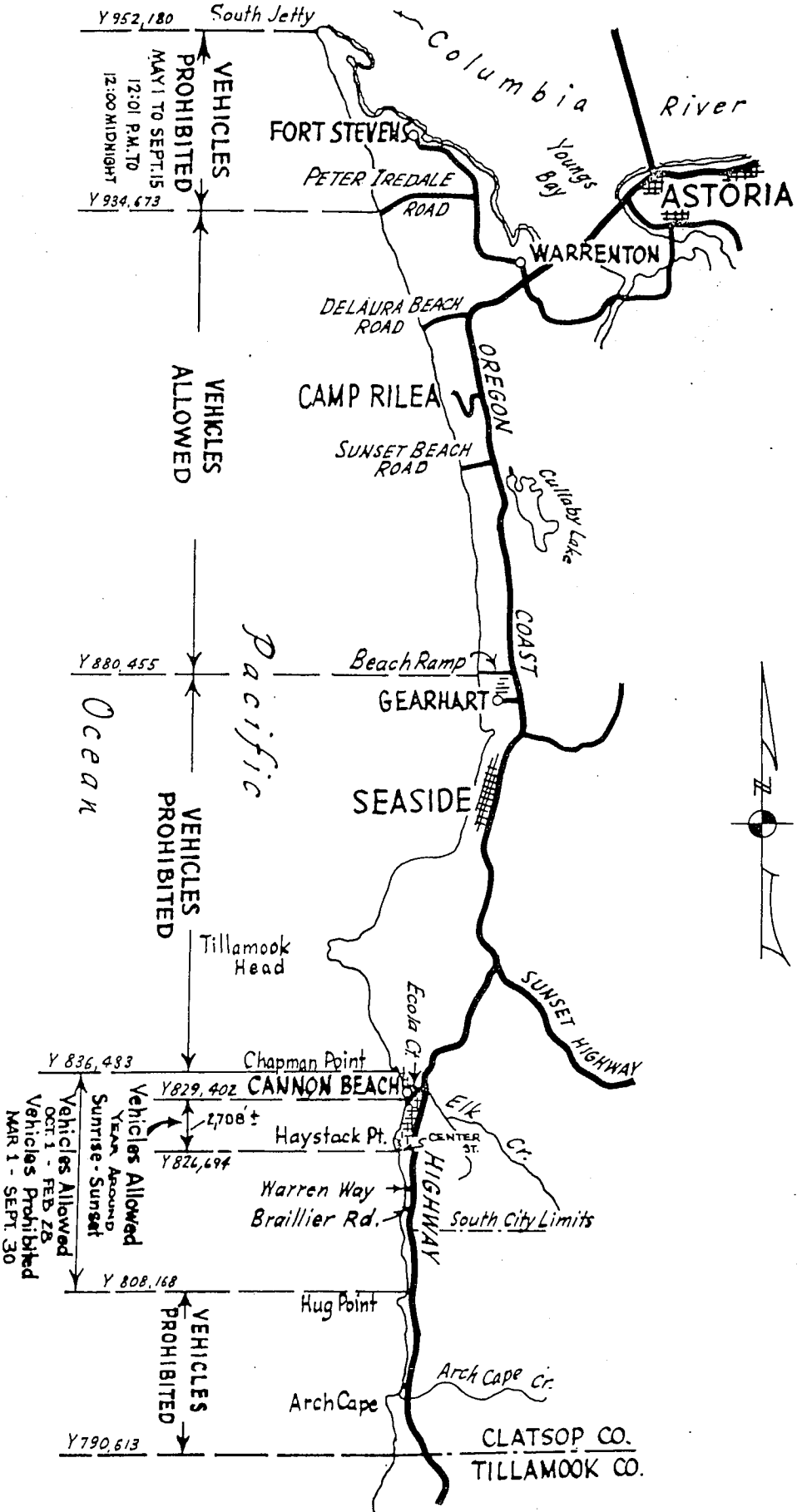
Crosshatching indicates areas potentially suitable for an ORV designation



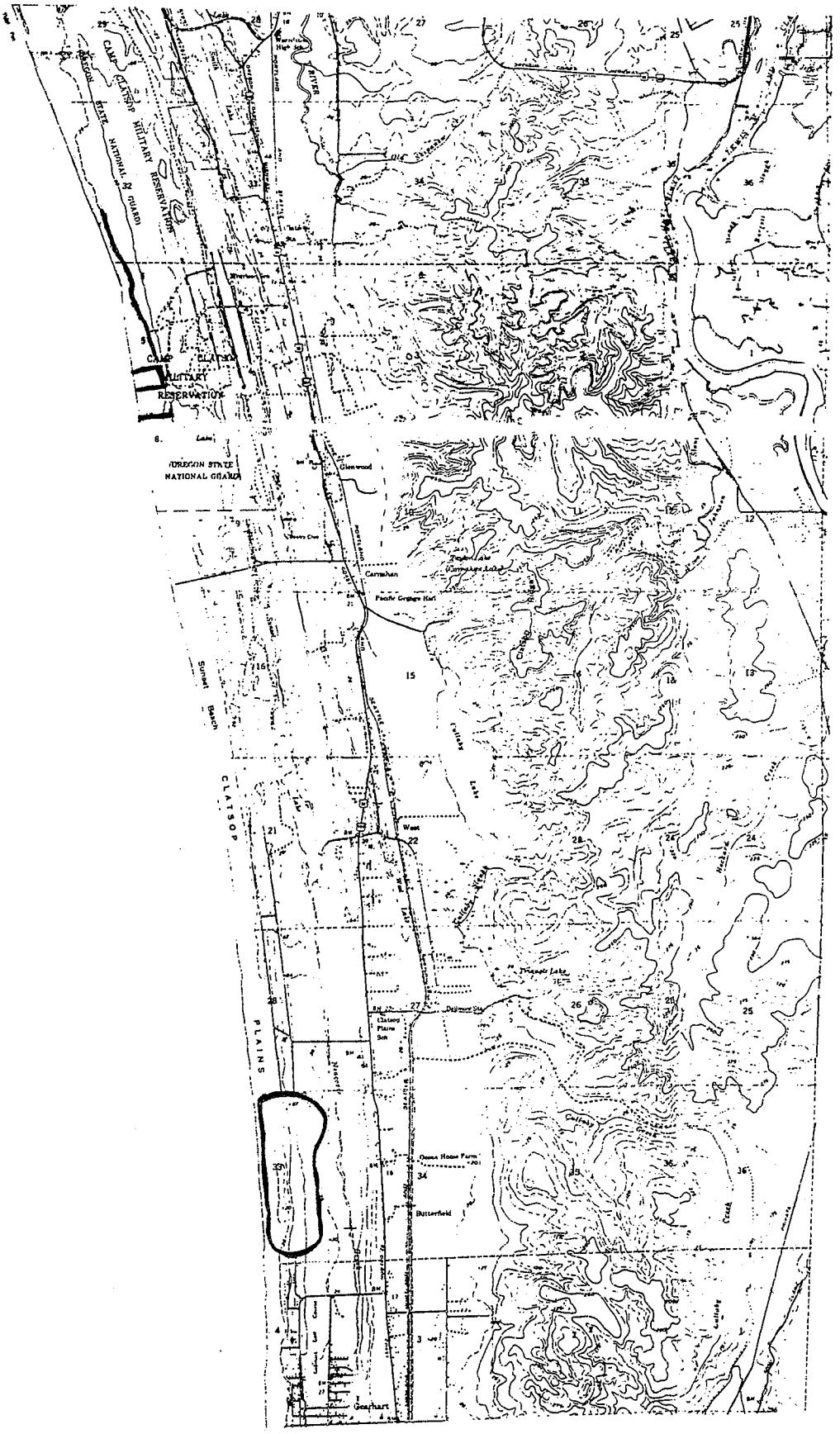
Scale in Miles

*The key and scale in miles applies to the topographic maps.

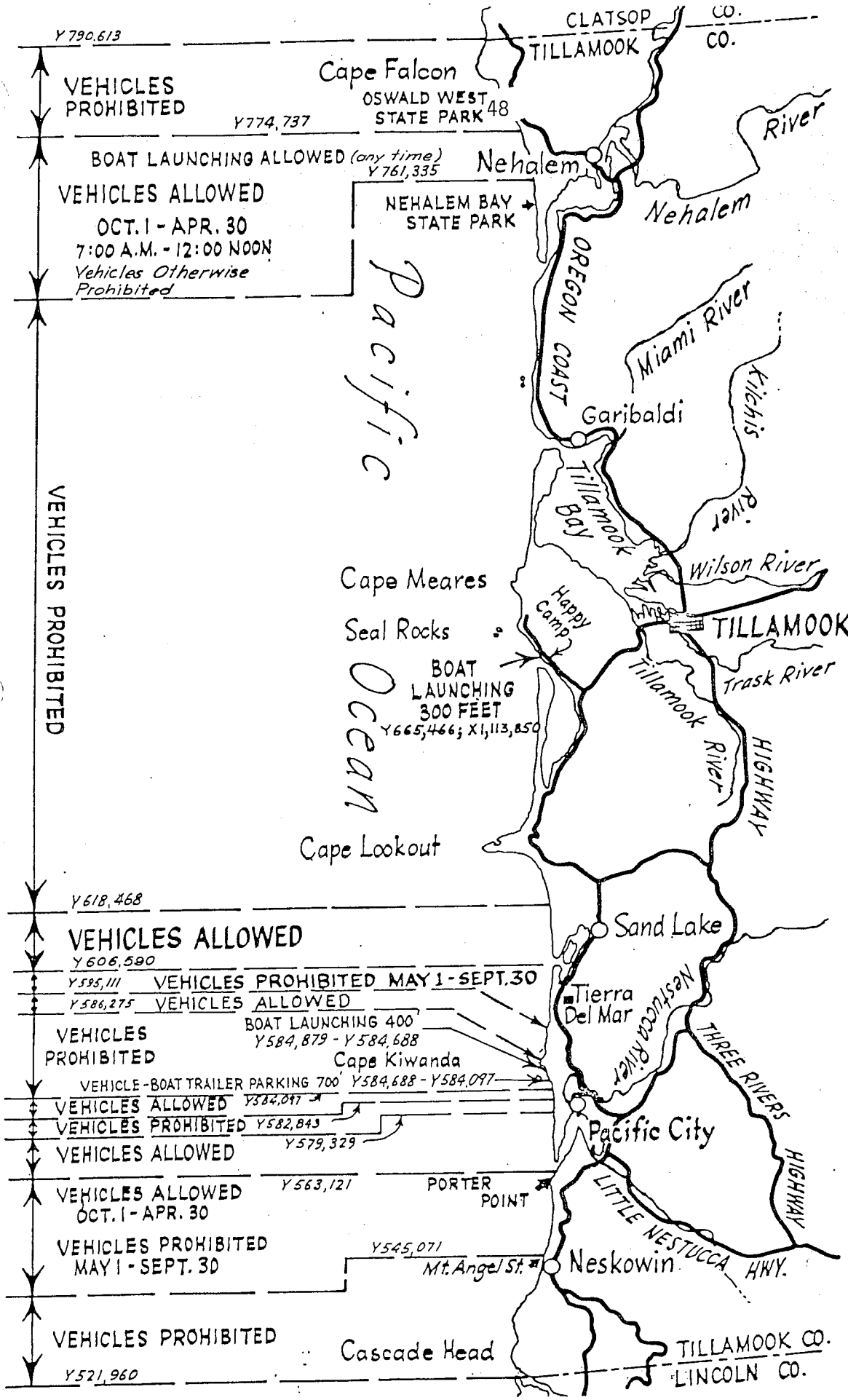
Map Sources: Oregon Coastal Conservation & Development Commission
Oregon State Highway Commission



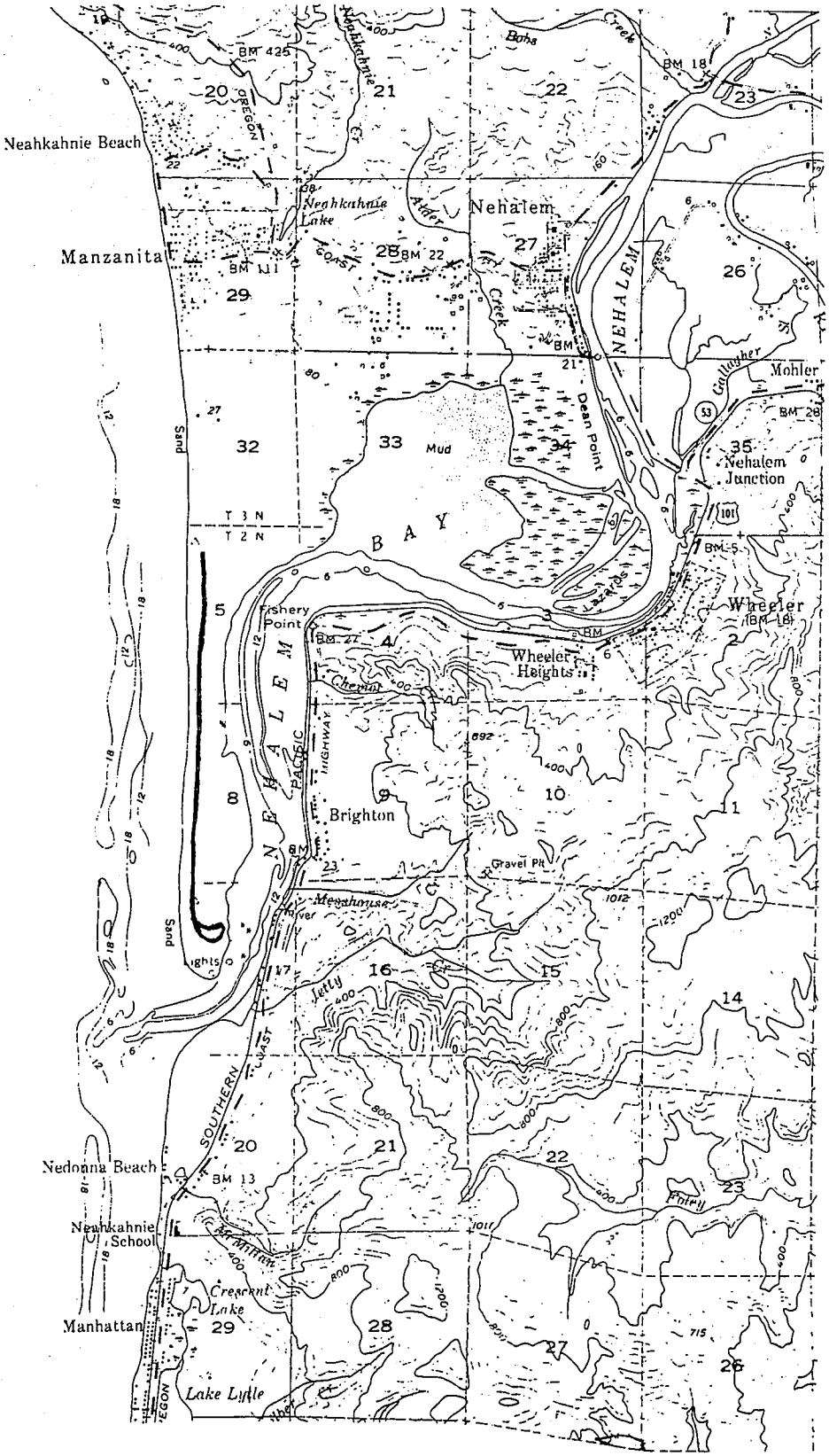
Map 1. Clatsop County beach status.



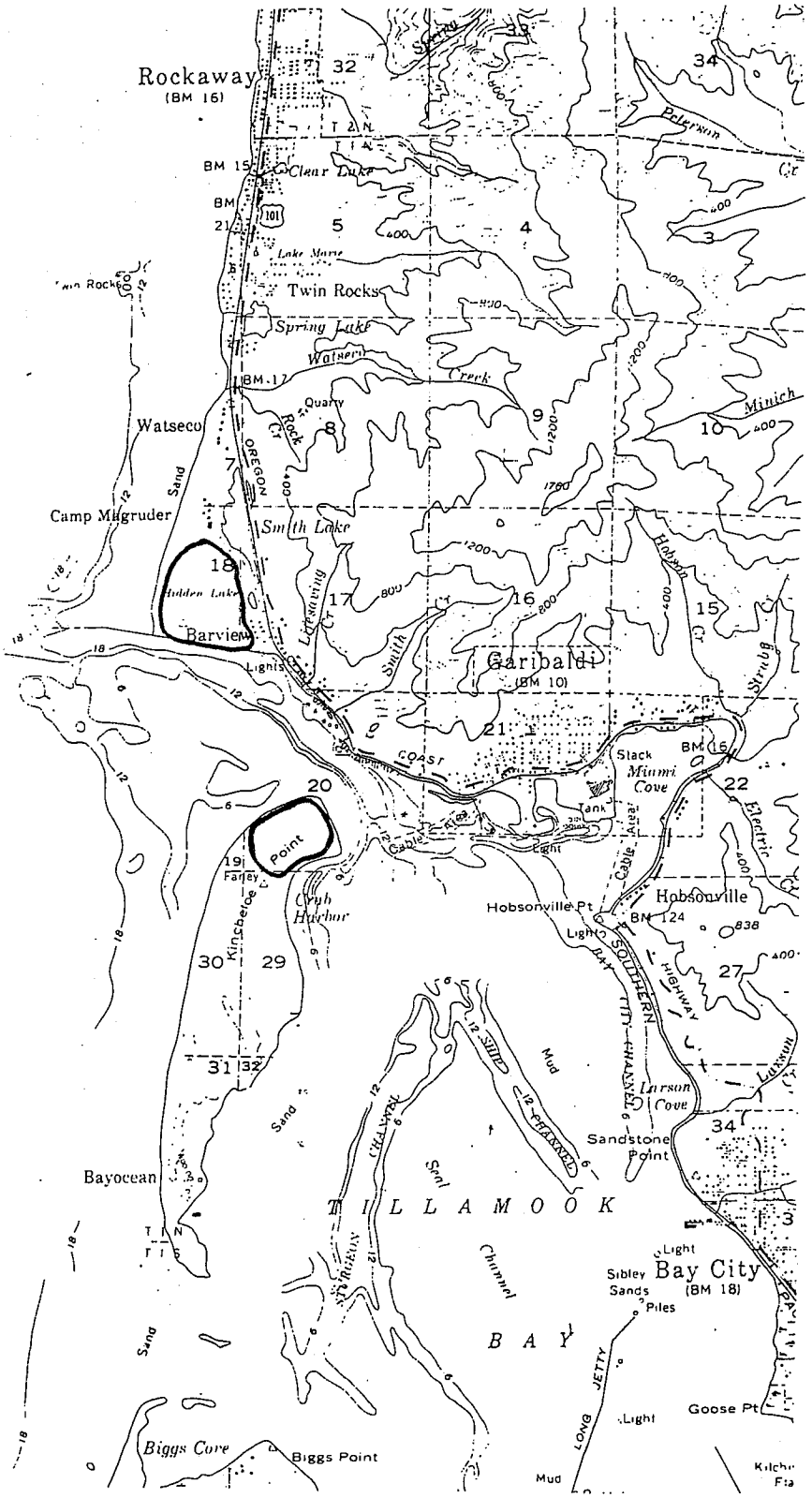
Map 2. ORV use in Clatsop County.



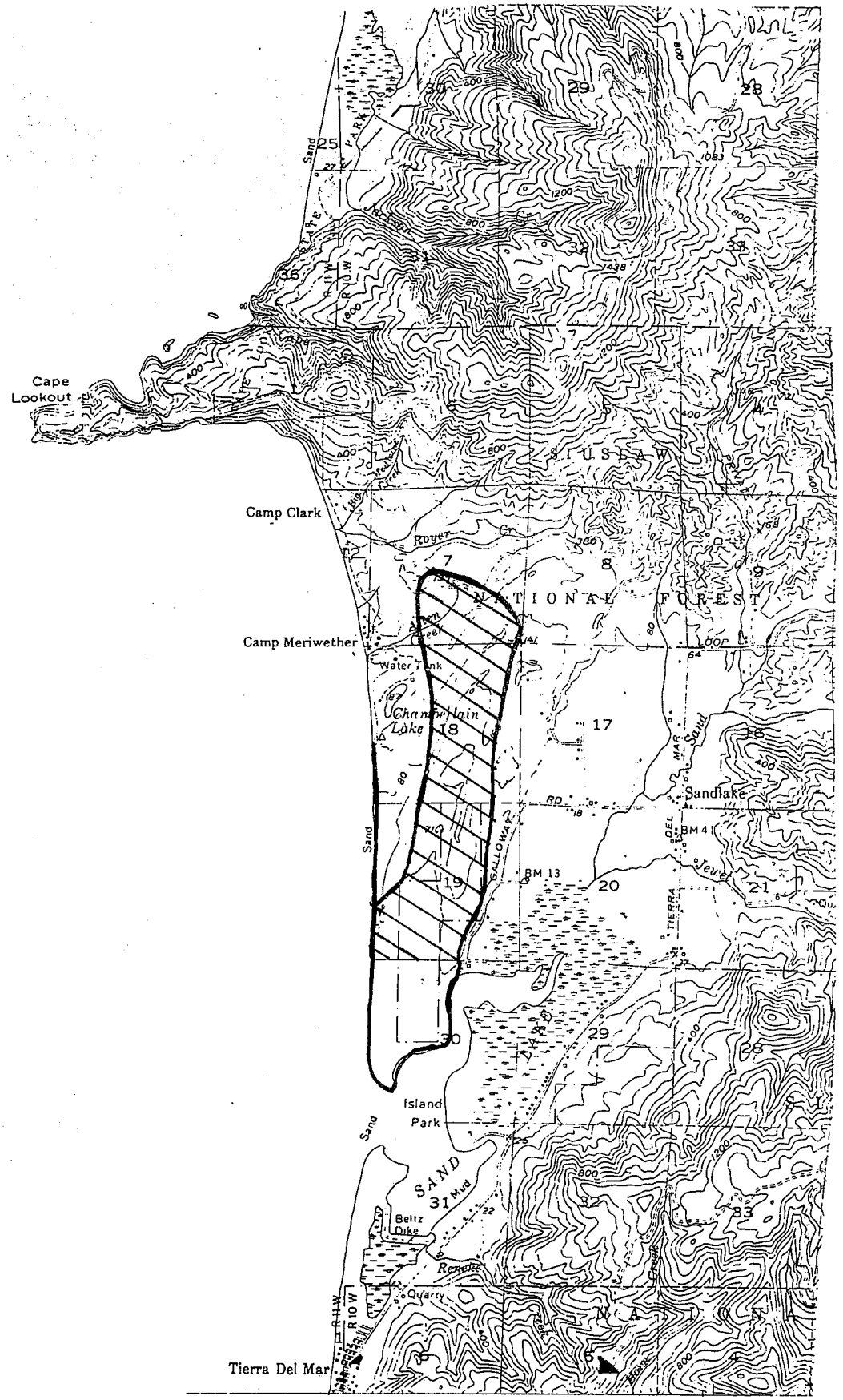
Map 3. Tillamook County beach status.



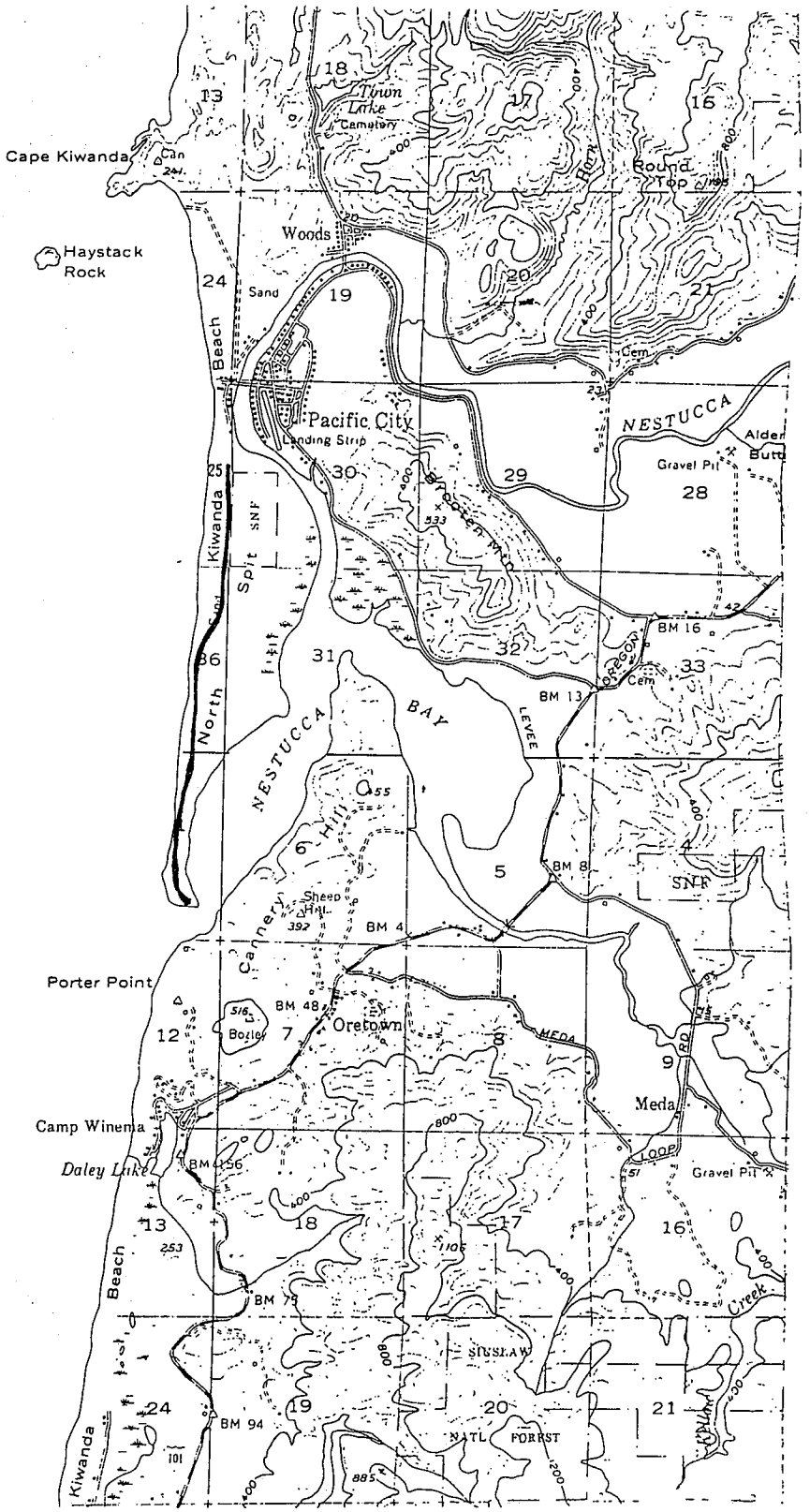
Map 4. ORV use in Tillamook County.



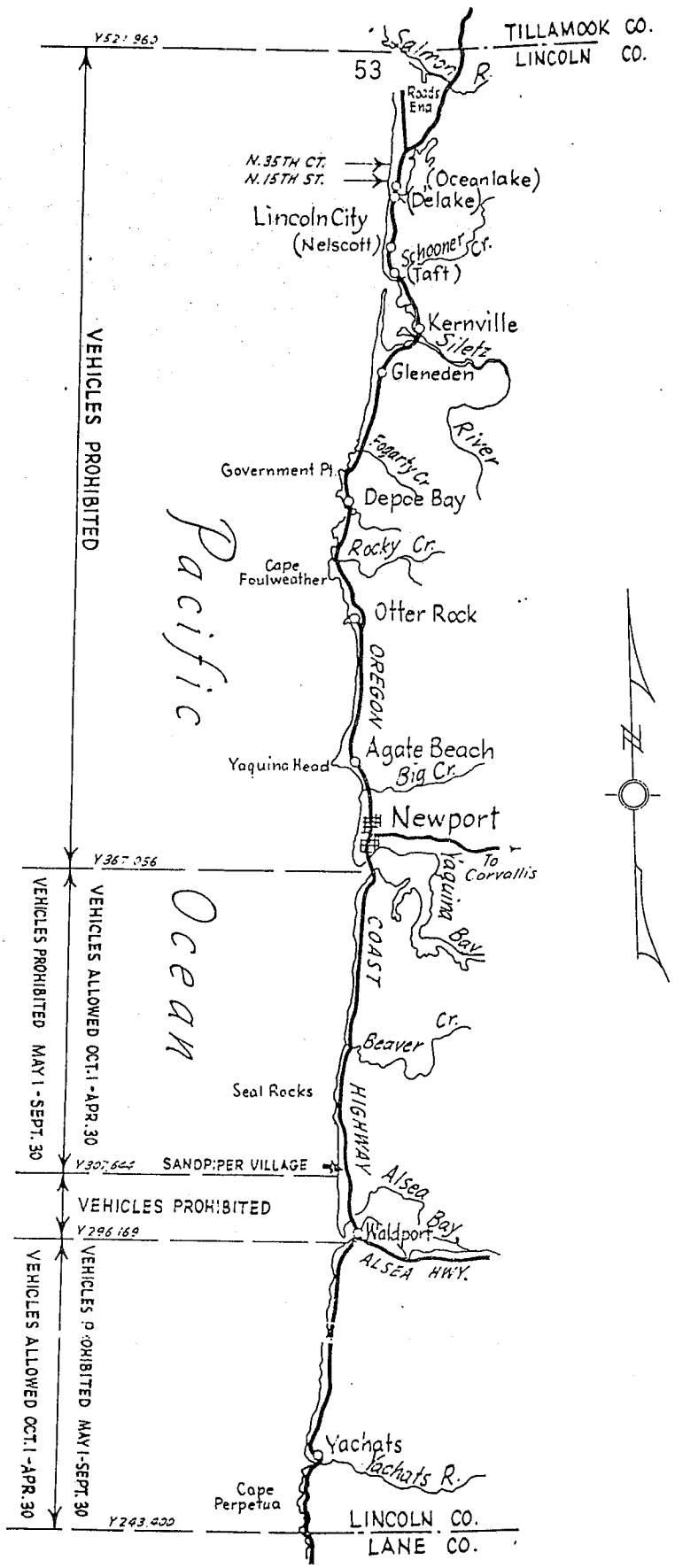
Map 5. ORV use in Tillamook County.



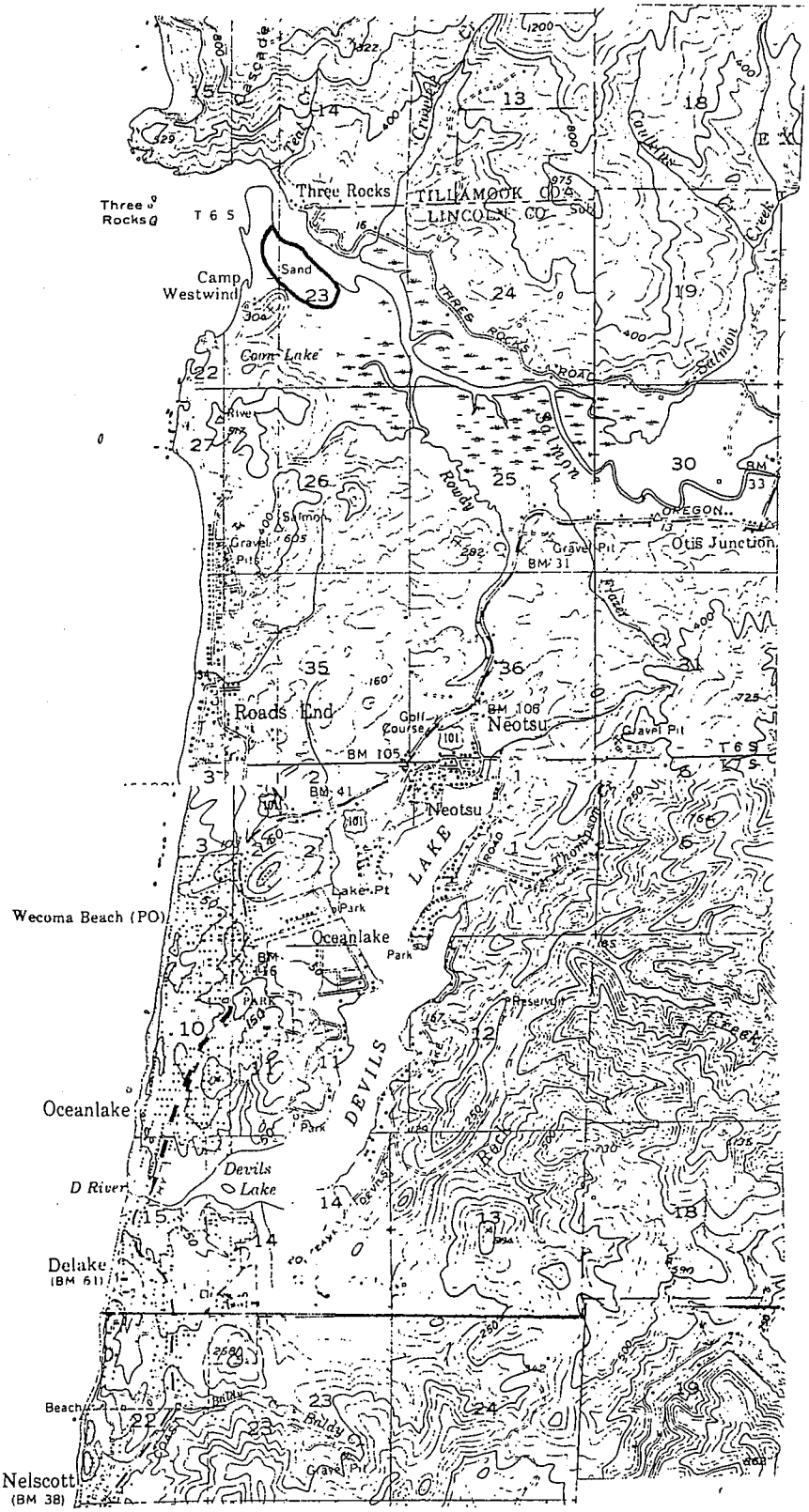
Map 6. ORV areas of use and potential suitability in Tillamook County.



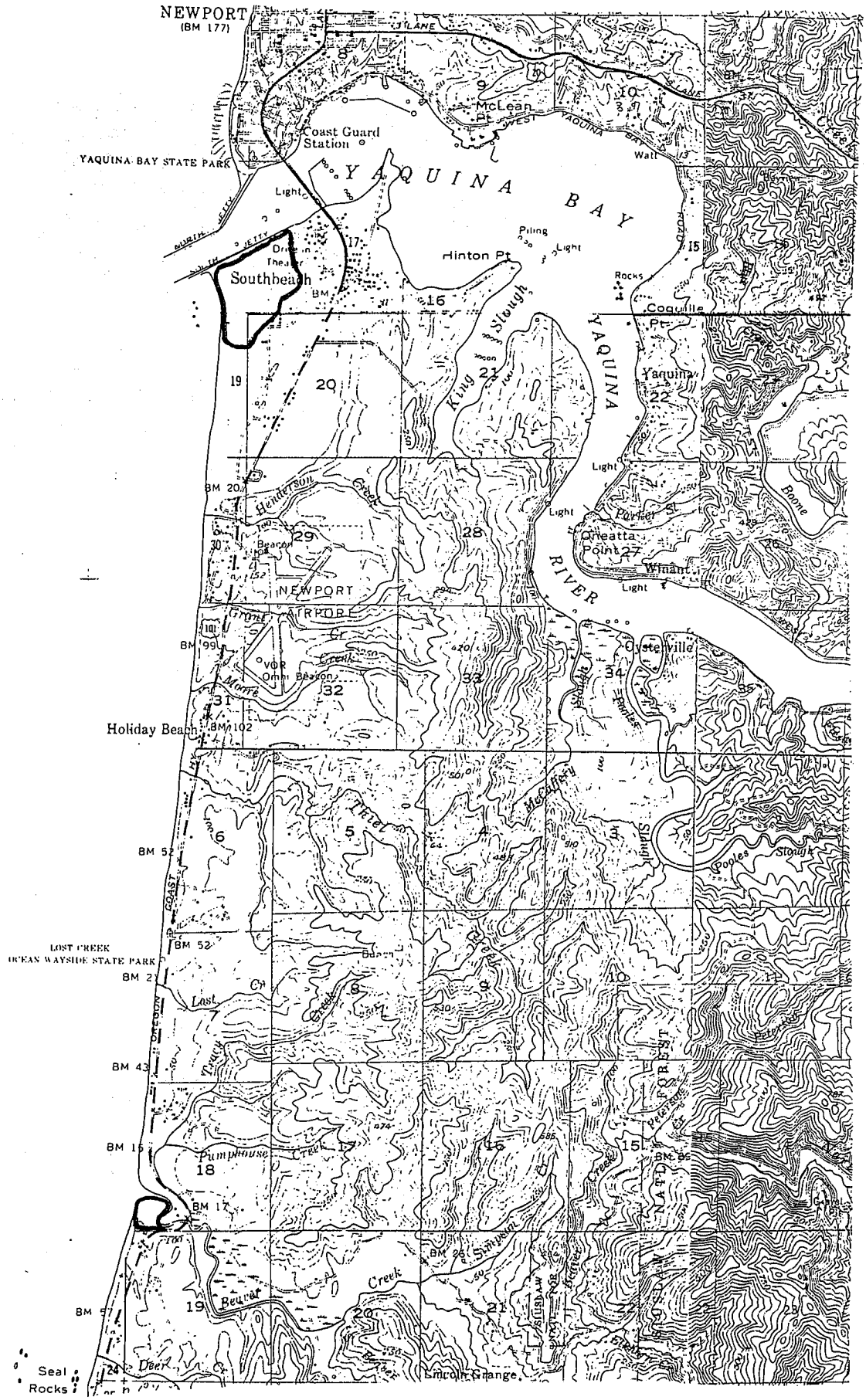
Map 7. ORV use in Tillamook County.



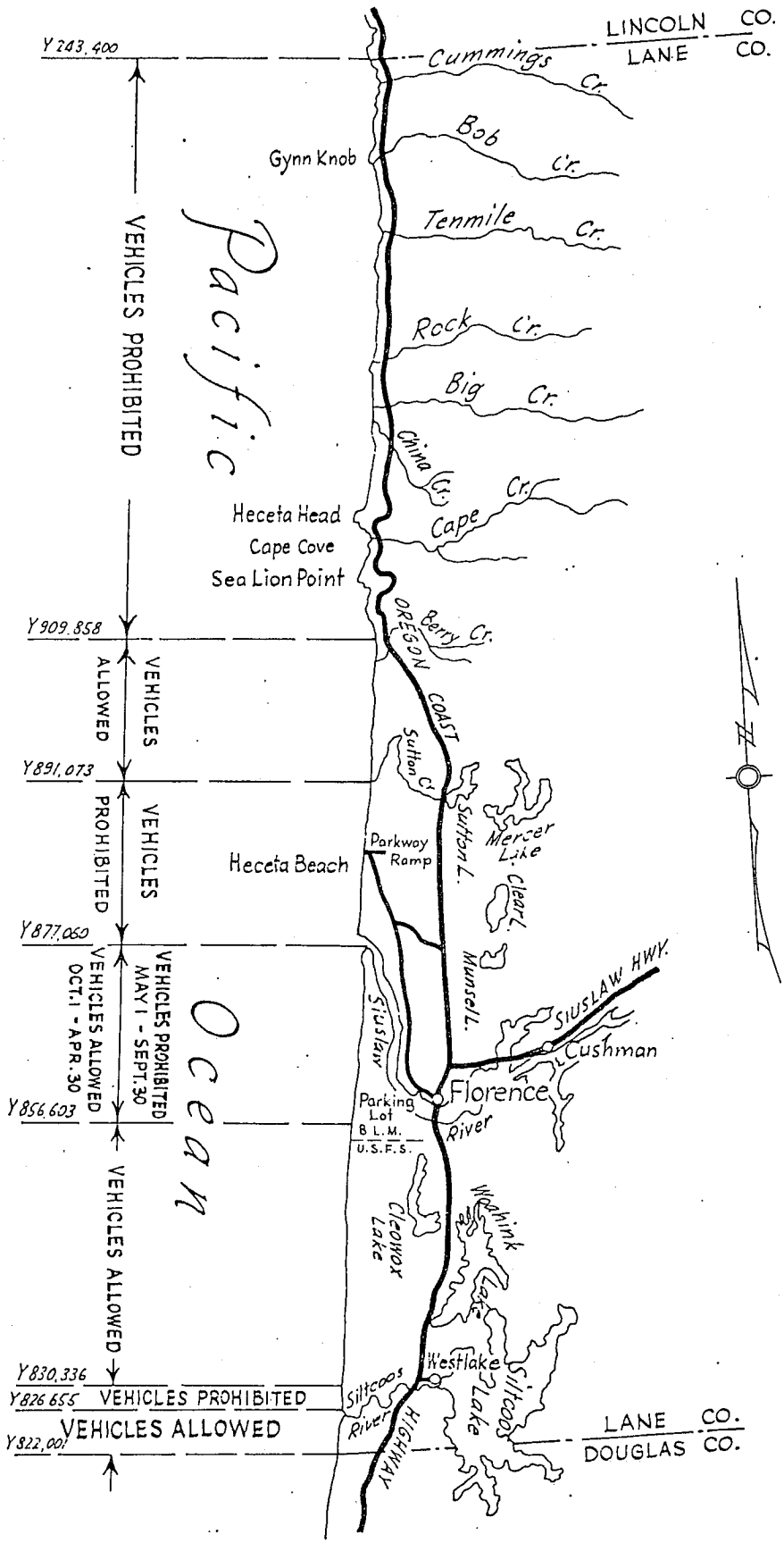
Map 8. Lincoln County beach status.



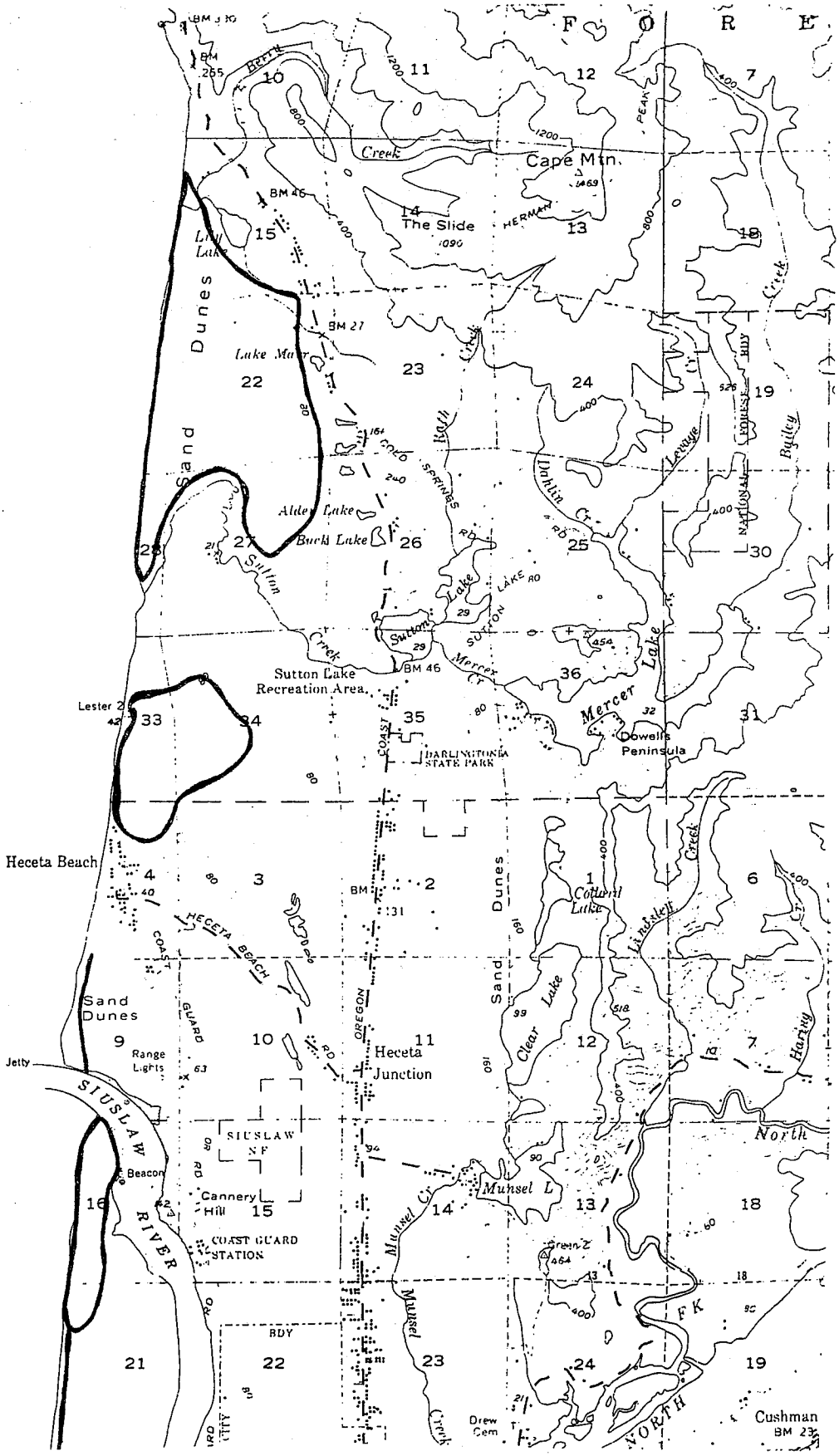
Map 9. ORV use in Lincoln County.



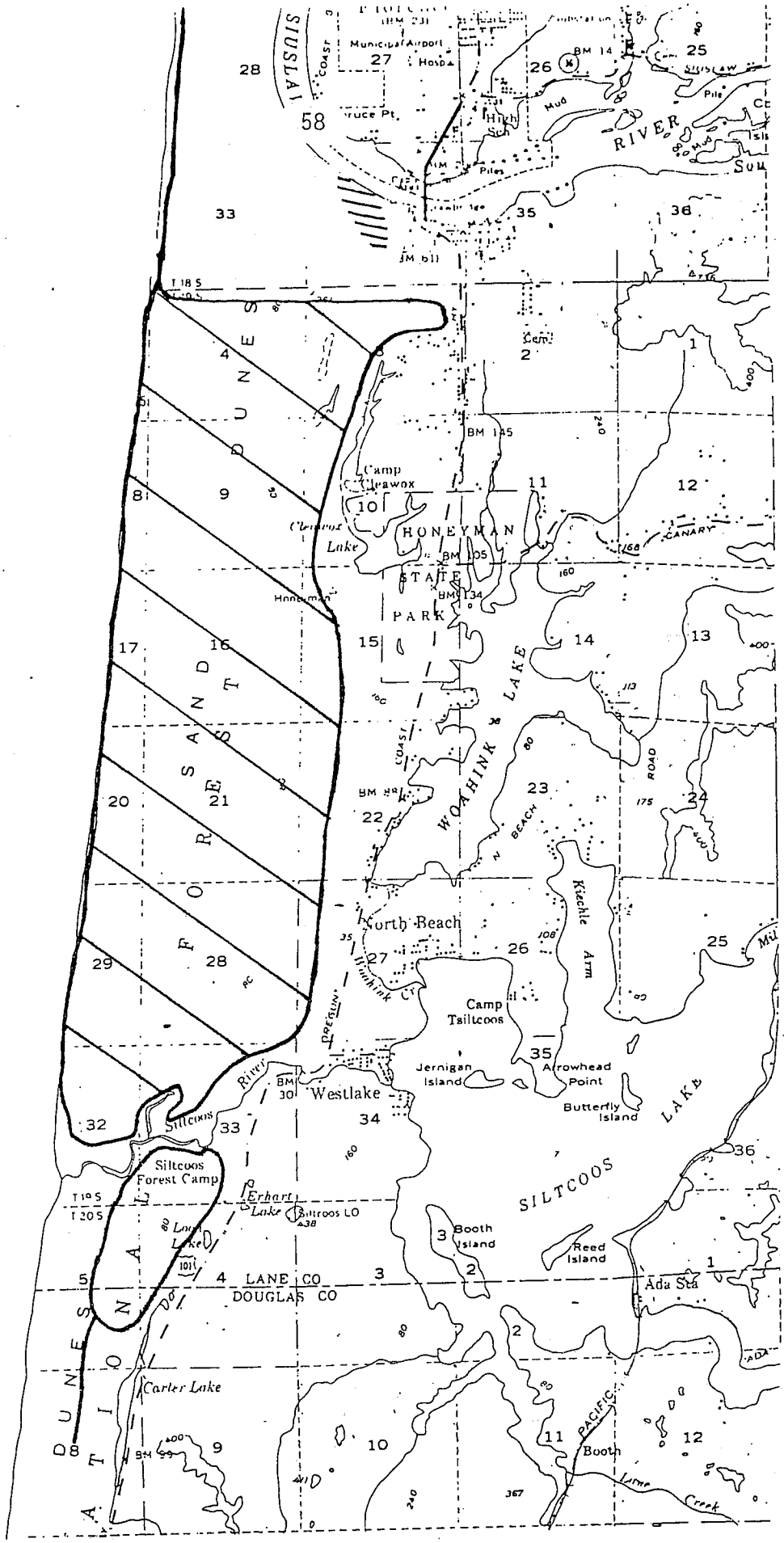
Map 10. ORV use in Lincoln County.



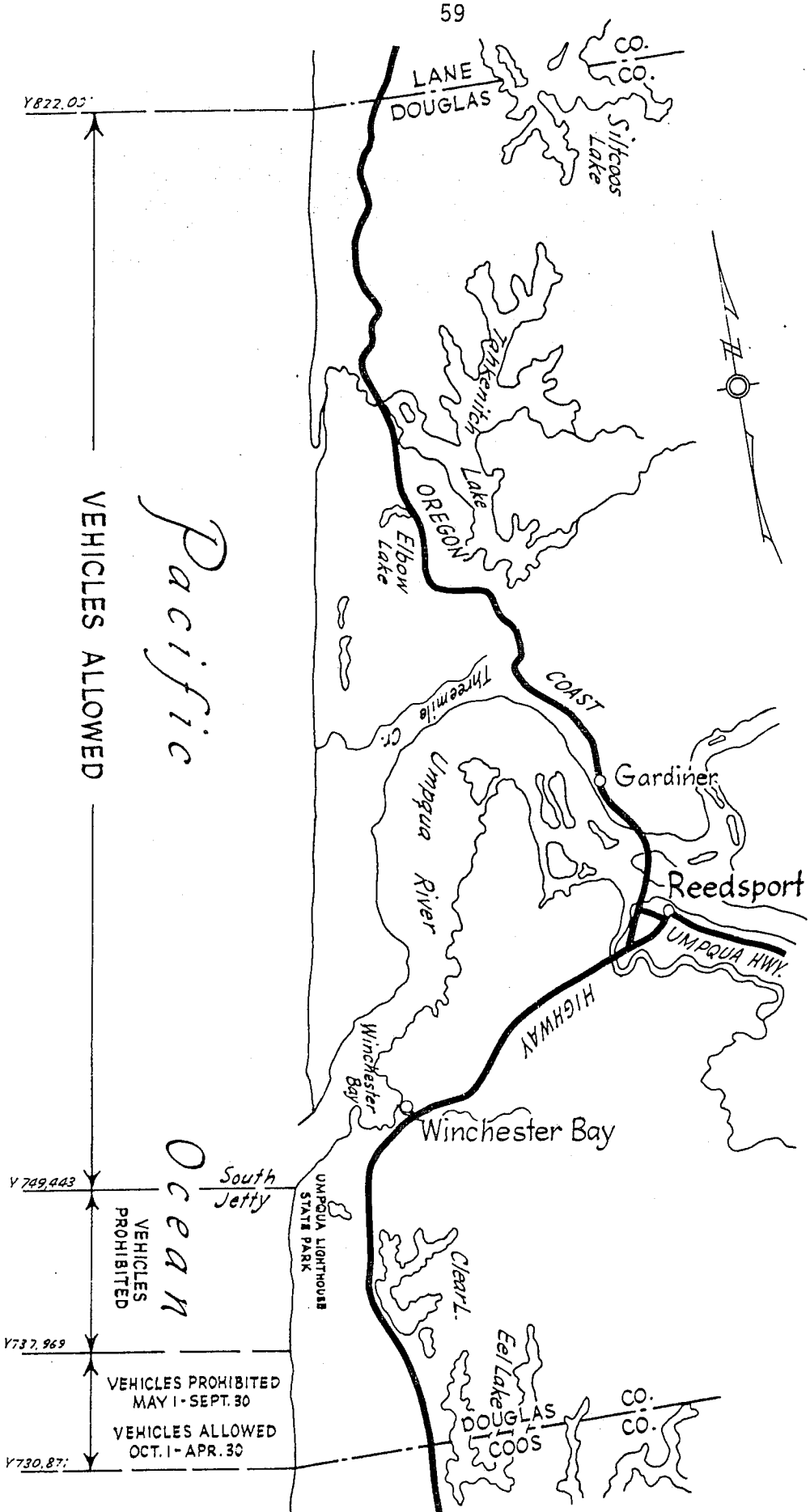
Map 11. Lane County beach status.



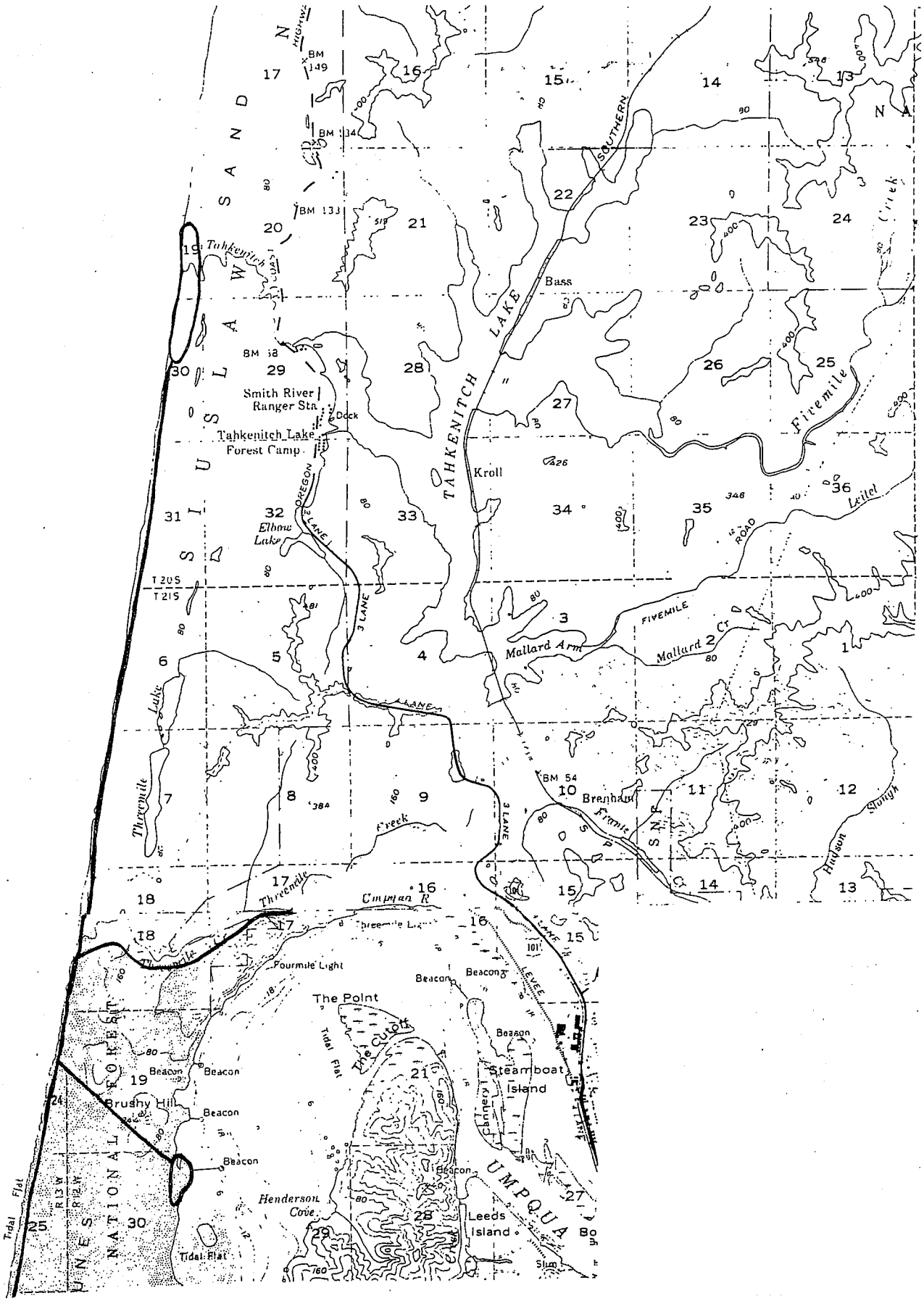
Map 12. ORV use in Lane County.



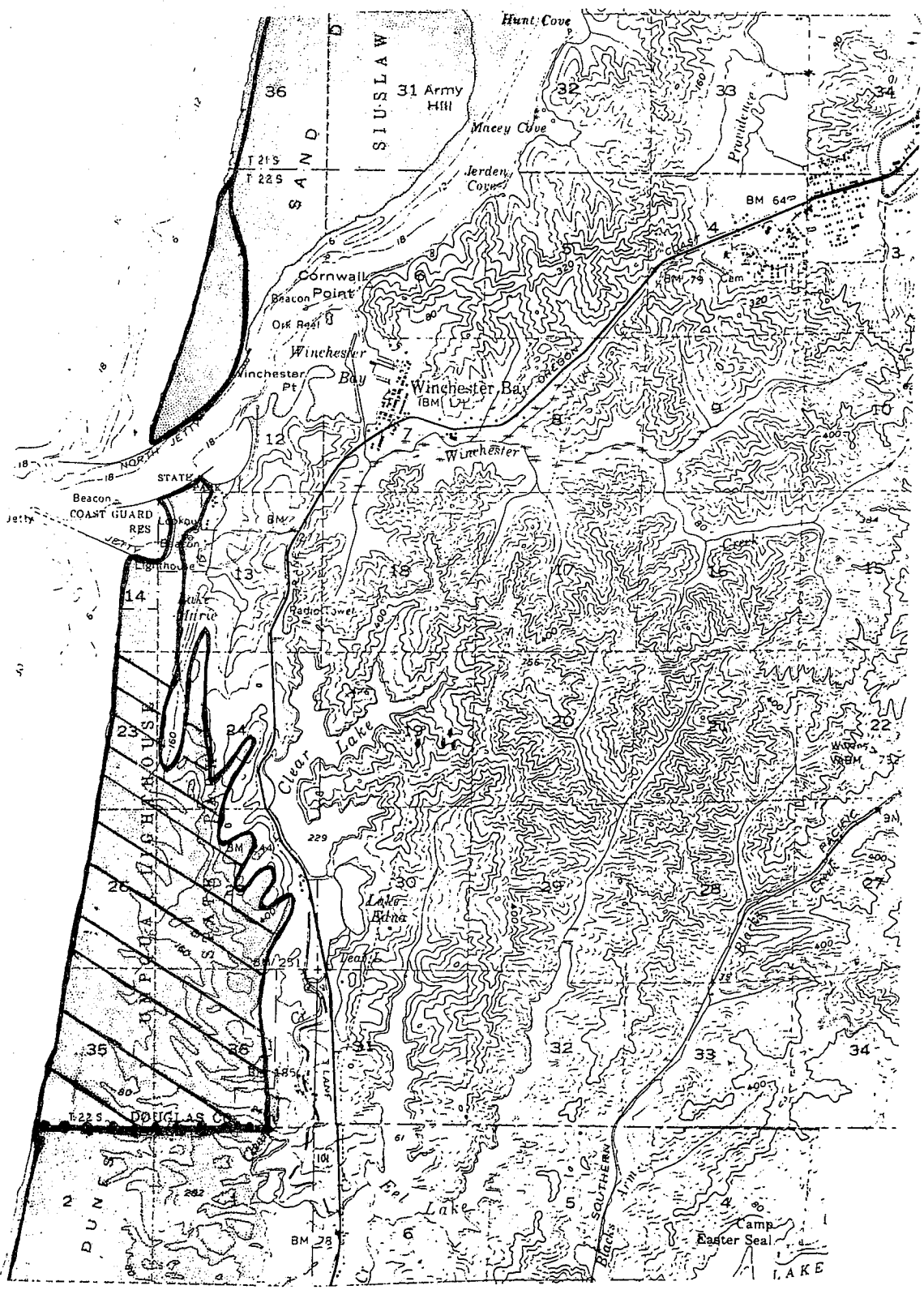
Map 13. Areas of ORV use and potential suitability in Lane County.



Map 14. Beach status in Douglas County.



Map 15. ORV use in Douglas County.



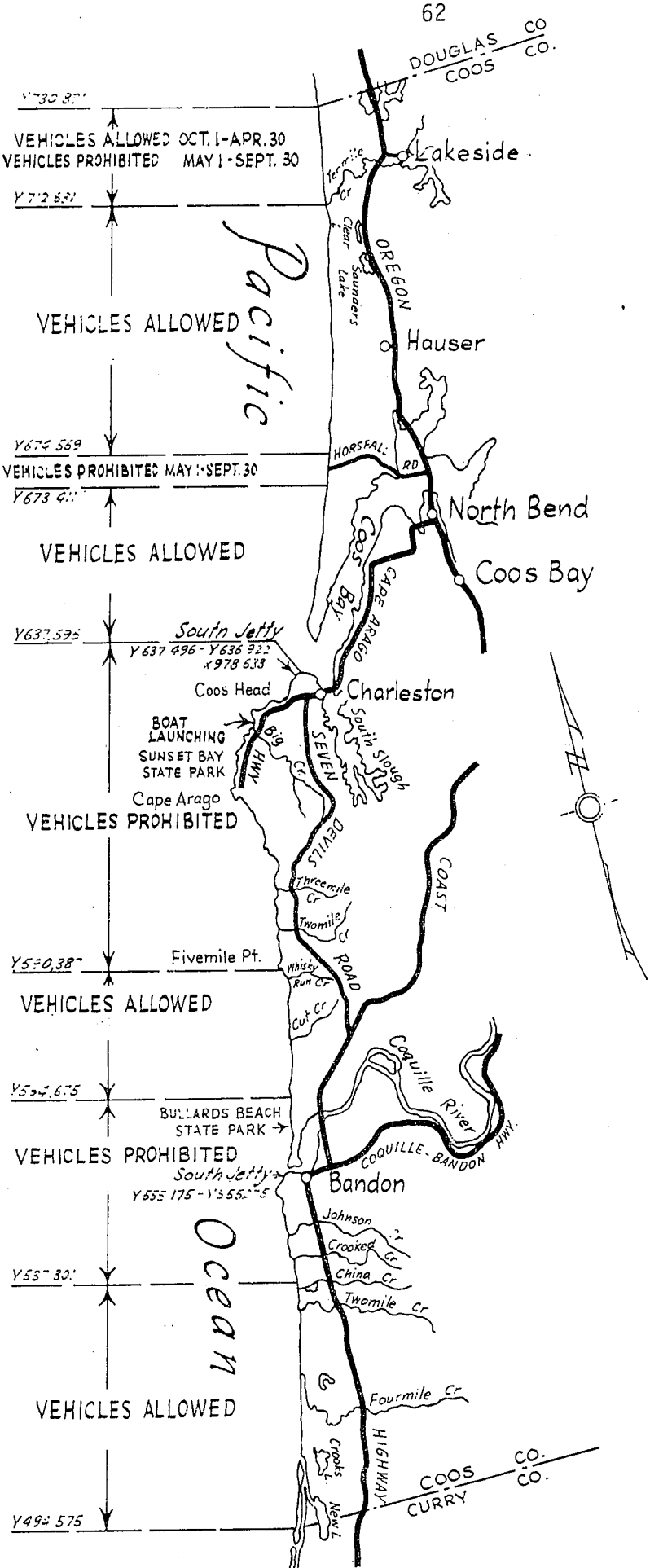
Map 16. Areas of ORV use and potential suitability in Douglas County.

Exhibit A

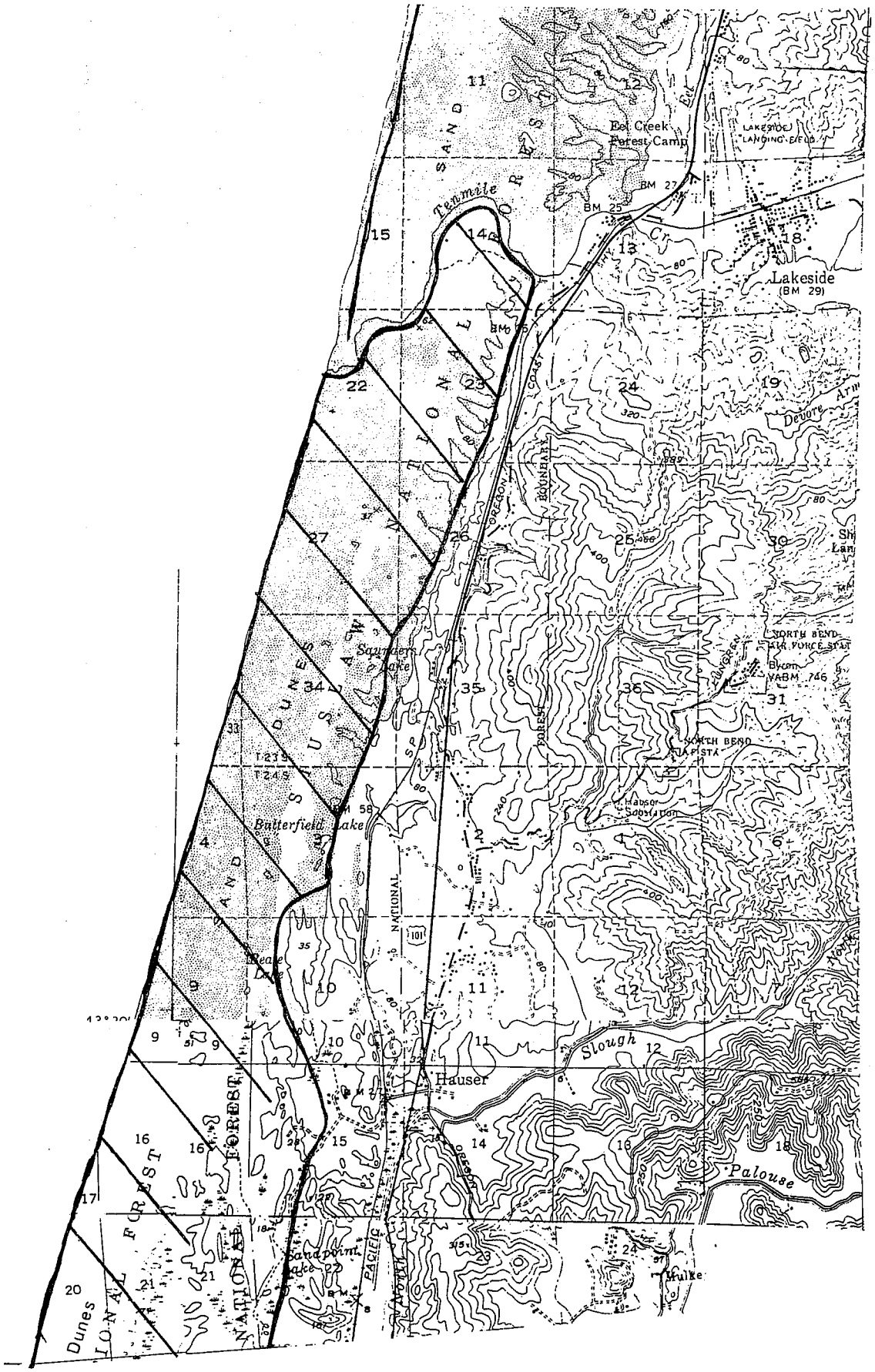
VEHICLE RESTRICTIONS ON THE OCEAN SHORE

In Coos County

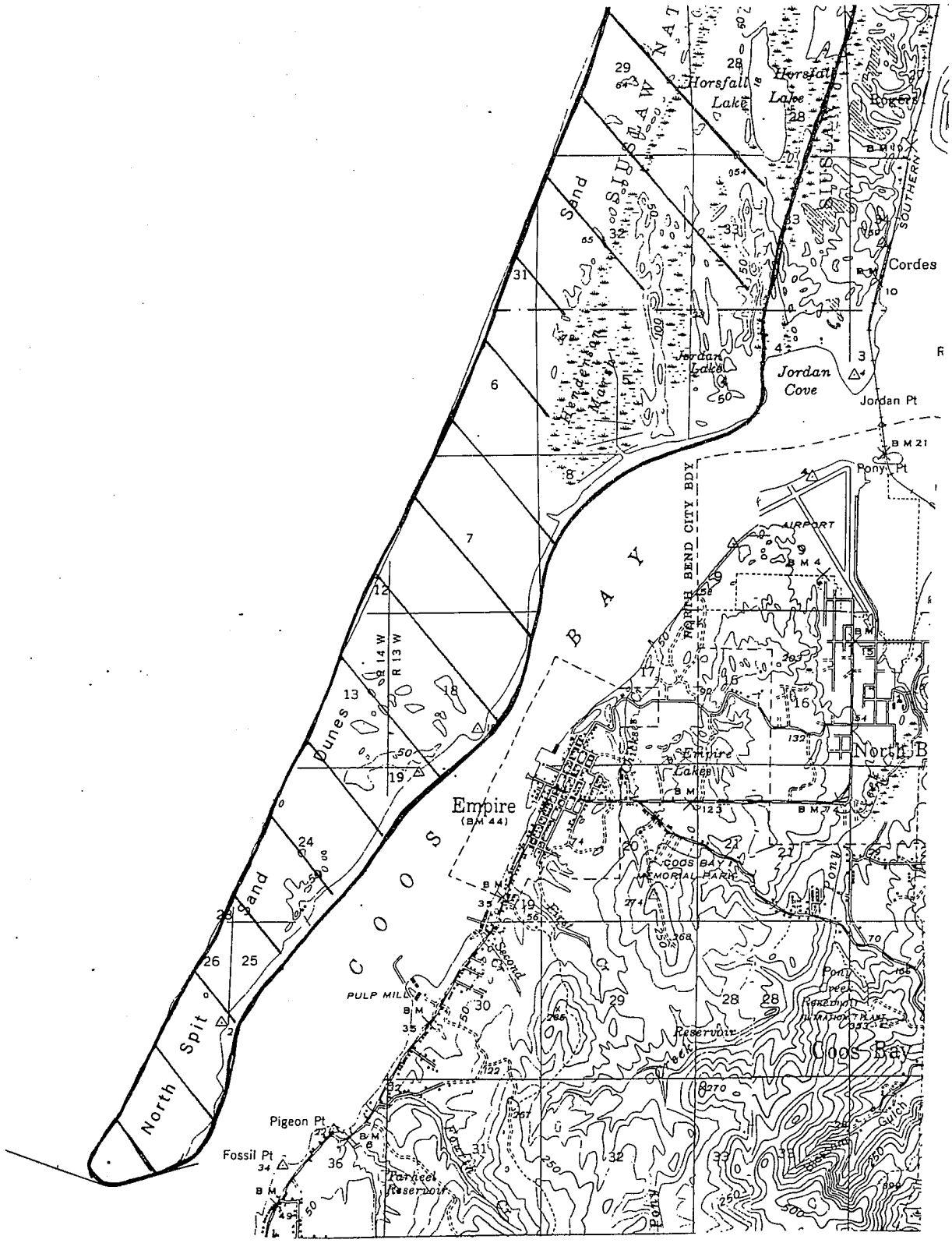
OREGON STATE HIGHWAY COMMISSION



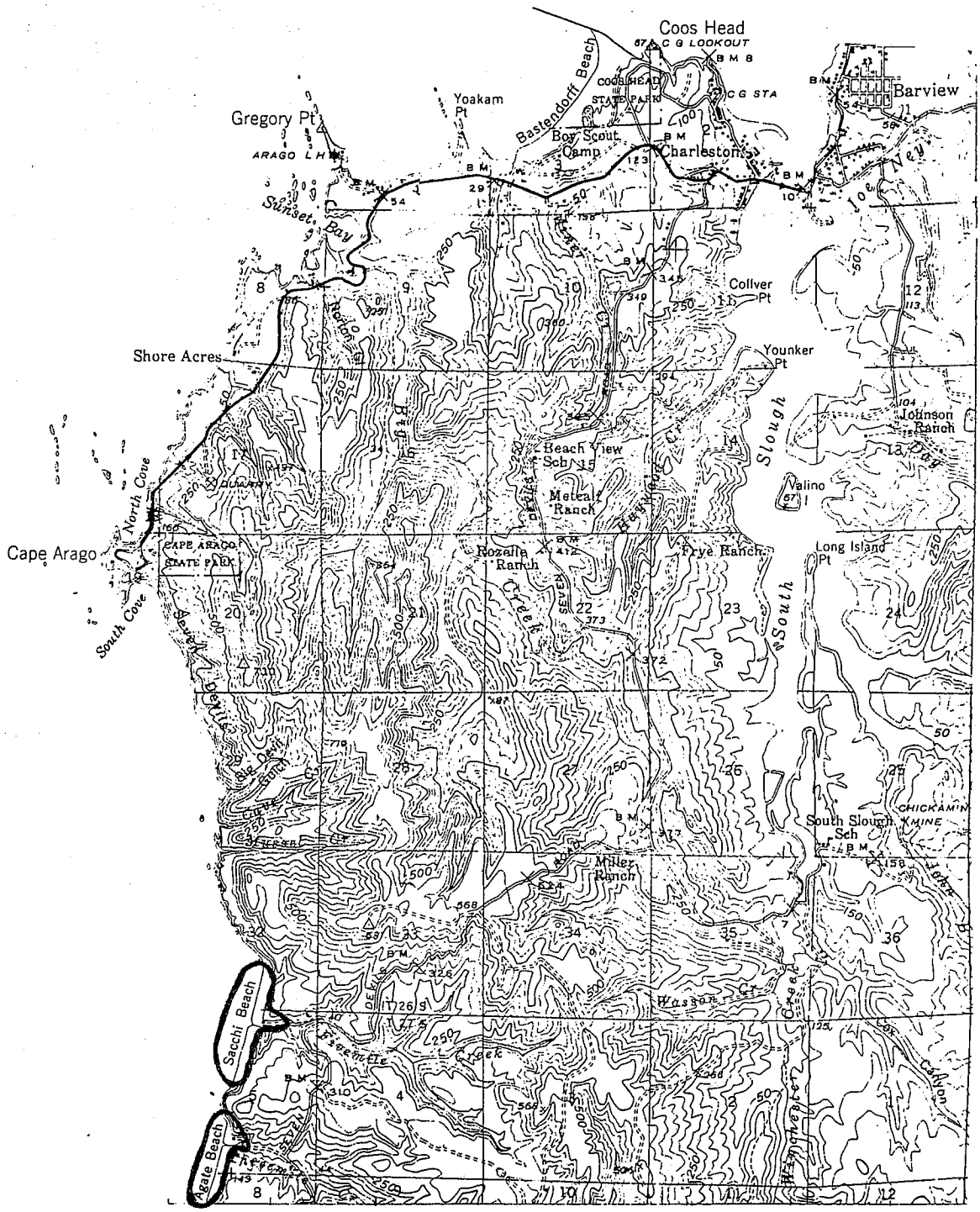
Map 17. Road status in Coos County.



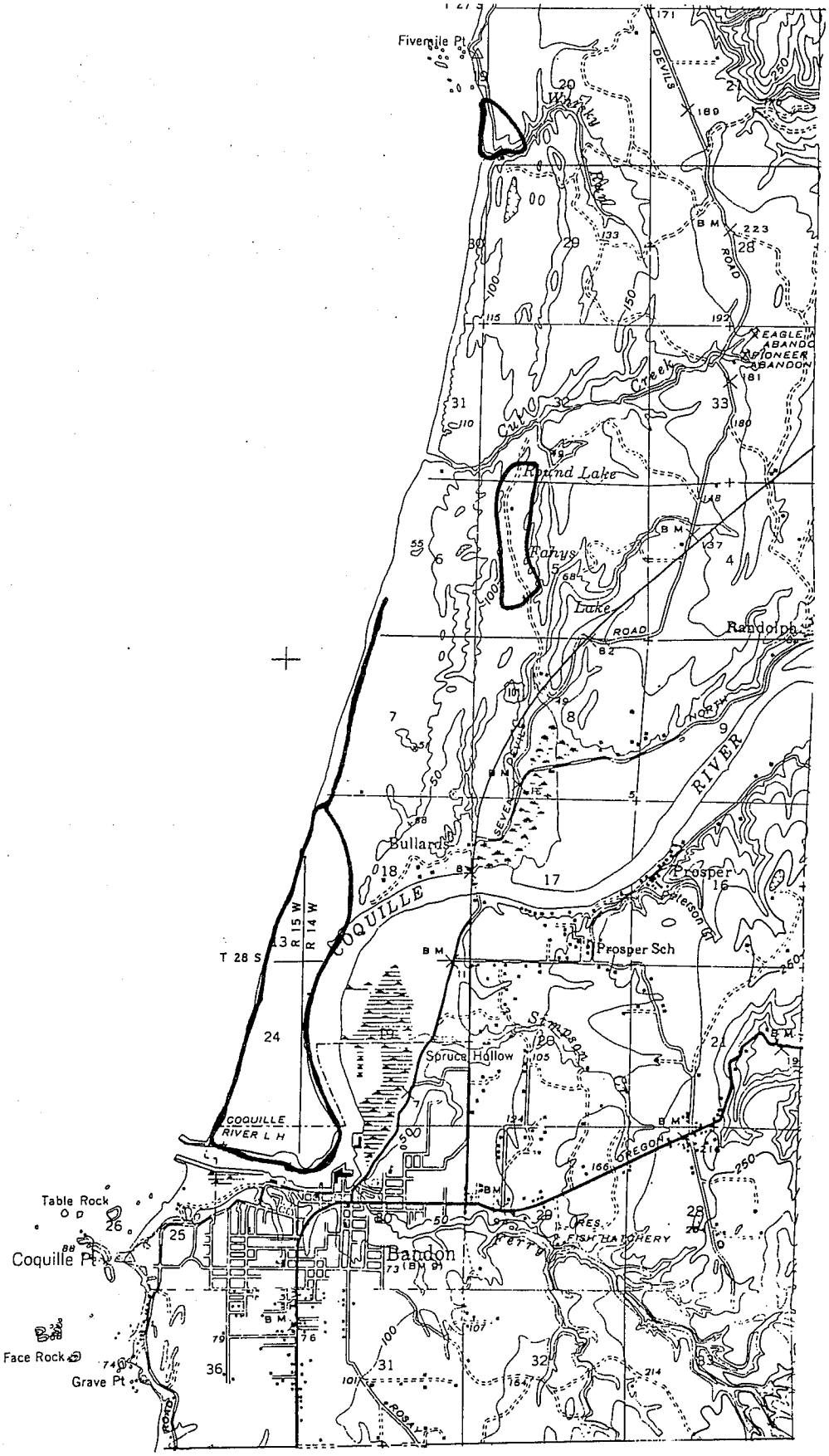
Map 18. Areas of ORV use and potential suitability in Coos County.



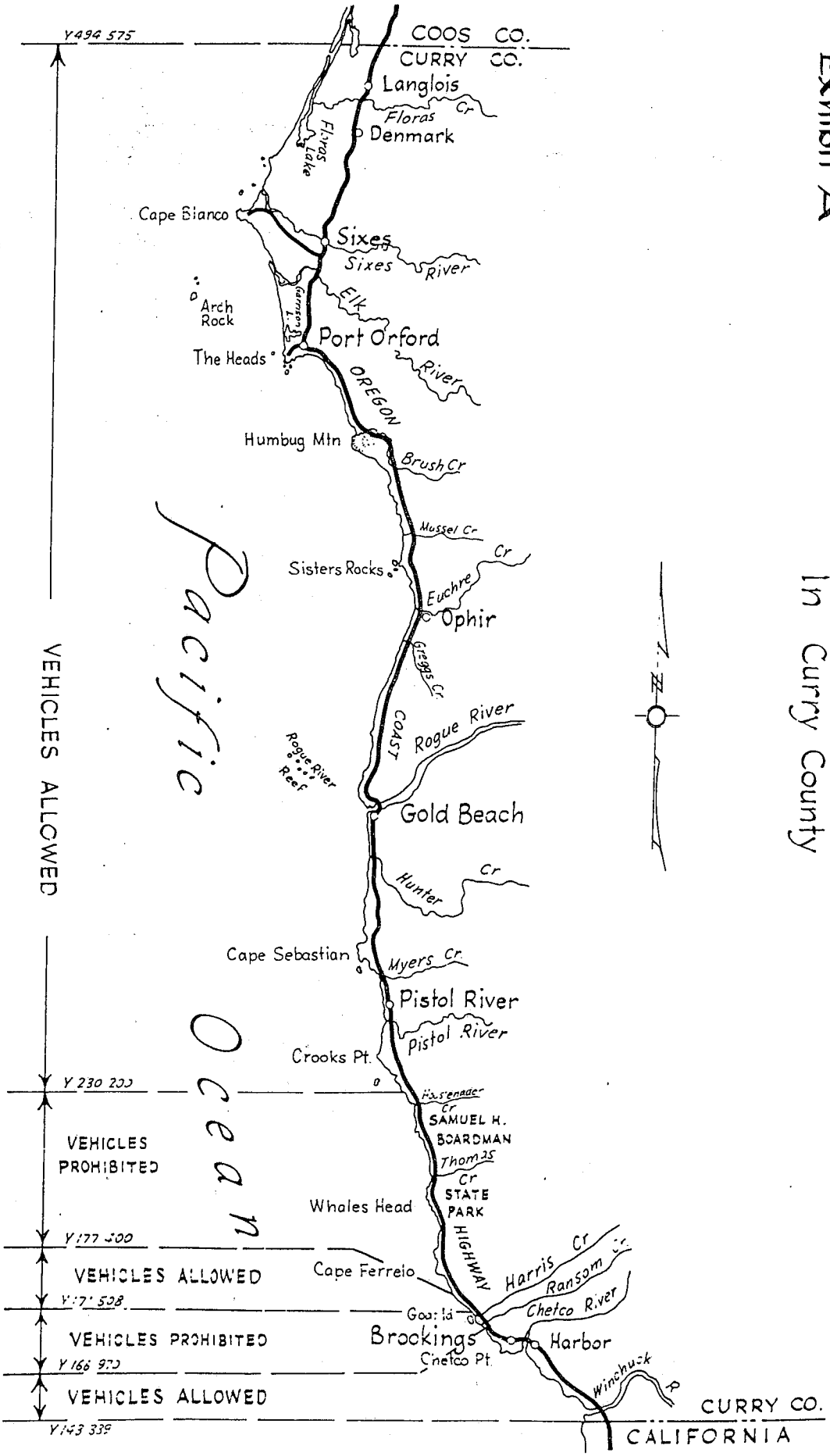
Map 19. Areas of ORV use and potential suitability in Coos County.



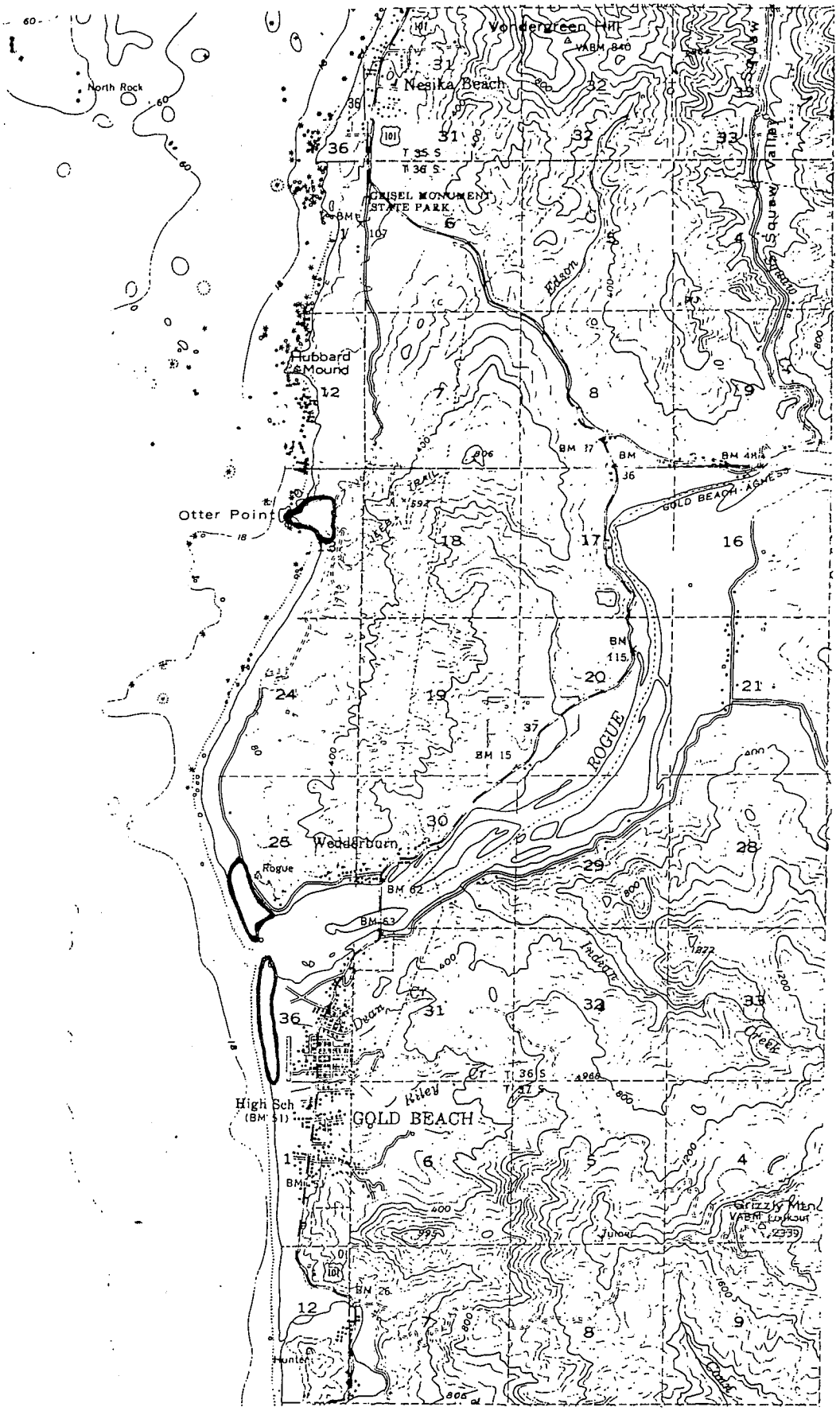
Map 20. ORV use in Coos County.



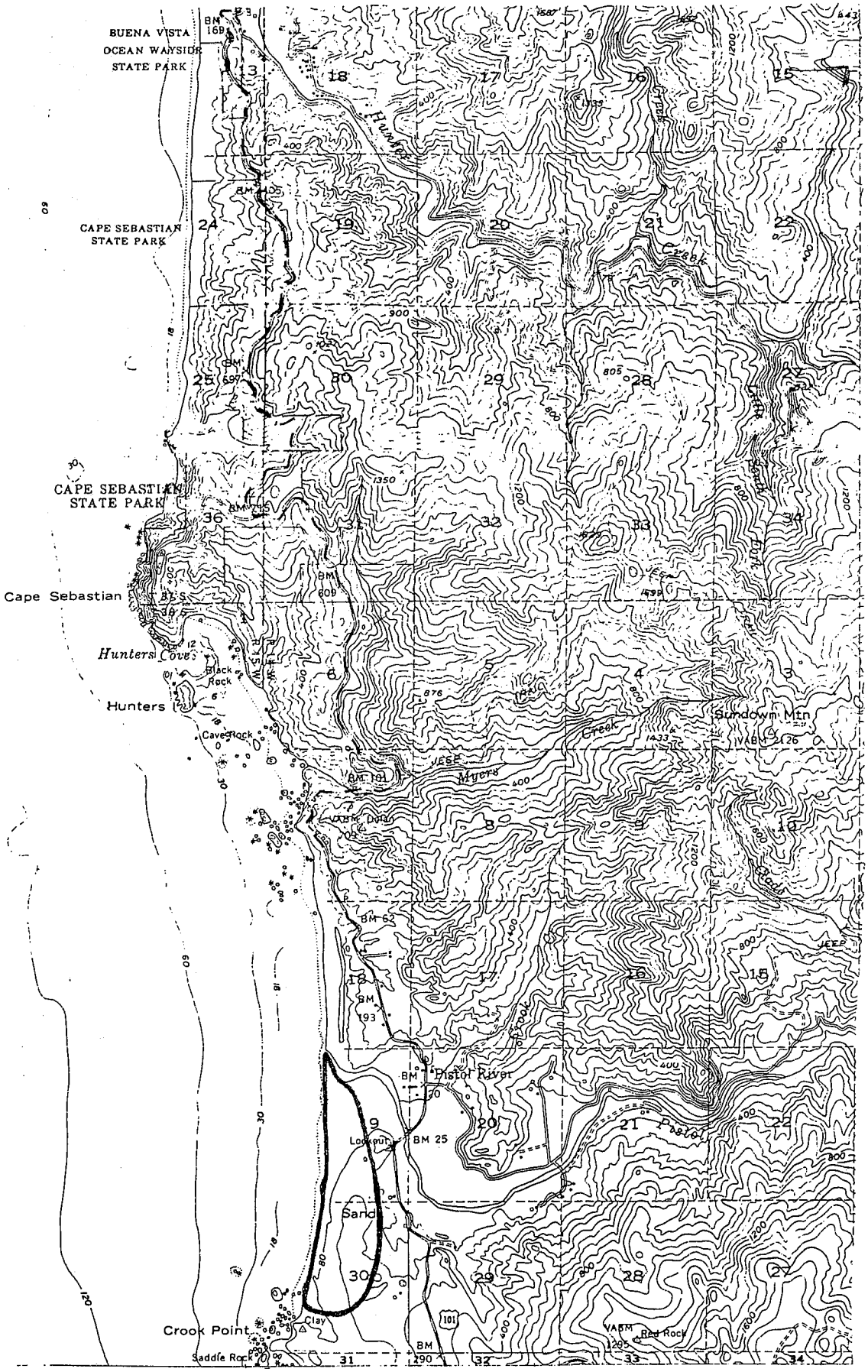
Map 21: ORV use in Coos County.



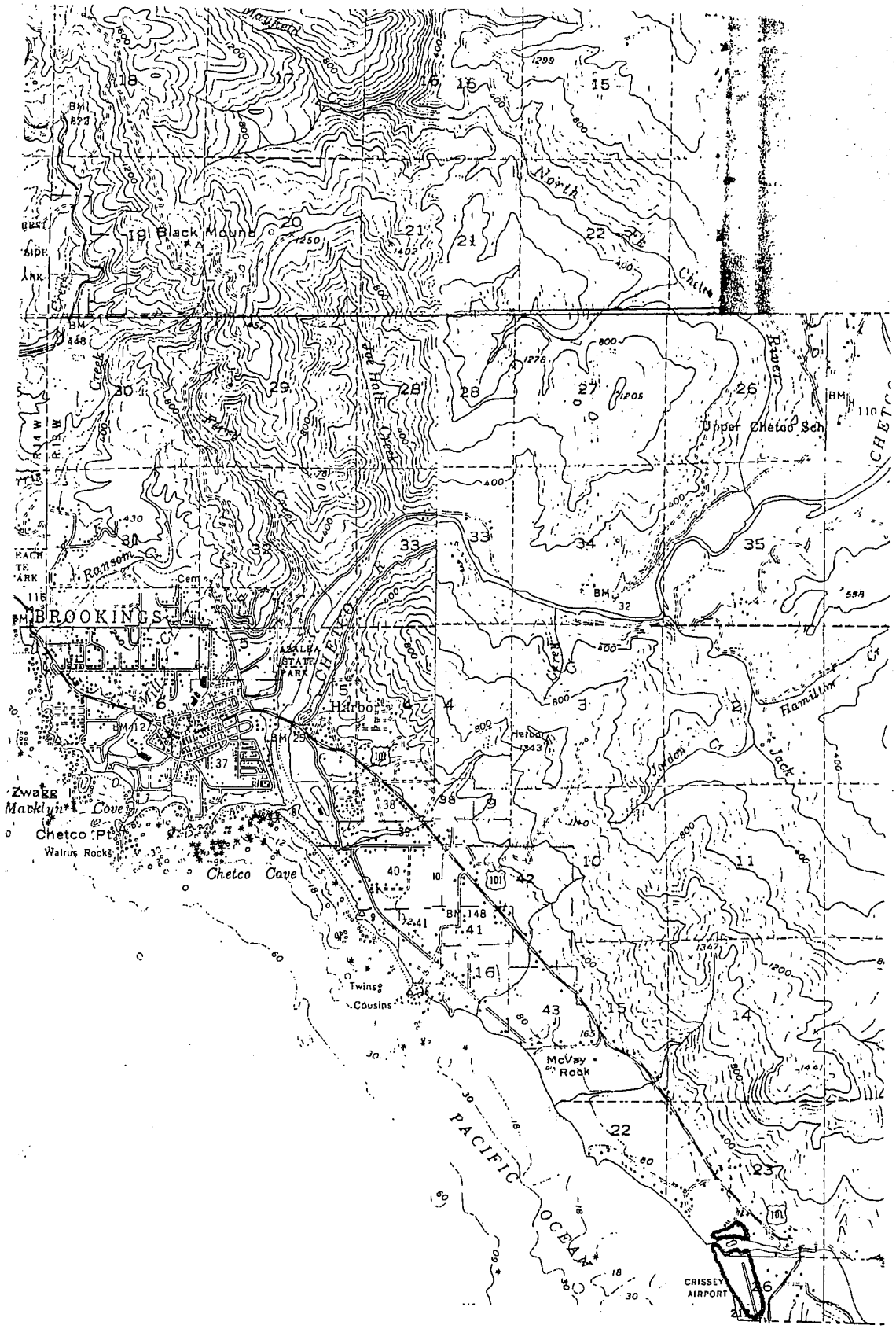
Map 22. Beach status in Curry County.



Map 23. ORV use in Curry County.



Map 24. ORV use in Curry County.



Map 25. ORV use in Curry County.

X. RECOMMENDATIONS AND RATIONALES

A. General

1. Off-Road Vehicle Advisory Councils should be established including ORV club representatives and individual participants, land managers, interested representatives from environmental groups, and park and recreation personnel on both a local and state level.

Such bodies would provide realistic and informed advice to develop and implement legislation. It could serve a similar function on a local level.

2. State legislation should be adopted which would comprehensively provide for and manage ORV recreation within Oregon. The legislation should:

It would provide for and manage an activity that presently exists.

a. Recognize ORV use as a legitimate form of recreation;

Acceptance of legitimate ORV use will promote more effective management of ORV activities.

b. Provide for ORV area development that would meet the needs of the ORV participant (such areas should be located in close proximity to the majority of the participants);

c. Restrict the use of ORVs to maintained roads and trails and areas designated for the various types of ORV activities;

d. Require establishment of environmental monitoring plans that suit an area's needs and the impacts of the ORV activity;

This would provide for ORV recreation and not necessarily reduce the areas open to ORVs. The benefits of limiting ORV use to designated areas would be to bring the multitude of management and environmental problems into a more reasonable realm. User conflict will be reduced. Hidden environmental impacts would be less likely to occur, and the impact that would occur in a designated area could be monitored and dealt with. Nuisance use would be minimized. Law enforcement would be facilitated since there would be no question whether an area was open or closed to ORV use. The need for management could be focused at a given area. De facto use would be reduced, for instance at South Beach and on Yaquina Head (hill-climbing on the slope east of the lighthouse by motorcycles and four-wheel drive vehicles). Providing good facilities for ORV recreation and stopping random use would increase the quality

	of the ORV experience, increase its compatibility, and reduce its environmental impacts.
e. Register vehicles used off-roads that are not otherwise registered; (1) this should include a fee which should be held accountable in a special ORV fund; (2) the gas taxes from vehicle use off-road should be determined and placed in the ORV fund; (3) the ORV funds should be expended for: (a) provision of ORV areas and facilities, (b) management and enforcement of ORV areas, (c) environmental monitoring programs, (d) ORV related research (environmental impacts, user needs, etc.), (e) user education programs (which would be developed by ORV participants, land managers, etc. and include nature interpretation). (f) local grants to develop ORV areas;	Registration would provide vital information on the number of ORVs and ORV users to better assess their needs. It would raise money specifically to provide ORV recreation.
f. Registration should require visible vehicle identification in some form;	Such markings would facilitate law enforcement. The mobility and anonymity of ORVs make enforcement difficult.
g. Give state ORV planning responsibilities to the Park and Recreation Branch;	Recognize ORVs as legitimate recreational activity.
h. Provide specific operating conditions regulating conduct and equipment;	Safety and resource protection would be promoted.
i. Provide that all law enforcement personnel from different agencies (federal, state, and	A broad approach is necessary to cover multi-jurisdictional areas and ORV mobility. Uniform

local) have the power to enforce ORV regulations which should be coordinated and uniform.	regulations would be easier for people to comply with.

B. Specific

1. South Jetty Hill (within the NRA) should be closed to pedestrians by posting it as a vehicle play area. People should be informed and discouraged from entering such a hazardous area.	This would promote public safety. People unfamiliar with ORV use in the area should be informed of the potential hazard from vehicles.
2. A pedestrian corridor should be created from Cleawox Lake to the beach, and pedestrians should be warned they are entering a vehicle play area and to stay within the corridor. Vehicles should only be allowed to cross the pedestrian corridor in open sand areas of high visibility (east of the Goose Pasture).	Promotion of public safety.
3. ORV planning between the Oregon Dunes National Recreation Area, State, and local agencies should be coordinated.	Although the NRA is federal land, it can have a very direct effect on adjacent land. Any significant change in vehicle status within the NRA would have an impact on other areas.
4. To provide for ORV use on open sand, no additional substantial ORV closures should be implemented within the Oregon Dunes National Recreation Area.	The vast majority of open sand dunes on the Oregon coast are located within the Oregon Dunes National Recreation Area. Further closure of those areas open to ORVs would shift the use to smaller dune areas typically less suitable. Closures could result in the curtailment of some ORV use.
5. The north spit of the Coos River may be suitable for vehicle access corridor designations and perhaps a vehicle play designation. One access corridor might run down the beach or foredune with one or two crossovers to the bay side in the most appropriate places	The need for ORV areas in addition to the forty-seven per cent of the NRA is not considered here. Such a determination should be made by a community and the appropriate land holding agencies. There is no management available from the Corps of Engineers so an alternate

(considering critical habitat and user interests). Vehicle play may be potentially suitable on the open sand dunes. These uses should be conditional upon: (1) development of a management plan including enforcement of the access corridor designations and the vehicle play area's boundaries, and (2) the performance of users and the effectiveness of the management plan. The latter conditions can be monitored by field observations and aerial photography. If the conditions are not met, then the vehicle designation would be inappropriate. A local ORV advisory council should be formed to develop a complete ORV plan including the South Coast Beach and Dune Recreationalists, the Corps of Engineers, the County, the private landholders involved, and any other appropriate parties.	source must be found if the area is to be suitable. The county and the ORV clubs may fill the management need. This could be a realistic chance for ORV recreationalists to demonstrate their capabilities of self-management.
6. A major ORV facility should be developed near the Portland area. The use of dredge spoils may facilitate this. Perhaps hills and other challenging topography could be formed. Potentially ORV funds could be used to help develop such a project.	This would provide for ORV recreation and increase the viability of restricted ORV use. It should relieve the user pressure at Sand Lake and allow for its eventual phase out regarding ORV use.

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APPENDIX A

Executive Orders 11644 and 11989

EXECUTIVE ORDER 11644 February 8, 1972

USE OF OFF-ROAD VEHICLES ON THE PUBLIC LANDS

An estimated 5 million off-road recreational vehicles--motorcycles, minibikes, trail bikes, snowmobiles, dune-buggies, all-terrain vehicles, and others--are in use in the United States today, and their popularity continues to increase rapidly. The widespread use of such vehicles on the public lands--often for legitimate purposes but also in frequent conflict with wise land and resource management practices, environmental values, and other types of recreational activity--has demonstrated the need for a unified Federal policy toward the use of such vehicles on the public lands.

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States by the Constitution of the United States and in furtherance of the purpose and policy of the National Environmental Policy Act of 1969 (42 U.S.C. 4321), it is hereby ordered as follows:

Section 1. Purpose. It is the purpose of this order to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.

Sec. 2. Definitions. As used in this order, the term:

(1) "public lands" means (A) all lands under the custody and control of the Secretary of the Interior and the Secretary of Agriculture, except Indian lands, (B) lands under the custody and control of the Tennessee Valley Authority that are situated in western Kentucky and Tennessee and are designated as "Land Between the Lakes", and (C) lands under the custody and control of the Secretary of Defense;

(2) "respective agency head" means the Secretary of the Interior, the Secretary of Defense, the Secretary of Agriculture, and the Board of Directors of the Tennessee Valley Authority, with respect to public lands under the custody and control of each;

(3) "off-road vehicle" means any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (A) any registered motorboat, (B) any military, fire, emergency, or law enforcement vehicle when used for emergency purposes, and (C) any vehicle whose use i expressly authorized by the respective agency head under a permit, lease, license, or contract; and

(4) "official use" means use by an employee, agent, or designated representative of the Federal Government or one of its contractors in the course of his employment, agency, or representation.

Sec. 3. Zones of Use. (a) Each respective agency head shall develop and issue regulations and administrative instructions, within six months of the date of this order, to provide for administrative designation of the specific areas and trails on public lands on which the use of off-road vehicles may be permitted, and areas in which the use of off-road vehicles may not be permitted, and set a date by which such designation of all public lands shall be completed. Those regulations shall direct that the designation

of such areas and trails will be based upon the protection of the resources of the public lands, promotion of the safety of all users of those lands, and minimization of conflicts among the various uses of those lands. The regulations shall further require that the designation of such areas and trails shall be in accordance with the following--

(1) Areas and trails shall be located to minimize damage to soil, watershed, vegetation, or other resources of the public lands.

(2) Areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats.

(3) Areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.

(4) Areas and trails shall not be located in officially designated Wilderness Areas or Primitive Areas. Areas and trails shall be located in areas of the National Park system, Natural Areas, or National Wildlife Refuges and Game Ranges only if the respective agency head determines that off-road vehicle use in such locations will not adversely affect their natural, aesthetic, or scenic values.

(b) The respcetive agency head shall ensure adequate opportunity for public participation in the promulgation of such regulations and in the designation of areas and trails under this section.

(c) The limitations on off-road vehicle use imposed under this section shall not apply to official use.

Sec. 4. Operating Conditions. Each respective agency head shall develop and publish, within one year of the date of this order, regulations prescribing operating conditions for off-road vehicles on the public lands. These regulations shall be directed at protecting resource values, preserving public health, safety, and welfare, and minimizing use conflicts.

Sec. 5. Public Information. The respective agency head shall ensure that areas and trails where off-road vehicle use is permitted are well marked and shall provide for the publication and distribution of information, including maps, describing such areas and trails and explaining the conditions on vehicle use. He shall seek cooperation of relevant State agencies in the dissemination of this information.

Sec. 6. Enforcement. The respective agency head shall, where authorized by law, prescribe appropriate penalties for violation of regulations adopted pursuant to this order, and shall establish procedures for the enforcement of those regulations. To the extent permitted by law, he may enter into agreements with State or local governmental agencies for cooperative enforcement of laws and regulations relating to off-road vehicle use.

Sec. 7. Consultation. Before issuing the regulations or administrative instructions required by this order or designating areas or trails as required by this order and those regulations and administrative instructions, the Secretary of the Interior shall, as appropriate, consult with the Atomic Energy Commission.

Sec. 8. Monitoring of Effects and Review. (a) The respective agency head shall monitor the effects of use of off-road vehicles on lands under their jurisdictions. On the basis of the information gathered, they shall from time to time amend or rescind designations of areas or other actions taken pursuant to this order as necessary to further the policy of this order.

(b) The Council on Environmental Quality shall maintain a continuing review of the implementation of this order.

RICHARD NIXON

The White House,
February 8, 1972

EXECUTIVE ORDER 11989 May 24, 1977

OFF-ROAD VEHICLES ON PUBLIC LANDS

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in order to clarify agency authority to define zones of use by off-road vehicles on public lands, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Executive Order No. 11644 of February 8, 1972, is hereby amended as follows:

Section 1. Clause (B) of Section 2(3) of Executive Order No. 11644, setting forth an exclusion from the definition of off-road vehicles, is amended to read "(B) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and".

Sec. 2. Add the following new Section to Executive Order No. 11644:

"Sec. 9. Special Protection of the Public Lands. (a) Notwithstanding the provisions of Section 3 of this Order, the respective agency head shall, whenever he determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands, immediately close such areas or trails to the type of off-road vehicle causing such effects, until such time as he determines that such adverse effects have been eliminated and that measures have been implemented to prevent future recurrence.

"(b) Each respective agency head is authorized to adopt the policy that portions of the public lands within his jurisdiction shall be closed to use by off-road vehicles except those areas or trails which are suitable and specifically designated as open to such use pursuant to Section 3 of this Order.".

JIMMY CARTER

The White House
May 24, 1977.

APPENDIX B

Proposed Bureau of Land
Management Regulations

[4310-84]

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[43 CFR Part 6290]

OFF-ROAD VEHICLES

Use of Public Lands

AGENCY: Bureau of Land Management, Interior.

ACTION: Proposed rulemaking.

SUMMARY: This proposed rulemaking is developed to provide for management and control of off-road vehicle recreation on public lands. Concentrated off-road vehicle recreation on public lands has, in some areas, caused excessive damage to natural resources and disrupted more passive land uses. Management of off-road vehicle activities will provide for continuation of off-road vehicle recreation under conditions that will protect natural resources and other resource users and promote public safety.

DATE: Comments by September 5, 1978.

ADDRESS: Send comments to: Director (210), Bureau of Land Management, 1800 C Street NW., Washington, D.C. 20246. Comments will be available for public review in Room 5555 at the above address from 7:45 a.m.-4:15 p.m. on regular working days.

FOR FURTER INFORMATION CONTACT:

Larry Young, 202-343-9353.

SUPPLEMENTARY INFORMATION: On April 15, 1974, final rulemaking was published in the FEDERAL REGISTER (FR 13613) establishing regulations to control and direct the use of ORV's on public lands. By decision and order issued by the U.S. District Court for the District of Columbia on May 2, 1975, these regulations were declared to be in violation of Executive Order 11644 and to have been promulgated without adequate consideration of alternatives as required by the National Enviromental Policy Act. The court further ordered that after adequate consideration of alternatives, as required by the National Environmental Policy Act, regulations be issued which did meet the requirements of Executive Order 11644. Under the direction of the Bureau of Outdoor Recreation, the Off-Road Vehicle Environmental Impact Statement was revised to expand the alternatives as ordered by the court. A draft statement was made available to the public on July 19, 1976, and open to public comment until October 7, 1976. On July 28, 1976, proposed Off-Road Vehicle regulations were published in the FEDERAL REGISTER (FR 31518) and the public was given until October 7, 1976, to submit comments on this proposal. More than 1,300 comments were received on the proposed rulemaking and 140 comments were received on the draft environmental impact statement. Based on careful consideration of the comments received a final Environmental Impact Statement has been prepared by the Heritage Conservation and Recreation Service, formerly the Bureau of Outdoor Recreation.

Of the more than 1,300 comments received on the proposed rulemaking approximately 830 were mailgrams and letters addressed to the President, later referred to the Bureau, asking that Executive Order 11644 be amended or rescinded. The Bureau does not have the authority to amend or rescind the Executive order but is in fact under order by the courts to issue regulations that will conform to the Executive order. However, the President has recently amended Executive Order 11644, and the regulations have been amended as appropriate to include provisions under the amended Executive order.

Of the remaining comments received, totalling more than 470, many commentors were generally opposed to the entire proposal and offered few, if any, suggested amendments. In addition to changes to include provisions of the amendments to Executive Order 11644, changes have been made in the proposed rulemaking in response to public comments received on the July 28, 1976, publication of proposed rulemaking. Public comments and suggestions are invited regarding the amended proposed rulemaking.

Final regulations will reflect any additional comments received on the amended proposed rules.

DISCUSSION OF MAJOR COMMENTS RECEIVED ON THE PROPOSED RULEMAKING OF JULY 28, 1976

PUBLIC PARTICIPATION AND INFORMATION

The need for improved public participation and dissemination of information was of major concern to many commentors. They felt the Bureau had not done an adequate job of informing the public and obtaining public input in the planning and management of the ORV program. Request was made to amend the proposed rules to insure that the public would be involved in the planning system and in the designation procedures. It was also suggested that designation notices be available in local Bureau Offices at all times and that maps and other information informing the public of designations and other conditions of use be readily available and widely distributed.

It has been the procedure of the Bureau to obtain public participation in its planning process. Guidelines for planning, which reflect the Bureau's planning process, have been signed into law with the passage of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.). The rulemaking has been amended to strengthen the provision for public participation. Comments also stressed the need for the Bureau to improve its public distribution of maps, brochures and other information concerning the location of public lands and ORV land use designations. The Bureau agrees with these suggestions and will strive to improve communication with the public during the land use planning phase as well as the use phase of the management cycle for a particular administrative unit.

PERMITS

The majority of the comments addressing the provisions for issuing permits requested that the 25 vehicle limit be eliminated or substantially increased, that family-type, non-commercial, and non-competitive events be exempt from permit requirements, and that the term "organized events" be deleted or amended to be less inclusive. A few commentors wanted permits for all ORV use. A permit system is felt to be necessary for management and control of ORV's. The permit provisions have been amended, removed from this part, and placed in part 6260 of this chapter. The provisions require permits for (1) commercial events (2) competitive events for which participants register, and (3) events involving 50 or more ORV's. The amendment also requires that applications for permits be submitted on forms approved by the Director and be made no less than 120 calendar days in advance of the intended use unless a shorter time is authorized by the authorized officer. The lead time is required for preparing the necessary environmental reports, statements and conditions of use, and to provide that the applicant receive an approved permit 30 days in advance of the use date.

CONDITIONS OF USE

Interest in the provisions relating to conditions governing use centered on the licensing and supervision provisions. Commentors asked that the requirement be deleted or modified. This provision has been amended to provide an exemption from the licensing and supervisions requirement for an individual who has been certified by an agency of State government as competent to drive an ORV as a result of successfully completing a State endorsed operators training program. The licensing and supervision requirement is also waived for areas in Alaska designated by the State Director for Alaska. Executive Order 11644 requires that the ORV regulations provide for safety provisions. Because many of the deaths and injuries associated with ORV use have occurred to

younger drivers, the training, licensing and supervision provisions required for individuals under 18 years of age should provide for greater safety to users of the public lands.

Commentors also suggested that ORV use should be in harmony with other authorized uses of the public lands. The proposal has been amended to provide that ORV use be managed to minimize conflicts with other authorized uses of the public lands.

Comments suggested that the terms "reckless," "careless," and "negligent" were too broad and could be the basis of arbitrary decisions. These are terms that are commonly used in State vehicle operating requirements. They have been retained in the proposal. The terms have been used extensively enough that vehicle users have a general understanding as to what the terms mean and can use them as a guide in the operation of their vehicles.

Suggestion was made to improve the safety provisions relating to the use of headlights and taillights. A change was made in the proposal to require lighted headlights and taillights when operating during night hours from sunset to sunrise. This will reduce the possibility of an ORV operating in the dark without lights when coming to or going from an ORV use area.

DEFINITIONS

The definition section of the proposal prompted many comments. Of major interest was the definition of an "ORV." It was suggested that there be separate definitions for the different types of ORV's (snowmobiles, two-wheel, four-wheel, etc.). As the Department is under court order to conform its regulations to Executive Order 11644, the definition of ORV was amended only slightly. The changes made are the insertion of the word "motorized," the deletion of the words "deriving motive power from any source other than muscle," and deletion of the exception provision exempting as an ORV a vehicle operating under a special recreation permit issued in accordance with Part 6260 of 43 CFR. It was not the intent of this rulemaking to exclude, as an ORV, motorized vehicles permitted under the provisions thereof.

The term "authorized officer" was deleted because it is already defined in 43 CFR Part 1810. Several commentors expressed concern over the broad authorities of the authorized officer and wanted to know who he is and to whom he is subject. Bureau Order No. 701 is the official delegation document for the Bureau. Under section 3.9 of this Order all ORV actions have been delegated to the District Manager. Under section 3.1 of the Order the District Manager may redelegate his authority to Area Managers or the Chief, Division of Administration after first obtaining approval of such delegation from the State Director and after publicizing the delegation in the FEDERAL REGISTER.

As suggested in a comment, the word "designated" has been added to clarify the definitions of open, limited and closed areas and trails.

DESIGNATION—CRITERIA AND PROCEDURES

A great diversity of public concern was demonstrated in the comments dealing with designation. Many commentors were opposed to any designation while others wanted all lands closed to ORV use until designated. Some commentors wanted immediate closures not only on "wilderness" and "primitive" areas but also on "natural" areas, special cultural areas, and other areas having fragile or scenic values. Other commentors suggested keeping open to ORV use only those areas presently being used. Some commentors expressed strong disagreement with the designation deadline date of 1987. This date was felt to be too distant and allowed an unwarranted period of time to bring ORV use under adequate control and management.

The status of the public lands prior to designation in conformance with Executive Order 11644, under the terms of the District Court Order of May 5, 1975, is simply undesignated. This means that those areas which have previously been open, closed, or limited shall generally remain so until designated under E.O. 11644 or 11989. However, this does not preclude the use of other existing authorities to open, close, or limit areas as needed for reasons other than ORV use. Closures or limitations might be because of withdrawals for habitat preservation, public safety, resource protection, etc. Wilderness areas, big-game wintering areas, critical watersheds, etc., can be protected even though the Executive Order 11644 designations have not been made.

To correlate the management of the several resources uses of the public lands, the Bureau of Land Management uses a coordinated multiple use planning system approach. The designation of ORV areas must be accomplished in harmony with this planning system. Action necessary to make designations is beginning immediately. All areas will be designated by 1987. It is estimated that 40 percent of the total designation process will be accomplished by 1981. This 40 percent will cover 60 percent of the major ORV use areas. For example, the Federal Land Policy and Management Act of 1976 designated the California Desert Conservation Area and directed that a comprehensive management plan be completed and implemented by September 30, 1980. This Conservation Area presently sustains about half of the total ORV use occurring on the public lands administered by the Bureau. Other major ORV use areas are also receiving timely planning and management attention.

Executive Order 11644 directed that officially designated wilderness and primitive areas be closed to ORV use and need not be designated under the three ORV designations defined in this part. Additional closures may be justified through the Bureau planning system. The Federal Land Policy and Management Act of 1976 has directed that by October 21, 1991, the Secretary shall review those roadless areas of 5,000 acres or more and roadless islands of the public lands identified during the inventory required by the Federal Land Policy and Management Act as having wilderness characteristics as described in the Wilderness Act (16 U.S.C. 1131 et seq.). Once identified, these areas having wilderness characteristics shall continue to be managed during the review period so as not to impair the suitability of such areas for preservation as wilderness, subject, however, "to the continuation of existing mining and grazing uses and mineral leasing in the manner and degree in which the same was being conducted on the date of approval" of the Federal Land Policy and Management Act. The ORV designations of lands identified as potential wilderness areas are being made consistent with these provisions of the Federal Land Policy and Management Act.

Request was made to clarify the status of current ORV designations. Designations made to date under 43 CFR Part 6290 are null and void. United States District Court, District of Columbia Court Order 74-1215, dated May 2, 1975, declared 43 CFR Part 6290 in violation of Executive Order 11644. Therefore, any designations made under those regulations also were in violation of the Executive Order. ORV closures and conditions of uses made under subpart 6221—Primitive Areas, § 6010.4—Closure of lands and subpart 6261—Rules for Visitor Use of Developed Recreation Sites, remain valid and in effect.

As suggested in the comments, the provision for monitoring ORV use has been clarified by stating that the authorized officer or his delegate shall monitor the effects of ORV use. The types of temporary designation changes have been expanded by adding that temporary designations may also "open" areas previously closed. The paragraph dealing with withdrawals has been deleted since the withdrawal procedures referred to do not comply with the provisions of the Federal Land Policy and Management Act of 1976.

VEHICLE STANDARDS

Commentors suggested reducing the required level of vehicle operating

standards as required in the proposal, feeling that the standards were excessive. Snowmobile interests as well as other ORV groups wanted the spark arrester requirement removed. Request was made to delete the requirements for having brakes in good working condition as no one would operate an ORV without good brakes. The provision of the proposal covering noise standards appeared to some commentors as excessive since the Environmental Protection Agency did not have established noise standards. Some commentors read the proposal as saying that all ORV's required lights. Some commentors suggested that state standards be followed in lieu of Federal standards. The provision requiring minimum vehicle standards was retained because it is felt that basic vehicle standards are necessary. Even though states may have vehicle standards there is a lack of consistency of standards among states. The broad standards in the regulations are the minimum standards and will prevail where State law and regulations do not exist or are less stringent.

The proposal requires that an ORV have a spark arrester only when the authorized officer requires it. The proposal has been amended to waive the spark arrester requirement where three or more inches of snow are on the ground. The provision on noise standards has been amended to require compliance with Environmental Protection Agency standards when they are established and become available to the public. The requirement for lights on ORV's was apparently misunderstood. It requires ORV's operating during night hours from sunset to sunrise to be equipped with and use lights. Vehicles operated only during daylight hours are not required to have lights.

OTHER COMMENTS

The law enforcement provision drew several comments that the Bureau lacked both personnel and the authority to conduct law enforcement activities. The proposal used as the authority the act of September 15, 1960, as amended (16 U.S.C. 670 et seq.), sometimes referred to as the Sikes Act. This act provides authority to enforce the regulations issued to control ORV use on those specific designated areas of public land within a State on which conservation and rehabilitation programs are to be implemented. The other authority on which the law enforcement provisions was based was the Land and Water Conservation Fund Act (16 U.S.C. 460 1-6a) which provides for enforcing the collection of fees and permit requirements.

After this proposed rulemaking was printed in the FEDERAL REGISTER on July 28, 1976, the Federal Land Policy and Management Act of 1976 was enacted. This law provides the Bureau of Land Management with broad law enforcement authority. Not only may BLM personnel be given law enforcement responsibilities, but the act provides for the use of local law enforcement personnel through compensation by the Bureau.

A few commentors wanted limits established for temporary designations. Generally, such designations would be for a season—for deviation from normal wildlife use patterns, climatic conditions, public safety, etc., which most often would not exceed a year in duration.

Some commentors expressed concern that the proposed regulations would hinder access to isolated tracts of State or private lands within large blocks of public lands. The Bureau does not intend to hinder lawful and proper ingress and egress to such lands. Owners of such lands who desire access to their lands may work with local Bureau officials to arrive at solutions to their access needs. A number of commentors, including many who have mineral interests and holders of rights of way permits, suggested the proposed regulations be amended to specifically allow for the use of motorized vehicles in exploring and prospecting for minerals and for inspection and maintenance of rights-of-way. The definition of an "off-road vehicle" specifically excludes vehicles expressly authorized by the authorized officer or otherwise officially approved. Examples of situations where authorized and approved use of motorized vehicles would be excluded from the definition of an ORV are: the specific conditions of motorized vehicle use contained in a right-of-way permit, an approved plan of operation as described in the proposed regulations dealing with the surface management of public lands under the U.S. mining laws as published in the FEDERAL REGISTER on December 9, 1976, or a condition of use in a grazing license.

PRINCIPAL AUTHOR

Larry Young of the Bureau of Land Management, Washington Office, Division of Recreation Management.

INFLATION IMPACT STATEMENT

The Department of the Interior has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Order 11821 and OMB Circular A-107.

It is proposed to amend 43 CFR Part 6290 as set forth below.

Dated: June 28, 1978.

GUY R. MARTIN,
Assistant Secretary of the Interior.

1. Part 6290 is revised to read as follows:

PART 6290—OFF-ROAD VEHICLES

Subpart 6290—General

Sec.
6290.0-1 Purpose.
6290.0-2 Objectives.
6290.0-3 Authority.
6290.0-5 Definitons.
6290.0-7 Enforcement.
6290.0-8 Applicability.

Subpart 6291—Conditions of Use of Public Lands

6291.1 Regulations governing use.
6291.2 Special rules.

Subpart 6292—Areas and Trails Designation

6292.1 Designation criteria.
6292.2 Designation procedures.
6292.3 Designation changes.

Subpart 6293—Vehicle Operation

6293.1 Standards.

Subpart 6294—Permits

6294.1 Permit requirements.

AUTHORITY: 43 U.S.C. 1201, National Environmental Policy Act of 1969, 42 U.S.C. 4321; 43 U.S.C. 2, 1201; and Executive Order 11644 (37 FR 2877); Executive Order 11989 (42 FR 26959) (43 U.S.C. 1701 et. seq.)

Subpart 6290—General

§ 6290.0-1 Purpose.

The purpose of this part is to establish criteria for designating public lands as open, limited or closed to the use of off-road vehicles and for establishing controls governing the use and operation of off-road vehicles in such areas.

§ 6290.0-2 Objectives.

The objectives of these regulations are to protect the resources of the public lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.

§ 6290.0-3 Authority.

The provisions of this part are issued under the Federal Land Policy and Management Act of 1976 (90 Stat. 2743; 43 U.S.C. 1701 et seq.); the Taylor Grazing Act (43 U.S.C. 315a); the National Environmental Policy Act (42 U.S.C. 4321 et seq.); the Endangered Species Act (16 U.S.C. 1531 et seq.); the Wild and Scenic Rivers Act (16 U.S.C. 1281c); the act of September 15, 1960, as amended (16 U.S.C. 670 et seq.); the Land and Water Conservation Fund Act (16 U.S.C. 460 1-6a); the National Trails System Act (16 U.S.C. 1241 et seq.) and E.O. 11644 (Use of Off-Road Vehicles on the Public Lands), 37 FR 2877, 3 CFR 74, 332, as amended by E.O. 11989 42 FR 26959 (May 25, 1977).

§ 6290.0-5 Definitions.

As used in this part:

(a) "Off-Road Vehicle" means any motorized vehicle capable of, or de-

their natural, esthetic, or scenic values.

§ 6292.2 Designation procedures.

(a) *Public participation.* The authorized officer shall, to the extent practical, designate and redesignate areas and trails in conjunction with the Bureau planning system for the formulation of multiple-use management plans. Plans shall consider current and potential impacts of specific vehicle types on all resources and users in the region of the area under consideration. Prior to making designations or redesignations, the authorized officer shall consult with interested user groups, Federal, State, county, and local agencies, local landowners, and other parties in a manner that provides an opportunity for the public to express itself and have those views taken into account.

(b) *Identification of designated areas and trails.* The authorized officer shall take action by posting and other appropriate measures to identify designated areas and trails so that the public will be aware of locations and limitations applicable thereto. Public notice of designations or redesignations shall be given at the time of designation or redesignation through publication in the FEDERAL REGISTER and local news media. Copies of such notices shall be available to the public in local Bureau offices. The authorized officer will make available to the public other information material as may be appropriate.

§ 6292.3 Designation changes.

(a) *Monitoring use.* The authorized officer shall monitor effects of the use of off-road vehicles. On the basis of information so obtained, and whenever the authorized officer deems it necessary to carry out the objectives of the part, designations may be amended, revised, revoked, or other actions taken pursuant to the regulations in this part.

(b) *Temporary action.* The authorized officer may temporarily open, close, or limit public use and travel in accordance with the provisions of § 6010.4 of this chapter as to public lands which have been designated or redesignated in accordance with this subpart, and as to public lands which have not been designated.

Subpart 6293—Vehicle Operations

§ 6293.1 Standards.

(a) No off-road vehicle may be operated on public lands unless equipped with brakes in good working condition.

(b) No off-road vehicle equipped with a muffler cutout, bypass, or similar device, or producing excessive noise exceeding Environmental Protection Agency standards, when established, may be operated on public lands.

(c) The authorized officer may, by posting appropriate signs or by marking a map which shall be available for public inspection at local Bureau offices, indicate those public lands upon which no off-road vehicle may be operated unless equipped with a properly installed spark arrester that meets and is qualified to either the U.S. Department of Agriculture—Forest Service Standard 5100-1a, or the 80-percent efficiency level when determined by the appropriate Society of Automotive Engineers (SAE) Recommended Practices J335 or J350, which standards include the requirement that such spark arrester shall have an efficiency to retain or destroy at least 80 percent of carbon particles for all flow rates, and which includes a requirement that such spark arrestor has been warranted by its manufacturer as meeting such requirement for at least 1,000 hours subject to normal use, with maintenance and mounting in accordance with the manufacturer's recommendation. A spark arrester is not required when an off-road vehicle is being operated in an area which has 3 or more inches of snow on the ground.

(d) Vehicles operating during the time specified in § 6291.1(g)(5) shall comply with the following: (1) Headlights shall be of sufficient power to illuminate an object at 300 feet at night under normal, clear atmospheric conditions. Two- or three-wheeled vehicles or single-tracked vehicles will have a minimum of one headlight. Vehicles having four or more wheels or more than a single track will have a minimum of two headlights, except double tracked snowmachines with a maximum capacity of two people may have only one headlight. (2) Red taillights, capable of being seen at a distance of 500 feet from the rear at night under normal, clear atmospheric conditions, are required on vehicles in the same numbers as headlights.

Subpart 6294—Permits

§ 6294.1 Permit requirements.

Permits are required for certain types of ORV use and shall be issued in accordance with the special recreation permit procedures under part 6260 of this chapter.

[FR Doc. 78-18478 Filed 7-6-78; 8:45 am]

APPENDIX C

Applicable (36 CFR 295);
(36 CFR 261.13) and revoked
(36 CFR 295.6-295.8) Forest
Service regulations.

PART 295—USE OF OFF-ROAD VEHICLES

Sec.
295.1 Applicability.
295.2 Definitions.
295.3 Planning designation of areas and trails.
295.4 Public participation.
295.5 Public information.
295.6—295.8 [Reserved]
295.9 Monitoring effects of off-road vehicle use.

AUTHORITY: 30 Stat. 35, as amended; 16 U.S.C. 551; 50 Stat. 525, as amended; 7 U.S.C. 1011; 83 Stat. 852; E.O. 11644.

SOURCE: 38 FR 26723, Sept. 25, 1973, unless otherwise noted.

§ 295.1 Applicability.

The regulations in this part pertain to administrative designation of specific areas and trails of National Forest System lands on which the use of off-road vehicles shall be allowed, restricted, or prohibited and establishing controls governing the use of off-road vehicles on such areas. The use of off-road vehicles in National Forest Wilderness and Primitive Areas is governed by §§ 293.1 through 293.17 of this Title.

§ 295.2 Definitions.

(a) "Off-road vehicles" means any motorized vehicles designed for or capable of cross country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other terrain which would include, but not be limited to, such vehicles as four wheel drive, motorcycle, snowmobile, amphibious, and air cushion vehicles; except that such term excludes (1) any registered motorboat, (2) any military, fire, emergency or law enforcement vehicle when used for official or emergency purposes, and (3) any vehicle whose use is expressly authorized by the Chief, Forest Service, under a permit, lease, license, or contract.

(b) "National Forest System lands" means National Forests, National Grasslands, and other lands and interests in land administered by the Forest Service.

(c) "Official use" means an employee, agent, or designated representative of the Federal Government or one of its contractors in the course of his employment, agency, or representation.

(d) "Trail" means a designated path or way of varying width which is commonly used by and maintained for hikers, horsemen, snow travelers, bicyclists or for motorized vehicles with a total width of 40 inches or less.

§ 295.3 Planning designation of areas and trails.

On National Forest System lands the continuing resource planning process will provide for designation of specific areas and trails for off-road vehicle use, use restrictions, and closures to any or all types of such use. This process will include coordination with appropriate Federal, State, and local agencies. The planning process will analyze and evaluate alternatives to enable decisions which best provide for the protection of the natural and historic resources, promotion of safety for all users, minimization of use conflicts, and accomplishment of all of the other resource objectives for National Forest System lands. Analysis and evaluation of off-road vehicles uses will take into consideration factors such as noise, safety, quality of the various recreational experiences provided, protential impacts on soil, watershed, vegetation, fish, wildlife, fish and wildlife habitat, and existing or proposed recreational uses of the same or neighboring lands. Regional Foresters and Forest Supervisors are authorized to designate areas and trails for off-road vehicles use, use restrictions, and closures to any or all types of such use.

[38 FR 26723, Sept. 25, 1973, as amended at 39 FR 10431, Mar. 20, 1974]

§ 295.4 Public participation.

The public shall be provided an opportunity to participate in the designation of areas and trails relating to off-road vehicle use. Advance notice will be given to allow review by the public of proposed designations or revisions of designations of any areas or trails for off-road vehicle use, for restrictions, or for closures to such use. Adequate time will be allowed for public response prior to any designations or revisions. In emergency situations, designation or revision of designation may be made without public participation to protect natural resources and to provide for public safety.

§ 295.5 Public information.

Areas and trails may be marked with appropriate signs to control off-road vehicle use. All notices issued concerning the regulation of off-road vehicles shall be posted so as to reasonably bring them to the attention of the public, and a copy of the notice shall be kept available to the public in the offices of the District Rangers and Forest Supervisors. Information and maps will be published and distributed describing the conditions of use and the time periods when areas and trails are: (a) Open to off-road vehicle use, (b) restricted to certain types of off-road vehicle use, (c) closed to off-road vehicle use.

§§ 295.6—295.8 [Reserved]

§ 295.9 Monitoring effects of off-road vehicle use.

The effects of off-road vehicle use on National Forest System lands will be monitored by the Forest Service. Designation, use restrictions, and operating conditions will be revised as needed to meet changing conditions.

PARTS 296–299 [RESERVED]

295.6 Operating conditions.

The following acts are prohibited when off-road vehicles are operated on areas or trails of National Forest System lands:

(a) Operation without a valid operator's license or learner's permit if required by the laws of the State in which the vehicle is being operated for that particular type of off-road vehicle;

(b) Operation by an unlicensed person under 18 years of age unless accompanied by or within the sight of a responsible adult who has a valid operators license if a license is required by the State for the type of vehicle being operated;

(c) Operation in a manner disregarding the rights and safety of others, or so as to endanger, or be likely to endanger, any person or property;

(d) Operation in excess of established speed limits;

(e) Operation while the operator is under the influence of alcohol or drugs;

(f) Operation in a manner creating excessive damage or disturbance of the land, wildlife, or vegetative resources;

(g) Operation not in conformance with applicable State laws and regulation requirements established for off-road vehicles;

(h) Operation when an internal combustion engine is not equipped with a properly installed muffler in good working condition;

(i) Operation when an internal or external conbustion engine is not equipped with a properly installed spark arrester, provided that such equipment is specified when an area or trail is designated for use by off-road vehicles. Such spark arrester shall meet and be qualified to either the Department of Agriculture, Forest Service Standard 5100-1a, or the 80 percent efficiency level when determined in accordance with the appropriate Society of Automotive Engineers (SAE) Recommended Practices J335 or J350. Qualification or spark arresters to either the Forest Service Standard of SAE Recommended Practices shall be determined by the Forest Service;

(j) Operation without an operable braking system;

(k) Operation from one-half hour after sunset to one-half hour before sunrise without working headlights and taillight;

(l) Operation which does not comply with:

(1) Any applicable noise emission standard established by the Administrator, Environmental Protection Agency, under authority of section 6 of the Noise Control Act of 1972 (PL 92-574);

(2) Any applicable U. S. Department of Agriculture or State standards for permissible levels of environmental noise.

In case of overlapping standards, the most stringent standards will govern.

[39 FR 10431, Mar. 20, 1974]

295.7 Restricted and prohibited use.

Except as provided in 295.8, and except for use in connection with mining activities under the provisions of the General Mining Act of 1872, the use of off-road vehicles is prohibited in areas and trails on National Forest System lands during any period when such areas and trails have been closed to vehicles or certain types of vehicles pursuant to these regulations.

295.8 Off-road vehicle permits.

Use of off-road vehicles on National Forest System lands where the use of off-road vehicles is prohibited may be allowed for official use or with prior authorization by means of an Off-Road Vehicle permit. Off-Road Vehicle permits may be issued by the Chief or authorized official of the Forest Service, and such permits shall be revocable for violation of the rules and regulations governing the National Forests.

PART 261—PROHIBITIONS

Subpart A—General Prohibitions

Sec.

261.1 Scope.
261.2 Definitions.
261.3 Interfering with forest officers prohibited.
261.4 Disorderly conduct.
261.5 Fire.
261.6 Timber and other forest products.
261.7 Livestock.
261.8 Fish and wildlife.
261.9 Property.
261.10 Occupancy and use.
261.11 Sanitation.
261.12 Forest development roads and trails.
261.13 Use of vehicles off roads.
261.14 Developed recreation sites.
261.15 Admission, recreation use and special recreation permit fees.
261.16 National Forest wilderness.
261.17 Boundary Waters Canoe Area, Superior National Forest.
261.18 Pacific Crest National Scenic Trail.
261.19 National Forest primitive areas.
261.20 Unauthorized use of "Smokey Bear" and "Woodsy Owl" symbol.

§ 261.13 Use of vehicles off roads.

It is prohibited to operate any vehicle off Forest Development, State or County roads:

(a) Without a valid license as required by State law.

(b) Without an operable braking system.

(c) From one-half hour after sunset to one-half hour before sunrise unless equipped with working head and tail lights.

(d) In violation of any applicable noise emission standard established by any Federal or State agency.

(e) While under the influence of alcohol or other drug;

(f) Creating excessive or unusual smoke;

(g) Carelessly, recklessly, or without regard for the safety of any person, or in a manner that endangers, or is likely to endanger, any person or property.

APPENDIX D

Oregon Revised Statutes that apply to off-road vehicles and snowmobiles.

OFF-ROAD VEHICLES

483.833 Definitions for ORS 483.833 to 483.847. As used in ORS 483.833 to 483.847, "off-road vehicle" means any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland or other natural terrain.
[1975 c.89 §2]

483.835 [1973 c.580 §5; 1975 c.287 §6; renumbered 487.755]

483.837 Equipment requirements when operated on certain public lands. Except as provided in ORS 483.847, an off-road vehicle is not in violation of laws governing equipment on motor vehicles if the off-road vehicle complies with the requirements of ORS 483.839 and 483.843 and is operated within the Oregon Dunes National Recreational Area on:

(1) Lands and roads under the custody and control of the Secretary of the United States Department of Agriculture; or

(2) That portion of the ocean shore open to vehicular traffic.
[1975 c.89 §3]

483.839 Required equipment. (1) Every off-road vehicle operating in an area specified in ORS 483.837 shall be equipped with:

(a) A muffler which permits the vehicle to meet standards for noise emissions adopted by the Environmental Quality Commission.

(b) Brakes of a type specified by the Administrator of the Motor Vehicles Division.

(c) A windshield wiper if the off-road vehicle is equipped with a windshield.

(d) A flag of a type specified by the administrator of the division when the off-road vehicle is operated on sand.

(e) Such other safety equipment as is required by rule adopted by the administrator.

(2) Paragraphs (c) and (d) of subsection (1) of this section shall not apply to motorcycles.
[1975 c.89 §4]

483.840 [1973 c.580 §6; repealed by 1975 c.451 §291]

483.843 Headlight and taillight requirements. Every off-road vehicle operating in an area specified in ORS 483.837 at any time from one-half hour after sunset to one-half hour after sunrise shall be equipped with and display headlights and taillights.
[1975 c.89 §5]

483.845 [1973 c.580 §7; repealed by 1975 c.451 §291]

483.847 Operation without required equipment. Operation of an off-road vehicle in an area specified in ORS 483.837 in violation of ORS 483.839 or 483.843 or any rule adopted pursuant to ORS 483.839 is a Class C misdemeanor.
[1975 c.89 §6]

483.850 [1973 c.580 §8; repealed by 1975 c.451 §291]

483.855 [1973 c.580 §9; repealed by 1975 c.451 §291]

483.860 [1973 c.580 §10; 1975 c.287 §8; repealed by 1975 c.451 §291]

483.865 [1973 c.580 §11; 1975 c.451 §127; renumbered 487.775]

483.870 [1973 c.580 §12; 1975 c.451 §129; renumbered 487.785]

483.705 [1969 c.598 §9; repealed by 1971 c.618 §28]

483.710 Operation of snowmobile to hunt; while under the influence of liquor or drugs; "dangerous drugs" defined. (1) No person shall operate a snowmobile in a manner so as to run down, harass, chase or annoy any game animals or birds or domestic animals. No person shall hunt from a snowmobile. This subsection does not apply to officers of the State Fish and Wildlife Commission, to persons under contract to the commission in the performance of their official duties or to individuals who have secured a permit from the commission for purposes of research and study.

(2) No owner or other person having charge or control of a snowmobile shall knowingly authorize or permit any person to operate the snowmobile across a highway who is incapable by reason of age, physical or mental disability or who is under the influence of intoxicating liquor or controlled substances.

(3) As used in ORS 483.730, "dangerous drugs" means any drug designated a controlled substance by the Committee on Controlled Substances.
[1969 c.598 §§10, 13; 1971 c.618 §23; 1977 c.745 §50]

Note: The amendments to 483.710 by section 50, chapter 745, Oregon Laws 1977, take effect July 1, 1978. See section 56, chapter 745, Oregon Laws 1977.

483.715 [1969 c.598 §11; repealed by 1971 c.618 §28]

483.725 Operator's license or certification required; age limit for operators; snowmobile safety education courses. (1) No person shall operate a snowmobile unless:

(a) He has an operator's license issued under ORS chapter 482 or has been certified, as provided by subsection (3) of this section, as qualified to operate a snowmobile; and

(b) He has on his person at the time he is operating the snowmobile his license or evidence of such certification.

(2) No person under 12 years of age shall operate a snowmobile on or across a highway or a railroad right of way.

(3) A person who does not have an operator's license issued under ORS chapter 482 may operate a snowmobile if he has taken a snowmobile safety education course and been certified as qualified to operate a snowmobile. The course shall be one given by an instructor designated by the division as qualified to conduct such a course and issue such a certificate. The division shall adopt regulations to provide for the designation of instructors and the issuance of certificates. The division shall by regulation prescribe reasonable fees to be collected in the administration of the program. Notwithstanding subsection (1) of this section, a person may operate a snowmobile while taking such a course from an instructor.
[1971 c.618 §18]

483.730 Prohibited acts. It shall be unlawful for any person to operate any snowmobile:

(1) At a rate of speed greater than reasonable and proper under the existing conditions.

(2) While under the influence of intoxicating liquor, dangerous drugs or narcotic drugs.

(3) In a negligent manner so as to endanger the person or property of another, or to cause injury or damage to either.

(4) Without a lighted headlight and taillight.

(5) Without an adequate braking device which may be operated either by hand or foot.

(6) Without an adequate and operating muffling device which shall effectively blend the exhaust and motor noise in such a manner so as to preclude excessive or unusual noise and, on snowmobiles manufactured after January 4, 1973, which shall effectively maintain such noise at a level of 82 decibels or below on the "A" scale at 100 feet under testing procedures established by the Department of State Police; however, snowmobiles used in organized racing events in an area designated for that purpose may use a bypass or cutout device.

(7) Upon the paved portion or upon the shoulder or inside bank or slope of any highway, or upon the median of any divided highway or upon any portion of a highway right of way under construction, except as provided in ORS 483.735 and 483.740.

(8) On or across a railroad right of way, except as provided by ORS 483.735 and 483.740; however, this subsection does not apply to snowmobiles being operated by officers or employes or authorized contractors or agents of a railroad in the course of their employment.

(9) In any area or in such a manner so as to expose the underlying soil or vegetation, or to injure, damage or destroy trees or growing crops.

(10) With a firearm in his possession, unless the firearm is unloaded, or with a bow, unless the bow is unstrung.

(11) A person who violates subsection (1) or subsections (3) to (10) of this section commits a Class B traffic infraction.

(12) A person who violates subsection (2) of this section commits a Class A traffic infraction.
[1971 c.618 §15; 1977 c.882 §26]

483.735 Crossing two or three lane highways. It shall be lawful to drive or operate a snowmobile across a two or three lane highway or a railroad right of way when:

(1) The crossing is made at an angle of approximately 90 degrees to the direction of the highway or railroad right of way and at a place where no obstruction prevents a quick and safe crossing;

(2) The snowmobile is brought to a complete stop before entering the highway or railroad right of way;

(3) The operator of the snowmobile yields the right of way to vehicles using the highway or equipment using the railroad tracks; and

(4) The crossing is made at an established public railroad crossing or at a place that is greater than 100 feet from any highway intersection.

(5) A person who violates this section commits a Class C traffic infraction.
[1971 c.618 §16; 1977 c.882 §27]

483.740 Operation of snowmobile upon highway or railroad right of way. (1) Notwithstanding subsection (2) of ORS 483.725 and ORS 483.735, it shall be lawful to operate a snowmobile upon a highway:

(a) Where the highway is completely covered with snow or ice and has been closed to motor vehicle traffic during the winter months;

(b) For the purpose of loading or unloading when such operation is performed with safety and without causing a hazard to vehicular traffic approaching from either direction on the highway;

(c) Where the highway is posted to permit snowmobiles;

(d) In an emergency during the period of time when and at locations where snow upon the highway renders travel by automobile impractical; or

(e) When traveling along a designated snowmobile trail.

(2) Notwithstanding subsection (2) of ORS 483.725 and ORS 483.735, it shall be lawful to operate a snowmobile upon a railroad right of way:

(a) Where the right of way is posted to permit snowmobiles; or

(b) In an emergency.

(3) A person who violates this section commits a Class C traffic infraction.
[1971 c.618 §17; 1977 c.882 §28]

483.745 Accident reports required. The operator of a snowmobile involved in any accident resulting in injury to or death of any person, or property damage in the estimated amount of $200 or more, or a person acting for the operator or the owner of the snowmobile having knowledge of the accident, should the operator of the snowmobile be unknown, shall submit such reports as are required under ORS 483.602 to 483.614, and ORS 483.602 to 483.612 are applicable to such reports when submitted.
[1971 c.618 §19; 1975 c.451 §269d]

483.750 Enforcement of ORS 483.725 to 483.740. ORS 483.725 to 483.740 shall be enforced by all police officers, game wardens and all other state law enforcement officers within their respective jurisdictions.
[1971 c.618 §20]

483.755 Regulation of snowmobiles by cities, counties, political subdivisions and state agencies. Notwithstanding any of the provisions of ORS 483.725 to 483.740 and subsection (3) of 483.991, any city, county or other political subdivision, or any state agency, may regulate the operation of snowmobiles on public lands, waters and other properties under its jurisdiction, and on streets or highways within its boundaries by adopting regulations or ordinances of its governing body, if such regulations are not inconsistent with ORS 483.725 to 483.740 and subsection (3) of 483.991.
[1971 c.618 §22; 1977 c.475 §6]

APPENDIX E

Oregon Revised Statutes and administrative rules relating to ORV noise.

467.010 Legislative findings and policy. The Legislative Assembly finds that the increasing incidence of noise emissions in this state at unreasonable levels is as much a threat to the environmental quality of life in this state and the health, safety and welfare of the people of this state as is pollution of the air and waters of this state. To provide protection of the health, safety and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions, it is hereby declared that the State of Oregon has an interest in the control of such pollution, and that a program of protection should be initiated. To carry out this purpose, it is desirable to centralize in the Environmental Quality Commission the authority to adopt reasonable state-wide standards for noise emissions permitted within this state and to implement and enforce compliance with such standards.
[1971 c.452 §1]

467.020 Emission of noise in excess of prescribed levels prohibited. No person may emit, cause the emission of, or permit the emission of noise in excess of the levels fixed therefor by the Environmental Quality Commission purusant to ORS 467.030.
[1971 c.452 §3]

467.030 Adoption of noise control rules, levels and standards. (1) In accordance with the applicable provisions of ORS chapter 183, the Environmental Quality Commission shall adopt rules relating to the control of levels of noise emitted into the environment of this state and including the following:

(a) Categories of noise emission sources, including the categories of motor vehicles and aircraft.

(b) Requirements and specifications for equipment to be used in the monitoring of noise emissions.

(c) Procedures for the collection, reporting, interpretations and use of data obtained from noise monitoring activities.

(2) The Environmental Quality Commission shall investigate and, after appropriate public notice and hearing, shall establish maximum permissible levels of noise emission for each category established, as well as the method of measurement of the levels of noise emission.

(3) The Environmental Quality Commission shall adopt, after appropriate public notice and hearing, standards for the control of noise emissions which shall be enforceable by order of the commission.
[1971 c.452 §2; 1973 c.107 §1; 1973 c.835 §159]

467.100 Local regulation of noise sources. (1) Pursuant to this chapter, in order to protect the health, safety and welfare of its citizens, a city or county may adopt and enforce noise ordinances or noise standards otherwise permitted by law. A city or county may also adopt such standards for a class of activity exempted by the commission or noise emission sources not regulated by the commission.

(2) The commission may by rule withdraw from enforcement any or all of its rules or standards adopted pursuant to this chapter within the boundaries of any city or county, if the commission finds such city or county:

(a) Has adopted noise standards that are at least as stringent as and no less protective than those standards adopted by the state; and

(b) Has a program of active enforcement of such standards which, in the commission's view, is at least as protective of the public health, safety and welfare as would be the enforcement provided by the department.

(3) The commission may modify or repeal such a rule as is made in accordance with subsection (2) of this section with regard to any particular city or county if it finds material change in any of the circumstances relied upon by the commission in making such rule. Such rulemaking shall be in conformance with the provisions of ORS chapter 183.

(4) Nothing in this section is intended to preclude contractual arrangements between a city or county and a state agency for services provided for the enforcement of state or local noise emission control standards.
[1977 c.511 §4]

467.990 Penalties. Violation of any provision of this chapter or rules or orders made under the provisions of this chapter is a Class B misdemeanor. Each day of violation shall be considered a separate offense.
[1971 c.452 §6; 1973 c.835 §161]

Department of Environmental Quality

Chapter 340, Oregon Administrative Rules

Division 35

Noise Control Regulations

Amended March 1, 1978

General

35-005 POLICY. In the interest of public health and welfare, and in accordance with ORS 467.010, it is declared to be the public policy of the State of Oregon:

(1) to provide a coordinated state-wide program of noise control to protect the health, safety, and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions;

(2) to facilitate cooperation among units of state and local governments in establishing and supporting noise control programs consistent with the State program and to encourage the enforcement of viable local noise control regulations by the appropriate local jurisdiction;

(3) to develop a program for the control of excessive noise sources which shall be undertaken in a progressive manner, and each of its objectives shall be accomplished by cooperation among all parties concerned.

.....

35-015 DEFINITIONS. As used in this Division:

(1) "Ambient Noise" means the all-encompassing noise associated with a given environment, being usually a composite of sounds from many sources near and far.

.....

(11) "In-Use Motor Vehicle" means any Motor Vehicle which is not a New Motor Vehicle.

.....

(14) "Motorcycle" means any Motor Vehicle, except Farm Tractors, designed to travel on not more than three wheels which are in contact with the ground.

(15) "Motor Vehicle" means any vehicle which is, or is designed to be self-propelled or is designed or used for transporting persons or property. This definition excludes, airplanes, but includes water craft.

.....

(18) "Noise Level" means weighted Sound Pressure Level measured by use of a metering characteristic with an "A" frequency weighting network and reporting as dBA.

(19) "Noise Sensitive Property" means real property on, or in, which people normally sleep, or on which exist facilities normally used by people as schools, churches, or public libraries. Property used in industrial or agricultural activities is not defined to be Noise Sensitive Property unless it meets the above criteria in more than an incidental manner.

.....

(21) "Off-Road Recreational Vehicle" means any Motor Vehicle, including water craft, used off Public Roads for recreational purposes. When a Road Vehicle is operated off-road, the vehicle shall be considered an Off-Road Recreational Vehicle if it is being operated for recreational purposes.

.....

(26) "Propulsion Noise" means that noise created in the propulsion of a Motor Vehicle. This includes, but is not limited to, exhaust system noise, induction system noise, tire noise, cooling system noise, aerodynamic noise and, where appropriate in the test procedure, braking system noise. This does not include noise created by Road Vehicle Auxiliary Equipment such as power take-offs and compressors.

(27) "Public Roads" means any street, alley, road, highway, freeway, thoroughfare, or section thereof in this state used by the public or dedicated or appropriated to public use.

(28) "Quiet Area" means any land or facility designated by the Commission as an appropriate area where the qualities of serenity, tranquility, and quiet are of extraordinary significance and serve an important public need, such as, without being limited to, a wilderness area, national park, state park, game reserve, wildlife breeding area or amphitheater. The Department shall submit areas suggested by the public as Quiet Areas, to the Commission, with the Department's recommendation.

(29) "Racing Events" means any competition using Motor Vehicles, conducted under a permit issued by the governmental authority having jurisdiction or, if such permit is not required, under the auspices of a recognized sanctioning body. This definition includes, but is not limited to, events on the surface of land and water.

(30) "Racing Vehicle" means any Motor Vehicle that is designed to be used exclusively in Racing Events.

(31) "Road Vehicle" means any Motor Vehicle registered for use on Public Roads, including any attached trailing vehicles.

.....

(33) "Sound Pressure Level" (SPL) means 20 times the logarithm to the base 10 of the ratio of the root-mean-square pressure of the sound to the reference pressure. SPL is given in decibels (dB). The reference pressure is 20 micropascals (20 micronewtons per square meter).

.....

35-030 NOISE CONTROL REGULATIONS FOR IN-USE MOTOR VEHICLES

(1) Standards and Regulations:

.....

(b) Off-Road Recreational Vehicles.

(A) No person shall operate any off-road recreational vehicle which exceeds the noise level limits specified in Table D.

(B) No person shall operate an off-road recreational vehicle with any of the following defects:

(i) no muffler

(ii) leaks in the exhaust system

(iii) pinched outlet pipe

.....

(d) Ambient Noise Limits

(A) No person shall cause, allow, permit, or fail to control the operation of motor vehicles, including motorcycles, on property which he owns or controls, nor shall any person operate any such motor vehicle if the operation thereof increases the ambient noise level such that the appropriate noise level specified in Table E is exceeded as measured from either of the following points, if located within 1000 feet (305 meters) of the motor vehicle:

(i) noise sensitive property, or

(ii) the boundary of a quiet area.

(B) Exempt from the requirements of this subsection shall be:

(i) motor vehicles operating in racing events;

(ii) motor vehicles initially entering or leaving property which is more than 1000 feet (305 meters) from the nearest noise sensitive property or boundary of a quiet area.

(iii) motor vehicles operating on public roads; and

(iv) Motor vehicles operating off-road for non-recreational purposes.

.....

TABLE D

Off-Road Recreational Vehicle Standards

Allowable Noise Limits

Vehicle Type	Model Year	Maximum Noise Level (dBA) and Distance from Vehicle to Measurement Point	
		Stationary Test 20 Inches (1/2 Meter)	Moving Test at 50 Feet (15.2 Meters)
Motorcycles	1975 and Before	102	
	After 1975	99	
Snowmobiles	1971 and Before		86
	1972-1975		84
	1976-1978		80
	After 1978		77
Boats			
Underwater Exhaust	All		84
Atmosphere Exhaust	All	100	84
All Others			
Front Engine	All	95	
Mid and Rear Engines	All	97	

TABLE E

Ambient Standards for Vehicles Operated Near Noise Sensitive Property

Allowable Noise Limits

Time	Maximum Noise Level, dBA
7 a.m. - 10 p.m.	60
10 p.m. - 7 a.m.	55

APPENDIX G

Cooperative agreement between Tillamook County and the U. S. Forest Service.

COOPERATIVE AGREEMENT

BETWEEN

TILLAMOOK COUNTY SHERIFF'S DEPARTMENT
TILLAMOOK, OREGON

AND

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
SIUSLAW NATIONAL FOREST
P. O. BOX 1148
CORVALLIS, OREGON

Under the Act of August 10, 1971 (P. L. 92-82).

Whereas, the Forest Service, hereinafter referred to as the Service, has the responsibility for the enforcement of the Federal laws and regulations relative to the National Forest System, and other lands administered by the Forest Service, and,

Whereas, the Service recognizes that public use of such lands, which are usually located in remote or sparsely populated areas, are attracting large numbers of visitors, and,

Whereas, the Tillamook County Sheriff's Department, hereafter referred to as the Cooperator, has the authority to enforce the State and local laws for Tillamook County on such lands, and,

Whereas, the Siuslaw National Forest is partially located in Tillamook County for which the cooperator has the responsibility of enforcement of State and local laws, and,

Whereas, the cooperator is limited by level of financing as to the amount of protection, patrol and investigation that can be provided at the more remote areas within Tillamook County,

Now therefore, the parties hereby mutually agree that it is desirable to cooperate in better utilizing the resources of both agencies while providing for more adequate protection of persons and property as follows:

A. The Tillamook County Sheriff's Department agrees:

1. To continue to enforce the civil and criminal laws of the State and/or county on lands within or a part of any unit of the National Forest System within the normal scope of its duty without reimbursement by the Service.

2. Upon specific request of the Service, to provide special services beyond those provided under Clause A-1 for the enforcement of State or local laws relating to the protection of persons and their property in accordance with the operating and financial plan.

3. To furnish the Service at intervals mutually agreed upon itemized statements of expenditures incurred.

4. To maintain accounting and performance records of the reimburseable expenses in a manner that will facilitate an examination by officials of the Service or other Federal officials who may be required to examine such records. Such records will be retained for a period of three years following the year the expenditures were incurred, unless disposition is otherwise agreed to in writing.

5. That all officers assigned to fulfill the services under this agreement will meet the same standards of training required of other officers in his jurisdiction or where State Peace Officer Standards of Training (P.O.S.T.) exist, will meet those standards.

6. When Forest Service radio frequencies are utilized, acquire Federal Communication Commission licenses.

B. The Service agrees, within availability of funds and established Service regulations and policies:

1. To enforce the Federal laws and regulations relating to the National Forest System.

2. To provide support and cooperation to the Tillamook County Sheriff's Department in enforcement of State and local laws on lands within or a part of any unit of the National Forest System.

3. To reimburse the Tillamook County Sheriff's Department for the special or support services provided under Clause A-1 and A-2 at the rates established in Clause B-2.

4. Obtain required licenses for operating radio on cooperator frequencies.

C. The parties mutually agree:

1. To provide the maximum cooperation possible, within the availability of funds and established laws, regulations, and policies governing the respective agencies that will assure the protection of persons and their property on land within or a part of any unit of the National Forest System.

2. To prepare and/or update annually an Operating and Financial Plan specifying the cooperation on behalf of both parties and the terms for reimbursement for the services referred to. This plan when signed by both parties is attached to and made a part of this agreement. Each party will designate in the plan a specific individual and alternate(s) to make or receive requests for special services under this agreement.

3. That officers of the Tillamook County Sheriff's Department performing services under this agreement in enforcing State and local laws are, and will remain under the supervision, authority, and responsibility of the Tillamook County Sheriff. Such services provided by the cooperator and its employees shall not be considered as coming within the scope of Federal employment and none of the benefits of Federal employment will be conferred under this agreement.

4. In connection with the performance of work under this agreement, the provisions of Form AD-369, Equal Opportunity, attached, are hereby included as a part of this agreement. On Form AD-369, "Contractor" means "Cooperator." "Contracting Officer" and "Contracting Agency" mean "Forest Service."

5. No member of, or delegate to, Congress, or Resident Commissioner, shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

6. The period of this agreement shall be from the date of execution until terminated by mutual agreement, or on 30 days' written notice from either party to the other.

7. Any changes in the provisions of this agreement which are necessary and proper will be made by formal amendment.

COOPERATOR

Chas D Bailey — 3/29/78

Chairman, Board of Commissioners
Tillamook County — Date

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

[signature] — 4/5/78

Forest Supervisor
Siuslaw national Forest — Date

Approved Dan D Wilson
Sheriff, Tillamook County

3-30-78
Date

APPENDIX H

Agreement between Tillamook County and Northwest Trail and Dune Association.

BEFORE THE BOARD OF COUNTY COMMISSIONERS

FOR TILLAMOOK COUNTY, OREGON

S P E C I A L U S E L I C E N S E

Permission is hereby granted to NORTHWEST TRAIL AND DUNE ASSOCIATION of 1150 Iris Lane N.W., Salem, Oregon 97304, hereinafter called the Licensee, to use the property shown on the attached map marked "Exhibit A" and made a part hereof to the same extent as if set forth in full. This license is issued for the purpose of allowing the Licensee to stage seven (7) drag races only between April 1 and October 15 each year for the duration of the license, and is subject to and contingent upon compliance with the conditions set forth below.

1. In consideration for this use, the Licensee shall pay to Tillamook County, Oregon the sum of One thousand dollars ($1,000.) per year for the duration of this license, said first year sum payable upon execution of this agreement. Subsequent yearly payments shall be payable on or before the 31st day of March each year.

2. Development Plans: layout or construction plans for this area must be approved in advance and in writing by the Chairman of the Board of County Commissioners or his designee. Trees, shrubs, and other plants may be planted in such manner and in such places about the premises as may be approved by the Chairman of the Board of County Commissioners or his designee.

3. The Licensee shall maintain the improvements and premises to Tillamook County standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Chairman of the Board of County Commissioners or his designee.

4. The Licensee shall provide necessary fencing in accordance with and under the direction of Siuslaw National Forest and including the licensed area of Tillamook County.

5. The Licensee, in exercising the privileges granted by this license, shall comply with the regulations of the Department of Agriculture and all Federal, State, county, and municipal laws, ordinances, or regulations which are applicable to the area or operations covered by this license.

6. The Licensee shall take all reasonable precautions to prevent and suppress forest fires. No material shall be disposed of by burning in open fires during the closed season established by law or regulation without a written permit from the Chairman of the Board of County Commissioners or his designee.

7. The Licensee shall exercise diligence in protecting from damage the land and property of Tillamook County covered by and used in connection with this license, and shall pay Tillamook County for any damage resulting from negligence or from the violation of the terms of this license, or of any law or regulation applicable to County lands by the Licensee, or by any agents or employe's of the Licensee acting within the scope of their agency or employment.

8. The Licensee shall fully repair all damage, other than ordinary wear and tear, to roads and trails caused by the Licensee in the exercise of the privilege granted by this license.

9. Upon abandonment, termination, revocation, or cancellation of this license, the Licensee shall remove within a reasonable time all stuctures or improvements, and shall restore the site, unless otherwise agreed upon in writing or in this license. If the Licensee fails to remove all such structures or improvements within a reasonable period, they shall become the property of Tillamook County, but that will not relieve the Licensee of liability for the cost of their removal and restoration of the site.

10. This license is not transferable. If the Licensee through voluntary sale or transfer, or through enforcement of contract, foreclosure, tax sale, or other valid legal proceeding shall cease to be the owner of the physical improvements other than those owned by Tillamook County situated on the land described in this license and is unable to furnish adequate proof of ability to redeem or otherwise reestablish title to said improvements, this license shall be subject to cancellation. But if the person to whom title to said improvements shall have been transferred in either manner provided is qualified as a Licensee and is willing that his future occupancy of the premises shall be subject to such new conditions and stipulations as existing or prospective circumstances may warrant, his continued occupancy or the premises may be authorized by license to him if, in the opinion of the issuing officer or his successor, issuance of a license is desirable and in the public interest.

11. In case of change of address, the Licensee shall immediately notify the Board of County Commissioners of Tillamook County, Oregon.

12. This license may be terminated upon breach of any of the conditions herein or at the discretion of the Board of County Commissioners, Tillamook County, Oregon.

13. In the event of any conflict between any of the preceding printed clauses or any provisions thereof and any of the following clauses or any provisions thereof, the following clauses will control.

14. The Licensee shall protect the scenic aesthetic values of the area under this license, and the adjacent land, as far as possible with the authorized use, during construction, operation and maintenance of the improvements.

15. This license is issued with the understanding and on the condition that, unless sooner terminated or revoked for cause, it will expire on October 15, 1983 and all structures and improvements, except those owned by Tillamook County, shall be moved in accordance with Clause 9 of this license. For the purpose of this license, two months after termination of the license will be considered a reasonable period in which to remove the structure and improvements. This termination date shall not be extended.

No additional improvements shall be constructed without prior written approval of the Board of County Commissioners of Tillamook County, Oregon.

This is strictly a license for the period hereinbefore designated only.

16. Licensee shall not cause, permit, or allow alcoholic beverages or illegal drugs to be sold, used or kept on the premises.

17. During the term of this license, the Licensee agrees:

a. In connection with the performance of work under this license, including maintenance and operation of the facility, the Licensee shall not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin.

b. The Licensee and his employe's shall not discriminate by segregation or otherwise against any person on the basis of race, color, religion, sex or national origin by curtailing or refusing to furnish accomodation, facilities, services, or use privileges offered to the public generally.

c. The Licensee shall include and require compliance with the above non-discrimination provisions in any subcontract made with respect to the operations under this license.

d. Signs setting forth this policy of non-discrimination will be conspicuously displayed at the public entrance to the premises.

18. The Licensee shall have in force public liability insurance covering: (1) property damage in the amount of Five thousand dollars ($5,000.), and (2) damage to persons in the minimum amount of One hundred thousand dollars ($100,000.) in the event of death or injury to more than one individual. The coverage shall extend to property damage, bodily injury, or death arising out of the Licensee's activities under the license including, but not limited to, the occupancy or use of the land and the construction, maintenance, and operation of the structures, facilities, or equipment authorized by this license. Such insurance shall also name the County of Tillamook as a co-insured and provide for specific coverage of the Licensee's contractually assumed obligation to indemnify the County of Tillamook. The Licensee shall require the insurance company to send an authenticated copy of its insurance policy to Tillamook County immediately upon issuance of the policy. The policy shall also contain a specific provision or rider to the effect that the policy will not be cancelled or its provisions changed or deleted before thirty (30) days written notice to the County Clerk of Tillamook County, Oregon.

19. The operation and maintenance of all sanitation, food service, and water-supply methods, systems and facilities shall comply with the standards of the local department of health and the United States Public Health Service.

The Licensee shall dispose of all garbage and refuse in a place outside of the Sand Beach area.

20. The Licensee agrees to take all reasonable precaution to avoid damage to property and resources of Tillamook County, and diligently to undertake suppression action in the event of fire resulting from the exercise of the privileges herein granted.

21. No fireworks or explosives of any kind or nature shall be stored or used on the land covered by this license, or in the stuctures thereon.

22. The Licensee shall restrict all parking to areas approved by the Tillamook County Board of Commissioners, and comply with the traffic control requirements on National Forest land as outlined in the Forest Service Special Use Permit.

23. No signs or advertising devices, except as required by paragraph 17, item D, shall be erected on the area covered by this license, or highways leading thereto, without prior approval by the Tillamook County Board of Commissioners as to location, design, size, color and message. Erected signs shall be maintained or renewed as

as necessary to neat and presentable standards.

24. The Licensee or designated representative shall be present on the premises at all times when the facilities are open to the public. The Licensee will notify Tillamook County Board of Commissioners in writing who the representative will be.

25. To provide for public safety, resource protection, orderliness, neatness, and sanitation acceptable to Tillamook County, the following plan is hereby made a part of the License:

PUBLIC SAFETY AND ORDERLINESS

a. RACE COURSES: Staging area (pits) will be staked and delineated by rope or other like substance and flagged to warn spectators and to keep them out. Size of area to be staked shall be based upon 200 square feet for each vehicle registered for competition.

b. DRAG STRIP: The entire racing area including starting line, finish line, and deceleration area will be roped off so as to restrict access by those vehicles not racing. A return route to the pits will be marked by flags or some like means.

c. MUFFLERS: Vehicles must have adequate mufflers installed unless they are operating in the pit area, of the race course.

d. PUBLIC INFORMATION: By use of the public address system or other suitable means, the Licensee shall, at least every two hours, inform the public and participants of the following:

1. Vehicle travel is restricted to open sand areas.

2. Fire danger is high in beach grass. Be careful with fire.

3. Mufflers are required for all non-contest vehicles.

4. Deposit litter in bags and cans.

e. COURSE POLICING: The Licensee will take steps to assure that straying vehicles or people are not on the race course while a competitor is racing. This will include barring non-racing traffic from the course for periods of time, up to 1/2 hour.

f. All events will be held in open sand areas. No clearing of vegetation is permitted except in areas designated and approved by the Board of County Commissioners.

g. The construction of permanent structures will not be permitted.

h. SANITATION:

1. At least four (4) chemical toilets shall be available for public use adjacent to the spectators or other locations deemed more feasible by the Chairman of the Board of Commissioners of Tillamook County, Oregon.

2. Large plastic bags shall be well distributed in the spectator and pit areas for the purpose of collecting litter, and other garbage and rubbish. The Licensee shall also pick up all remaining litter, garbage, and refuse following the close of each day's events within the permit area.

i. PARKING FOR DAY USE: Licensee shall furnish security for the parking lot and control entry to race vehicles or participants. Control can be accomplished by use of barricades or like devices. Signs informing the general public that the area is under license to the NORTHWEST TRAIL AND DUNE ASSOCIATION will be displayed on the barricades.

j. TRAFFIC CONTROL: Traffic control will be the responsibility of the Licensee who will supply a man at the road junction of the campground and beach road on Sundays, one (1) hour before the race until 4:00 p.m. If additional time is needed, it will be on a request basis by the Chairman of the Board of County Commissioners of Tillamook County.

26. Tillamook County designates the Chairman of the Board of County Commissioners of Tillamook County as supervisor and contact person pertaining to all matters under this License, whose address is P.O. Box 152, Tillamook, Oregon 97141.

DATED this 31st day of March, 1978.

LICENSEE:

Myke L. Holmes
President
Northwest Trail and Dunes Association

BOARD OF COUNTY COMMISSIONERS
FOR TILLAMOOK COUNTY, OREGON

Chas D Bailey
Chairman, Chas. D. Bailey

F.E. Knight
F.E. Knight

Granville Simmons
Granville Simmons

EXHIBIT I

Grievances associated with off-road vehicle use in the Sand Lake area, Tillamook County, Oregon.

May 31, 1976

This memorandum is being submitted so that there will be a documentation on file in your records of the property owners' complaints..

The Forest Service has created a monster on the sand dunes at Sand Lake that is a menace to the property and possibly the lives of those who live in this area.

The following list of complaints indicates the seriousness of the problem.

Tearing up of pasture land.
Pulling up fence posts.
Cutting trees and stealing wood.
Dumping sanitary bags and garbage on property.
Using private property for bathrooms.
Urinating in front of homes..
Tearing down "No Trespassing" signs.
Building fires in private woods, thus putting forests and homes in jeopard
Camping on private property.
Threatening personal injury and property damage when asked to get off of property.
All-night running without mufflers.
Exceeding the speed limit on county roads.
Creating sanitary hazards to private water systems.
Tearing up the sand stabilizing cover.
Endangering a child's life.
Threatening future damage to person and property.
No Forest Service or police patrol on the Derrick Road during the 3-day holiday.

What the property owners want to know is this: Does the Forest Service plan to take action to protect the property and lives of the residents of this area?

Signed by eleven local residents on the front of this page and eight on the back of it.

This list of grievances was submitted to the author December 15, 1978, with a cover letter dated December 9, 1978, reiterating their concerns. The letter was signed by eleven area residents and is on file at the OCZMA office in Newport, Oregon.

This intern report was read and accepted by a staff member at:

Agency: Oregon Coastal Zone Management Association, Inc.

Address: 132 West Olive
Newport, Oregon 97365

This report was completed by a WICHE intern. This intern's project was part of the Resources Development Internship Program administered by the Western Interstate Commission for Higher Education (WICHE).

The purpose of the internship program is to bring organizations involved in community and economic development, environmental problems and their students in the West for the benefit of all.

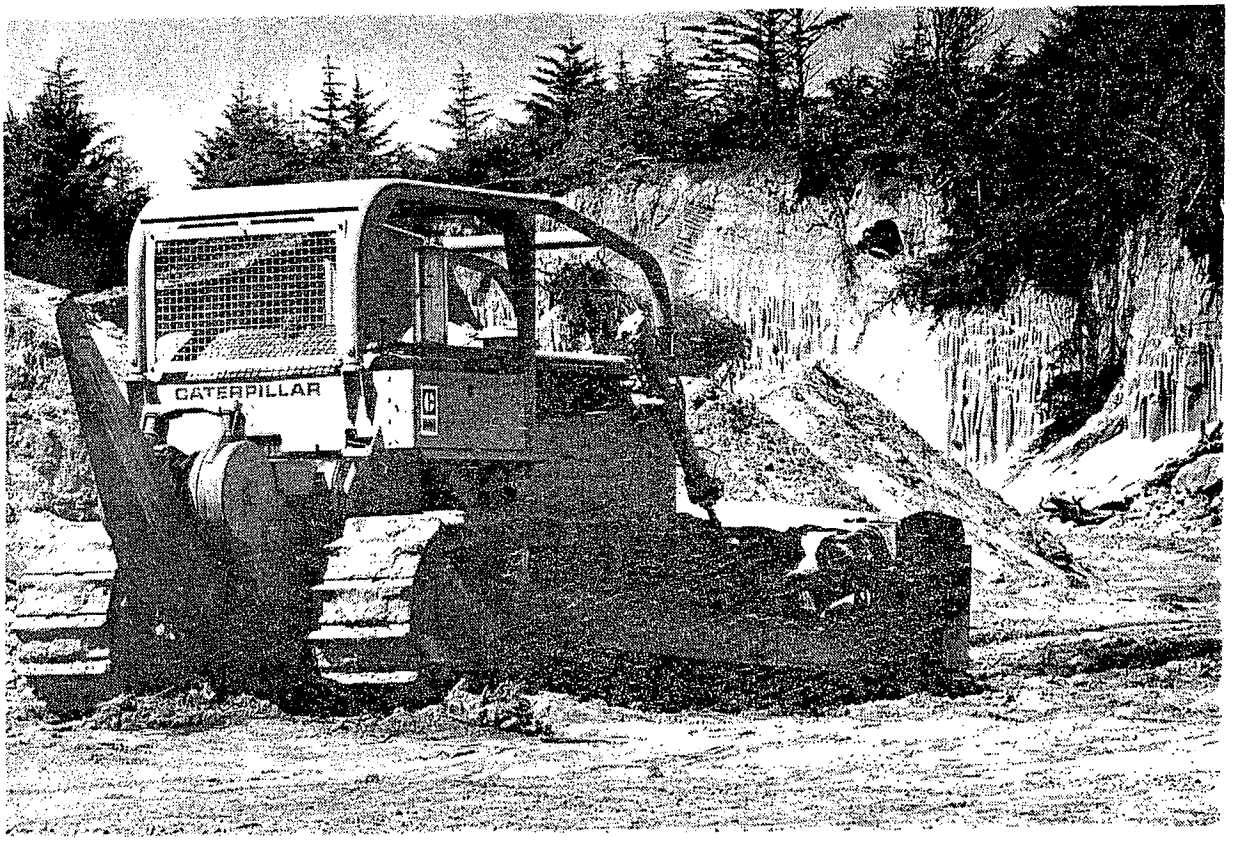
For these organizations, the intern program provides the problem-solving talents of student manpower while making the resources of universities and colleges more available. For institutions of higher education, the program provides relevant field education for their students while building their capacity for problem-solving.

WICHE is an organization in the West uniquely suited for sponsoring such a program. It is an interstate agency formed by the thirteen western states for the specific purpose of relating the resources of higher education to the needs of western citizens. WICHE has been concerned with a broad range of community needs in the West for some time, insofar as they bear directly on the well-being of western peoples and the future of higher education in the West. WICHE feels that the internship program is one method for meeting its obligations within the thirteen western states. In its efforts to achieve these objectives, WICHE appreciates having received the generous support and assistance of the National Endowment for the Humanities, the Economic Development Administration and by more than one hundred and fifty community agencies throughout the West.

For further information, write Resources Development Internship Program, WICHE, P. O. Drawer 'P', Boulder, Colorado 80302 or call (303) 443-6144.

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Sand Removal
Planning & Management Considerations
For The Oregon Coast



Oregon Coastal Zone Management Association, Inc.

This report was prepared as part of a larger document addressing various beach and dune planning and management considerations and techniques. Other segments of the document and additional materials are:

I. BACKGROUND ON BEACH AND DUNE PLANNING:

Background of the Study

An Introduction to Beach and Dune Physical and Biological Processes

Beach and Dune Planning and Management on the Oregon Coast: A Summary of the State-of-the-Arts

II. BEACH AND DUNE IDENTIFICATION:

A System of Classifying and Identifying Oregon's Coastal Beaches and Dunes

III. PHYSICAL AND BIOLOGICAL CONSIDERATIONS:

Physical Processes and Geologic Hazards on the Oregon Coast

Critical Species and Habitats of Oregon's Coastal Beaches and Dunes

IV. MANAGEMENT CONSIDERATIONS:

Dune Groundwater Planning and Management Considerations for the Oregon Coast

Off-road Vehicle Planning and Management on the Oregon Coast

Sand Removal Planning and Management Considerations for the Oregon Coast

Oregon's Coastal Beaches and Dunes: Uses, Impacts and Management Considerations

Dune Stabilization and Restoration: Methods and Criteria

V. IMPLEMENTATION TECHNIQUES:

Beach and Dune Implementation Techniques: Findings-of-Fact

Beach and Dune Implementation Techniques: Site Investigation Reports

*Beach and Dune Implementation Techniques: Model Ordinances**

VI. ANNOTATED BIBLIOGRAPHY:

Beach and Dune Planning and Management: An Annotated Bibliography

VII. EDUCATIONAL MATERIALS:

Slide show: *Managing Oregon's Beaches and Dunes*

Brochure: *Planning and Managing Oregon's Coastal Beaches and Dunes*

*Prepared under separate contract between Oregon Department of Land Conservation and Development and the Bureau of Governmental Research, Eugene,

Cover photo by Jay Rasmussen, Toledo, Oregon; cover design by Arlys Bernard, Newport, Oregon.

SAND REMOVAL
PLANNING AND MANAGEMENT CONSIDERATIONS
FOR THE OREGON COAST

by
Carl A. Lindberg
Project Director
Beaches and Dunes Study Team

Kathy Bridges Fitzpatrick
Editor and Project Administrator

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313 S.W. 2nd Street, Suite C P.O. Box 1033
Newport, Oregon ~ 97365

June, 1979

Funding for this study was provided by the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, under Section 306 of the Coastal Zone Management Act through the Oregon Department of Land Conservation and Development.

PREFACE

The following report presents the results of an in-depth analysis of beach and dune sand removal on the Oregon Coast conducted by the Oregon Coastal Zone Management Association, Inc. This report constitutes one element of an overall analysis of planning for and managing beaches and dunes as required by Oregon's Beaches and Dunes Goal.

This report was prepared by Carl Lindberg, OCZMA Beaches and Dunes Project Director, with assistance from other Study Team members composed of Christianna Crook, Research Associate, Wilbur Ternyik, Project Coordinator, Arlys Bernard, Project Secretary, and Kathy Fitzpatrick, Project Administrator.

In addition, valuable review and comments were made by the Beaches and Dunes Steering Committee composed of:

R. A. Corthell, U.S. Soil Conservation Service
Steve Stevens, U.S. Army Corps of Engineers
Sam Allison, Oregon Department of Water Resources
Peter Bond and John Phillips, Oregon Department of Transportation, Parks and Recreation Division
Bob Cortright, Oregon Department of Land Conservation and Development
Jim Lauman, Oregon Department of Fish and Wildlife
Jim Stembridge, Oregon Department of Soil and Water Conservation
Steve Felkins, Port of Coos Bay
Rainmar Bartl, Clatsop-Tillamook Intergovernmental Council
Gary Darnielle, Lane Council of Governments
Cathy Mecone, Coos-Curry Council of Governments
Marilyn Adkins, City of Florence Planning Department
Phil Bredesen, Lane County Planning Department
Steve Goeckritz, Tillamook County Planning Department
Oscar Granger, Lincoln County Planning Department
Curt Schneider, Clatsop County Planning Department

Additionally, OCZMA extends special appreciation to Peter Bond, Parks Planner, Parks and Recreation Branch of the Oregon Department of Transportation, and Stan Ausmus, Administrator, Mineland Reclamation Division, for their valuable review of and significant contributions to this report.

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I. INTRODUCTION

Sand removal as used in this report is a term identifying a wide range of man-made actions including the mining of sand for the extraction of ores and for use in the production of glass, concrete and ceramics, for sand blasting or for fill material. Additionally, sand is oftentimes removed from one location during excavation of a building site, to improve a view, or to protect a natural or man-made environment from inundation by migrating sand dunes.

There exists little in the way of published data on the topic of sand removal from beach and dunes areas, especially within the context of Oregon's Beaches and Dunes Goal. One researcher who has produced several reports over the years on the environmental geology of the Oregon coast has noted that only recent concerns have brought the topic into the fore (Beaulieu, 1979). Only one article was identified that comprehensively addressed sand removal from a beach or dune situation (Magoon, et al., 1972). This article addressed the commercial mining of sand in Northern California and identified two major uses for such sand--aggregate for concrete and fill, and speciality purposes (glassmaking - 65%, sandblasting - 13%, and grinding and polishing - 6%). In their conclusion the authors note two problems associated with the activity of sand removal--a depletion of the sand resource and a conflict with the recreational use of coastal sand areas.

One authority on shoreline processes, while noting that mining activities in shore areas is an important industry in some specific areas, does state a similar observation to that of Komar, (1978); Rea, (1977), and Magoon, et al., (1972), in that:

> "Mining of beach and dune sands has further depleted this source, while the entrapment of coastal materials by harbors, groins, and jetties has placed sand in short supply on beaches where it provides an essential element of protection of the coast from the erosive action of waves. Further, sand is a valuable recreational asset that is now in very short supply." (Inman, 1978, p. 2269).

Although little written information on sand removal is available, the issue was brought into focus when it was first mentioned as a concern in beach and dune areas in the January 1975 Progress Report published by the Oregon Coastal Conservation and Development Commission (OCCDC, 1975, p. 53). This same concern was carried over into the first draft of the Coastal Goals proposed by the Oregon Department of Land Conservation and Development which stated that:

"d. Removal of sand from sand areas should be permitted only when it is necessary to protect private or public property from sand damage or when such removal will not adversely affect the environment or the stability of adjacent areas as determined by a site investigation." (DLCD, 1975, p. 5).

In its final form, the adopted Beaches and Dunes Goal (#18) does not specifically require such a comprehensive examination of sand removal proposals and their impacts, but rather focuses on protection of life and property, which would necessitate a review of sand removal impacts.

II. SAND REMOVAL ON THE OREGON COAST

A. Historical Sand Removal Activities

Along the Oregon coast, sand has typically been removed for four major reasons: industrial purposes, construction activities, site alteration, and protection of structures, property and/or habitats.

1. Industrial processes

The sand or mineral(s) within the sand have been used in some industrial process. Such processes include the extraction of chromite, zircon, platinum, gold, etc. (von Bernewitz, 1930; Dasher, et. al., 1942; Beaulieu and Hughes, 1975), and the use of sand for ceramics, container glass, foundry molding, and sand blasting (Sterrett, 1958; Carter, et. al., 1962 and 1964; Beaulieu and Hughes, 1975; Gray, 1978).

Most of the mineral bearing sands are found in Coos and Curry Counties on Oregon's South Coast. Figure 1 illustrates the general locations of these and other minerals found on the Oregon coast. In these southern counties, beginning with "black sand" mining at Whiskey Run Creek in 1852, a series of surface mining operations was carried out until the end of World War II. These sands were mined generally for their chrome and gold content. Depending on future prices and availabilities, some of these sites may again become viable for production within the future.

2. Construction activities

The sand has been used in construction activities such as fill and concrete (Ketchum, 1972; Beaulieu and Hughes, 1975; Gray, 1978). The removal of sand for construction purposes has occurred at scattered locations up and down the coast as has the ad hoc removal of a bucket

or pickup load of sand. The most publicized removal for this purpose was at School House Creek in the Gleneden Beach area of Lincoln County. This operation did not have its beach sand removal permit renewed when it was found to possibly be related to the coastal erosion immediately to the north at Salishan Spit (Gray, 1978; Komar, 1978). This sand removal project was estimated to have removed between 43% to 75% (112,000 to 196,000 cubic meters) of the new sand being supplied to this area of the beach, (Rea, 1974, p. 74).

OREGON COASTAL RESOURCE ANALYSIS

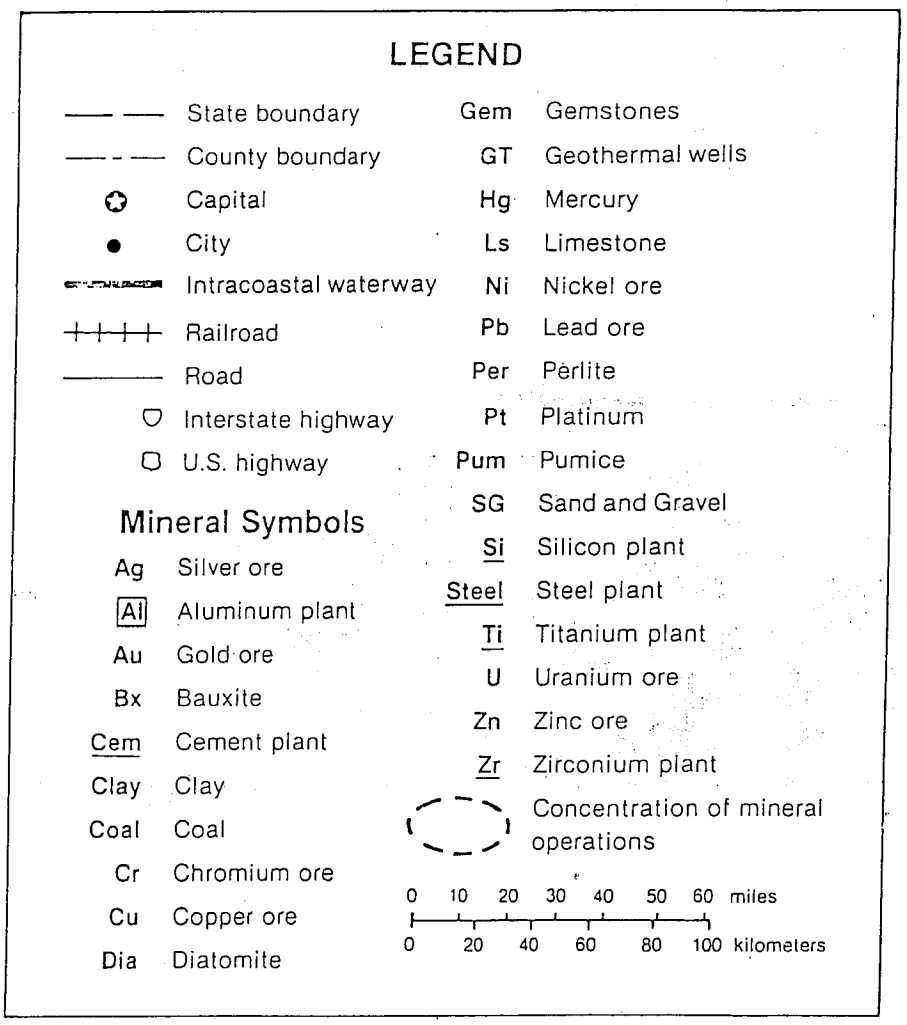
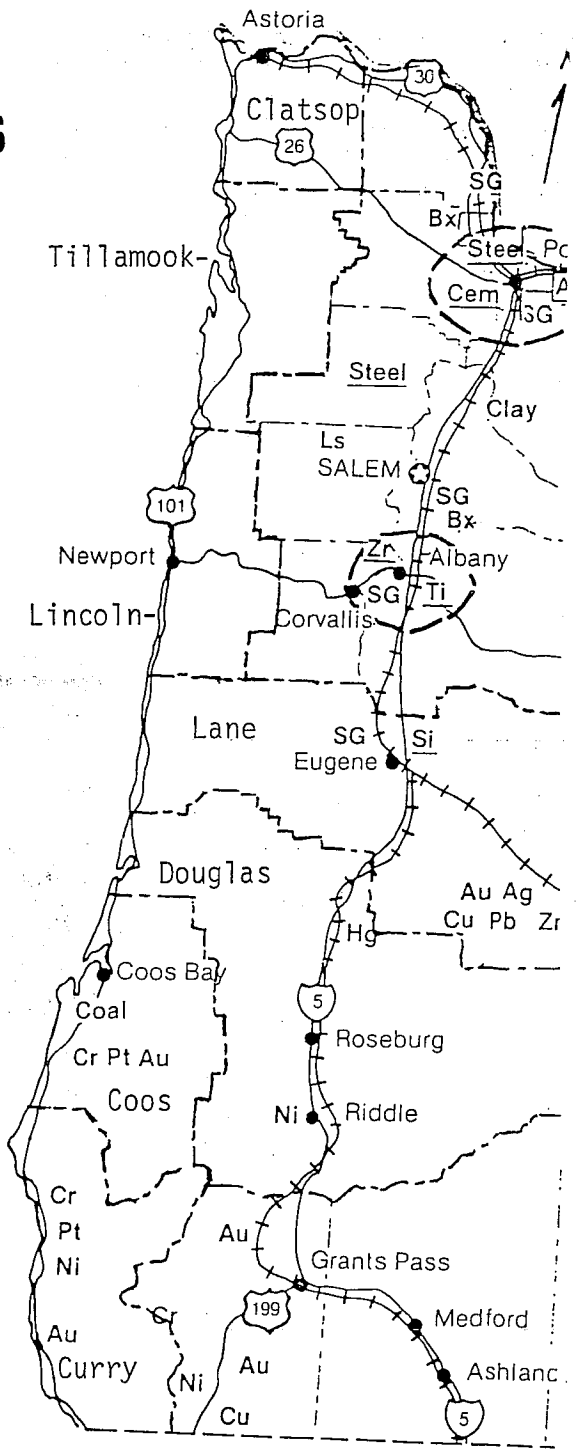


Figure 1. Minerals found on the Oregon coast (from U. S. Bureau of Mines, 1978).



3. Site alteration

Sand has been removed to alter a site prior to construction or to improve a view that is continually blocked by blowing and accumulating sand (Gray, 1978; Ternyik, 1978). This activity of site alteration goes on continually with each new structure erected and later, in some cases, to maintain a view. Removal related to construction should be reviewed in the future to ensure that it meets the goal requirements. Removal related to view protection should be analyzed to determine if such removal is necessary, the degree of hazard involved, and if it can be better treated by a stabilization program.

4. Protection of structures, property and/or habitats

Sand has been removed to protect man-made and natural environments from in-migrating sand (U.S. Soil Conservation Service, 1975; Brown, 1978; Ternyik, 1978). Protecting man-made and natural environments from in-migrating sand has been going on for some time. A massive program, coupled with plantings for stabilization, was carried out in the Clatsop Plains area in the 1930's (see Figure 2). Since then, there have been many cases of sand removal to protect highways and roads (Highway 101

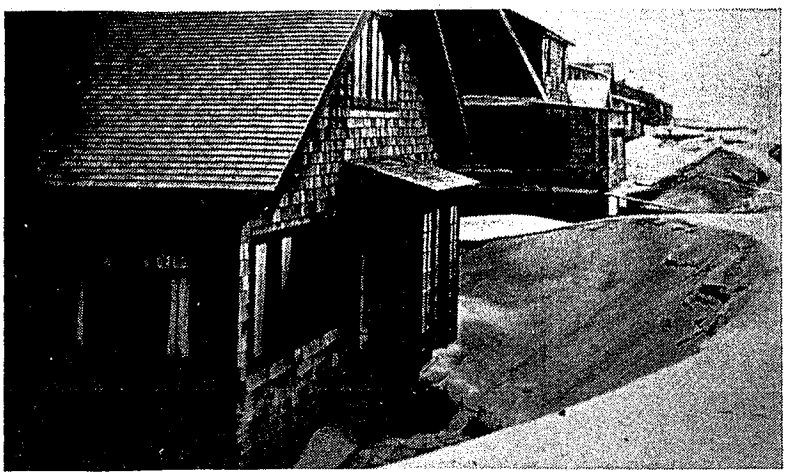


Figure 2. Blowing sand caused problems for Gearhart property owners in 1935 when sand piled up to the second floor of many residences. Removing sand, sometimes several times a year, proved expensive (from Warrenton Dune Soil and Water Conservation District, 1966).

at Humbug Canyon, seven miles south of Port Orford, along Highway 101 between Glenada and Dunes City, about one mile north of Woods, along Highway 101 near Rockaway and Arch Cape, and within Cannon Beach and Seaside), to protect parking lots (Del Ray Beach State Wayside north of Gearhart), to protect buildings (at a dune tour concession in the Oregon Dunes National Recreation Area), and to protect railroad lines (about one mile south of Menasha on the north slough of Coos Bay), (Brown, 1978; Ternyik, 1978), (see Figures 3-5). It is suggested that provisions for such necessary protective actions be included in local plans and ordinances.

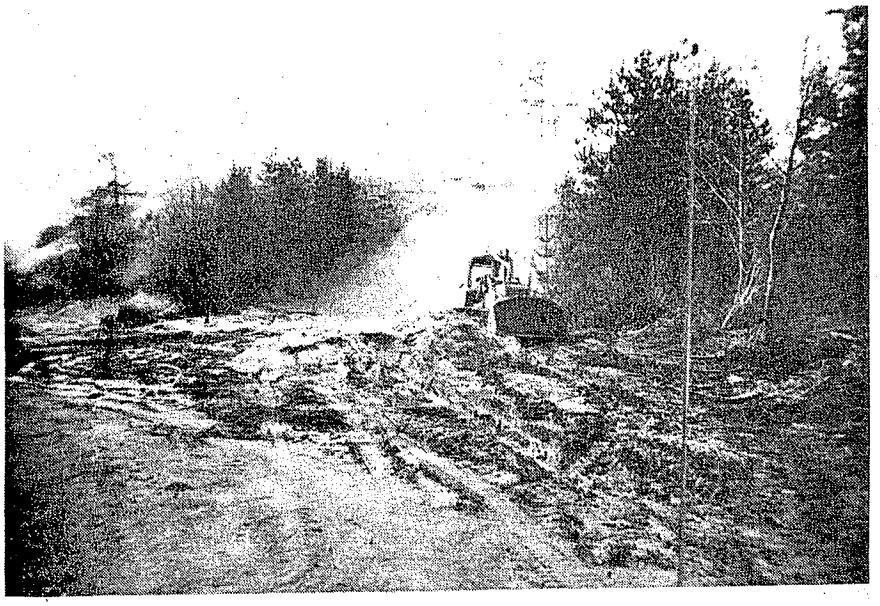


Figure 3. Sand being removed just west of Highway 101 between Glenada and Dunes City. Throughout this stretch of Highway 101, migrating dunes are within several hundred feet of the pavement.

Herb Schlicker, an engineering geologist with the State of Oregon's Department of Geology and Mineral Industries notes: "Removal of sand provides only a temporary solution and may have to be repeated frequently at considerable expense" (Schlicker, 1972, p. 68). In areas which are known to experience sand accumulation problems, it might be wiser to either establish a stabilization program or to limit the location of permanent structures and roads.

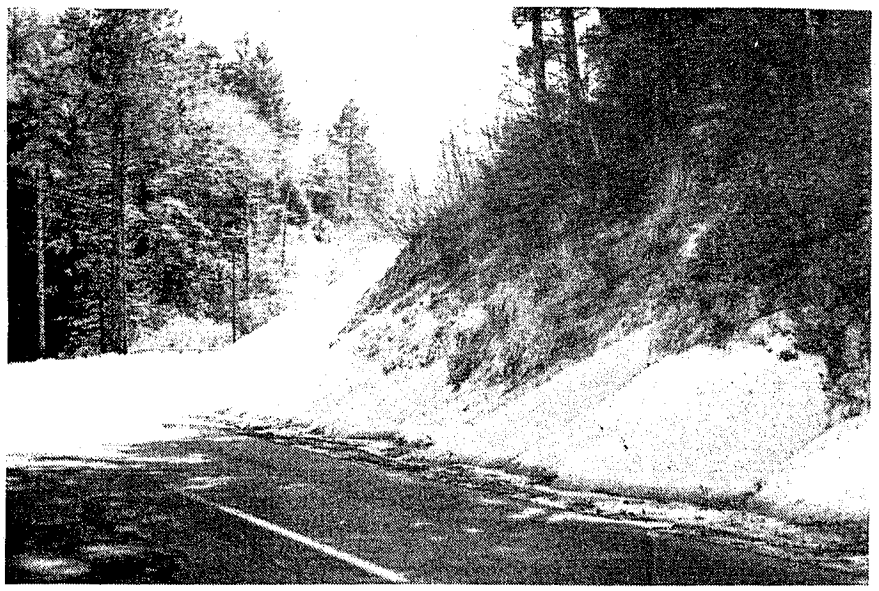


Figure 4. This migrating sand dune is constantly spilling onto the highway just north of Woods in Tillamook County.

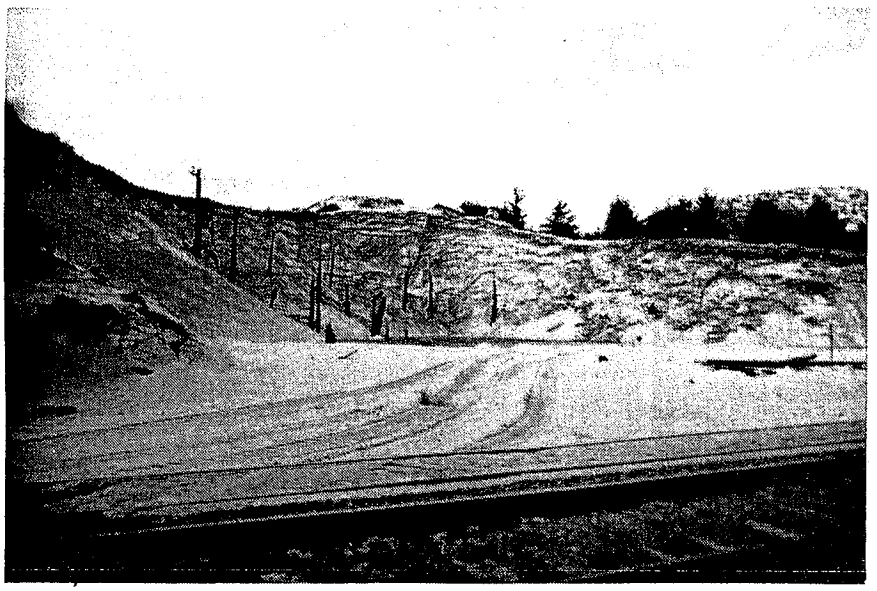


Figure 5. Sand removal activity along the Southern Pacific Railroad Line on the north slough of Coos Bay. Notice the layers of sand and the exposed trees that were buried by this in-migrating dune.

B. Historical Controls on Sand Removal

1. Local controls

Historically, there has been an interest in having some control or standards for sand removal activities on the Oregon coast. For example, in 1910 the coastal City of Newport adopted an ordinance prohibiting the removal of sand and gravel from its ocean beaches. Later in 1928, Newport repealed this ordinance in spite of the following State Attorney General's opinion:

> "The City of Newport may by ordinance regulate or forbid the taking of sand and gravel from the ocean beach on the grounds that such taking interferes with the safety, order and general welfare of the inhabitants of the City", (13 OR. Op. A.G. 515 [1928]).

The interest in such standards arose again in 1938 when the City Attorney of Newport was asked for an opinion on the City's ability to adopt a sand removal ordinance. The City Attorney's advice was affirmative, and later that year the editor of The Mineralogist, a national magazine, sent a letter to the City Council with stated concerns about sand and gravel operations on Newport's beaches, (Marsters, 1938; Dake, 1938).

More recently, the City of Florence adopted Ordinance #464 in January of 1968. Section VIII, "Securing Loose, Open or Raw Sand" of that ordinance states:

> "No person, firm, or corporation shall make any excavation or remove any natural or planted ground cover, trees and shrubs or grass, or any existing building or structure when any such action will expose loose, open, or raw sand which would be susceptible to movement or displacement onto any public way or public or private land, by the action of wind or running water unless provisions are made to prevent such movement or displacement."

The above ordinance seeks to maintain stability at the site of any activity within a sand area. Similarly, in August of 1978, the City of Seaside authorized their Public Works Department to remove sand that had been accreting on the beach and blowing inland onto yards and public rights-of-way, (The Daily Astorian, 1978).

2. State controls

Generally speaking, sand removal from beaches and dunes is not permitted in most states (The Conservation Foundation, 1975, p. 107; U. S. Army Corps of Engineers, 1975, pp. 1-21). However, on the West Coast, the State of Washington has recognized the importance of commercial sand and gravel mining "as a necessary industry" and calls for careful management (Washington Department of Ecology, 1971, pp. 31-32). Under the general guidelines of the Washington Shoreline Management Act, the state's two southern coastal counties, where a large amount of accretion is taking place, allow the removal of beach sand (to eighteen inches depth in Pacific County and to twelve inches depth in Grays Harbor County), however, much of this removal is related to the local cranberry bog operations (Ruef, 1979).

Within Oregon, three agencies are involved in sand removal activities and issue permits allowing such actions. The Oregon Department of Geology and Mineral Industries under the surface mining regulations of Chapter 517 is given the duty to issue permits for certain surface mining activities and set standards for reclamation. Such activities can take place in sand areas, but require a permit if:

(1) they remove more than 2500 cubic yards of minerals per year, and/or
(2) they affect at least one acre of land within a period of twelve consecutive months; and
(3) the material is not used on-site for construction purposes.

When an applicant applies for the surface mining permit, he must also include a "Reclamation and Development Plan" pursuant to ORS 517. 750-517.990. This plan is to include site plans, cross sections, aerial photos, and any other drawing necessary to illustrate the present and proposed final configuration of the site. The Department also requires a performance bond not to exceed $500.00 per acre, and a permit fee of $265.00. Copies of Chapter 517.750-.990, Reclamation Plan Guidelines, and the Application for Operating Permits or Grant Exemption under ORS 517 are included in Appendix A. Table 1 lists sites of known sand removal and current permits issued by the Oregon Department of Geology and Mineral Industries.

Another state agency having permit authority over sand removal on the coast is the Parks and Recreation Branch of the Oregon Department of Transportation. Chapter 390 of the Oregon Revised Statutes requires permits for removal of products along the ocean shore (west of the state's surveyed "zone line"). Except for exemptions for fish, wildlife, agates or souvenirs, no other natural mineral or animal product can be taken from the state controlled beach area without the expressed permission of the Department of Transportation. Furthermore, state law (ORS 390.725) requires that such permission be granted only after consultation with the State Fish and Wildlife Commission, the State Department of Geology

and Mineral Industries, and the Division of State Lands. Approval of the permit must contain any necessary provisions to protect the areas from any use, activity or practice adverse to the conservation of natural resources or public recreation. Copies of the most applicable provisions of the state statute and of the Permit Application for Removal of Sand, Rock, Minerals, Marine Growths, or Other Natural Products of the Ocean Shore are included in Appendix B. Table 2 lists those permits issued by the Oregon Parks and Recreation Brach pursuant to ORS 390.

Table 1. Sites registered or under permits issued by the Oregon Department of Geology and Mineral Industries pursuant to ORS 517.750-.990*

Location	Amount	Permittee	Purpose
Clatsop			
Sec 8 T8NR10W	up to 2500/yr	Individual (TE-04-0040)	Construction material**
NW 1/4 Sec 19 T8NR6W	unlimited	Oregon Portland Cement (LE-04-0012)	Sandstone quarry
Sec 3 T7NR10W	unlimited	Individual (SMP-04-0024)	Construction material
Tillamook			
SW 1/4 18 T4SR10W NW 1/4 19	unlimited	Federal Hwy. Adm. (SMP-29-0060)	Construction material
Sec 6 T3NR10W	unlimited	Individual (LE-29-0036)	Sandstone and Rock quarry
Sec 18 T4SR10W	unlimited	Individual (SMP29-0066)	Construction material
Lincoln			
SE 1/4 sec 22 T7SR11W	unlimited	Oceanlake Sand and Gravel Co. (LE-21-0011)	Construction material
Sec 27 T7SR11W	IN VIOLATION	Ford, Frank & Lewis (21-0036)	Construction material
Lane			
Sec 15 T18SR12W	unlimited	Individual (LE-20-0068)	Construction material

Table 1. continued

Location	Amount	Permittee	Purpose
Coos			
Sec 34 T24SR13W	unlimited	CooSand Corp. (SMP-06-0007)	Construction material

*from Ausmus, 1979.
**construction material--includes fill material, concrete, etc.

TE-total exemption--activity does not fall within the permitting purview of DOGAMI (e.g. less than 2,500 cu yd/yr, etc.)

LE-limited exemption--activity initiated prior to reclamation requirement reclamation plan not required.

SMP-surface mining permit--activity falls within DOGAMI's permitting authority; reclamation plan required.

Table 2. Sand removal permits issued by the Oregon Parks and Recreation branch of the Oregon Department of Transportation pursuant to ORS 390.725*

Date	Location	Amount	Permittee	Purpose
1970	Brookings, Curry County	Not stipulated	Individual	Removal for construction and fill purposes
1970	Brookings, Curry County	10,000 cu. yd.	Port of Brookings	Removal of sand to clear channel
1973	Beaver Creek at Ona Beach State Park, Lincoln County	4,800 cu. yd.	Lincoln County	Rechannelization of mouth of Beaver Creek

*from Bond, 1979.

Under ORS 541.605-665, the Oregon Division of State Lands maintains permit authority for fill and removal activities within waters of the state. Pursuant to this statute, the Division coordinates with the Parks and Recreation Branch on removal activities within beach areas. Additionally, the Division of State Lands is charged with administering the transfer of dredge spoils with proceeds from such sales going to the common school fund. Inquiries regarding use of dredge spoils and negotiation of fees, should be directed to the Division (Johnson, 1979).

Local governments should arrange to review and comment on all applications filed under these state programs within, or adjacent to, their jurisdictional boundaries. However, it should be noted that many sand removal activities that should be addressed under the provisions of Goal #18 do not fall under the jurisdictional provisions of these two state agencies. Therefore, local governments should require a site investigation report for most sand removal activities. Those minor activities exempted from the site investigation report requirement could be specifically listed with a blanket finding to support their exemption.

3. Federal controls

The major federally controlled beach and dune area is the forty-one mile long Oregon Dunes National Recreation Area on Oregon's central coast. This sand area of large migrating sand dunes was made a national recreation area by an act of Congress on March 23, 1972. The Siuslaw National Forest of the U.S. Forest Service maintains the administration of this unique area.

According to the Final Environmental Impact Statement concerning the Oregon Dunes National Recreation Area Management Plan (January, 1977), the sand removal policy is:

"J. Minerals

> The sand within the Oregon Dunes National Recreation Area is of high enough quality for making some varieties of glass. In recent years, an individual filed thirty-five mining claims covering 4,640 acres of this sand. Of these claims, twenty-five involving 3,160 acres were subsequently declared invalid, since the claimant had not established a market for this sand. Although the claimant had not established a market for the sand on the remaining ten claims prior to the effective date of the NRA Act, the validity proceedings are in progress, but have not been completed at this time. Since then, all lands within the NRA have been withdrawn from entry under both the mining and mineral leasing laws, subject to valid existing rights." (U. S. Forest Service, 1977, pp. 22-23)

The Environmental Impact Statement suggests that although private lands within the NRA have not been withdrawn from mineral entry, this potential activity is not considered a threat. Section 7 of PL 92-260 provides for industrial or commercial purposes that are proposed for private lands after December 31, 1970, to be certified as being compatible with or furthering the purposes of the Act, if the property owner is to retain his protection from condemnation. However, sand mining is incompatible with the purposes of the Act since it would negatively impact one of the elements that makes the Oregon Dunes NRA unique--the sand dunes.

The Impact Statement notes further that while "the NRA Act provides for no consequences should the state or counties decide to allow sand removal for glass manufacturing purposes, a cooperative relationship is expected to prevent this from happening." (U. S. Forest Service, 1977, p. 55).

Within the Oregon Dunes National Recreation Area there exists only one sand removal project. It is a mining operation, removing the sand for glass, foundry molding and traction sand[1]. The NRA management position is to use stabilization instead of removal in situations where potential inundation poses hazardous conditions. However, when sand migrates off NRA lands, it is no longer within the jurisdictional realm of the U. S. Forest Service. Thus, future removal or stabilization would be up to adjacent property owners, such as the Oregon Department of Transportation, when removing sand from Highway 101 just north of Siltcoos (Czmerys, 1979).

4. Intergovernmental coordination

The maintenance of open sand by various jurisdictional parties and the public can lead to a variety of planning and management conflicts. It is vital that adjacent property owners participate in the planning and management of dune forms to ensure the compatibility of management approaches and techniques. Local, state and federal jurisdictions would do well indeed to work cooperatively and jointly in coordinating their planning and management of beach and dune areas. A cooperative regional planning approach specific to shoreland areas has been developed by the National Parks Service and is included in Appendix C as an aid to coastal jurisdictions involved in a coordinated approach to beach and dune planning and management. Indeed, the federal consistency provisions of the Coastal Zone Management Act, coupled with Oregon's state coordination program, ensure that local jurisdictions have ample opportunity to coordinate their planning needs and efforts with state and federal agencies.

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[1]Traction sand - sand placed in front of the driving wheels of railroad locomotives for improved traction.

III. SAND REMOVAL ACTIVITIES AND POTENTIAL IMPACTS

There are six major concerns related to the activity of sand removal in beach and dune areas. These areas of concern are the impact(s) of a proposed sand removal activity on sand flow patterns, sand-formed lakes, groundwater supplies, aesthetics, wildlife habitats and adjacent property and associated structures.

A. Sand Flow Patterns

The removal of sand from the beach and dune area may lead to erosion of neighboring landforms either down the littoral drift system of the beach or in areas leeward of the removal activity. The energy levels and directions of wind, tide and currents are constantly impacting on the beach. A reservoir of sand, especially the beach and foredune, is needed to ensure that a supply of sand is available to maintain a buffer between land and sea (U. S. Army Corps of Engineers, 1975, pp. 5-21).

> "The key to the natural protective quality of the beachfront is the sand held in storage and yielded to the storm waves to dissipate the forces of their attack on the beachfront. Whenever the total volume of sand held in storage is reduced, the ability of the beachfront to absorb the energy of the storm waves is reduced. If the forces of a storm exceed the restorative capabilities of the beach, then extensive long-term erosion and alteration of the [beach] profile are likely results." (The Conservation Foundation, 1977, p. 103).

Decision-makers should review the sand budget of an area to determine if an historic surplus of sand exists before permitting sand removal. Removal should be conducted in such a manner as to minimize the interference with the free movement of sand or which would adversely affect the vegetative cover or modify the landscape topography in a manner which promotes erosion, unwanted sand migration, an over-steepened slope situation, alterations in driftwood accumulation patterns, or breaches in the foredune. Such considerations should be addressed within a site investigation report.

B. Sand-formed Lakes

Sand-formed, or dune-dammed lakes as they are sometimes called, are most commonly exposed areas of the water table in dune areas. As such, the main concern to their viability is the encroachment on them by in-migrating dunes. At Cleawox Lake, such migration is so rapid that in a period of several years the lake depth at a narrow section went from

twenty feet to five feet (Ternyik, 1978). The importance of these lakes for wildlife habitat, recreation and aesthetics should mandate protection and restoration measures including sand removal and dune stabilization.

In as much as these lakes are commonly exposed areas of the water table, the considerations mentioned below for the groundwater should also be reviewed when planning and managing such coastal lakes.

C. Groundwater Supplies

Sand removal excavations may intersect the local groundwater table. If a removal project is large enough, it may lower the local water table. Chemicals such as fuel and lubricating oil from heavy equipment may be introduced into the groundwater if the groundwater table is exposed during the removal project.

D. Aesthetics

The major resource study relating to Oregon coastal aesthetics is Visual Resource Analysis of the Oregon Coastal Zone produced by a firm of landscape architects under contract with the Oregon Coastal Conservation and Development Commission in 1974. While this study categorizes typical coastal landscapes as they relate to the land-water interface, it does not provide decision-makers with specific standards in this highly subjective area. "Shoreline Site Planning and Design" by Roy Mann is an excellent source of information on this subject (Clark, 1977).

Relying somewhat on the two sources mentioned above the following factors for the evaluation of a proposed sand removal project from an aesthetic standpoint include:

(1) the character of the sand features to be altered. (Is it representative of a typical or common landscape, or is it an obviously unique and important feature?);

(2) the size of the landform. (Would it be possible to remove a portion of the feature without altering its aesthetic value(s)?);

(3) impact of the removal on the site and the surrounding area. (Would the proposed sand removal be a detrimental, neutral or positive action to the general aesthetic values of the site and surrounding area?); and,

(4) other land use goals and planning objectives. (Would the removal be consistent with local plans and other land use objectives such as those expressed in Goal #5, Open Space, Scenic and Historic Areas and Natural Resources?).

E. Wildlife Habitats

The beach and dune system provides a living environment for a large number of plants and animals, the sensitivity of which varies under various habitat conditions. The scale and intensity of sand removal envisioned under existing constraints, in comparison with the total sand area, does not appear to pose any significant threat to the general habitat picture. Site investigations should give special attention to identified critical habitat areas and species. In fact, through a program of sound management, such as vegetation, restoration and sand removal (to protect habitats), improvement in the quality of habitat may be realized. In the past, largely due to a lack of beach and dune management on the coast, several wildlife habitats, including lakes and wetlands, have been smothered by migrating dunes such as at Cleawox Lake. Local decision-makers should be aware of local wildlife needs when reviewing proposals for sand removal to ensure that local key areas are not adversely affected, or to direct removal to areas where habitats may be restored.

F. Adjacent Property and Associated Structures

Other than the obvious impacts of noise, dust, fumes and traffic on adjoining properties, the dangers of eliminating lateral support[1] and the inundation of such properties by reactivated sand migrating downwind from the site of the removal project are also present. Local decision-makers should thus ensure that all such problems are considered within the site investigation report.

After a sand removal project has been terminated there are two future alternatives. First is to attempt to return the site to a somewhat natural setting for rural land uses by the re-introduction of native vegetation. The second alternative is the development of the site for other urban land uses. Several helpful studies have been produced by the National Sand and Gravel Association which address reclamation:

(1) "Site Utilization and Rehabilitation Practices," by Shellie and Rogier;

(2) "Simultaneous Excavation and Rehabilitation of Sand and Gravel Sites," by Bauer; and

(3) "Practical Operating Procedures for Progressive Rehabilitation of Sand and Gravel Sites," by Johnson.

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[1]Lateral support-the general support offered a parcel of ground by that land immediately surrounding it; a very important feature considering the unconsolidated nature of the sand.

IV. PLANNING AND MANAGING SAND REMOVAL ACTIVITIES

The beach and dune system consists of dynamic and fragile landforms in various stages of stability. Because of this variability of stability and the inherent possibility of adverse impact on the beach and dune system by sand removal projects, most sand removal projects should be accompanied by a site investigation report to be evaluated and considered before a final decision is made. This report should clearly identify impacts and suggest techniques and modifications to the original proposal designed to eliminate the adversities as much as possible, or to mitigate the impacts if circumstances warrant.

Site investigation reports for proposed sand removal projects should demonstrate by reliable and probative evidence that:

(1) the beach and dune system is capable of supporting the proposed removal activity including impacts associated with transportation, noise, site devegetation and disturbance, alteration of groundwater levels, contamination of surface and groundwater, erosion, and destruction of wildlife habitat;

(2) the proposed sand removal activity is compatible with existing or proposed use of the site or contiguous areas and structures including impacts associated with lateral support, noise, dust, blowing sand, traffic and aesthetic qualities; and,

(3) the proposed sand removal activity is compatible with all applicable local, state and federal plans, regulations or ordinances, and standards including local comprehensive plans and implementing ordinances.

Additionally, it is suggested that volumes of sand may be redistributed from one area to an adjacent area during the alteration of a particular site with the approval of the local jurisdiction if all of the following conditions are met:

(1) all involved property owners (those involved with the proposal) are in written agreement;

(2) the sand mass on one property is so great that existing development is threatened or that construction of future development would be prohibitive without some reduction of the sand mass; and

(3) the action as proposed would not weaken the overall dune system and that consideration be given to the resulting topography and stabilizing factors.

Finally, restrictions should be developed for excavations in sand areas to prevent:

(1) moisture loss and root damage to plants in the surrounding area;

(2) exposing sand areas to prolonged erosion; and

(3) creating or causing slope instability. (That is, no slope should be left unattended that could fail and cause serious injury or death; all such areas should be posted.)

At the same time, however, local decision-makers should heed and consider the following observation by ensuring the opportunity for future sand removal activities as needs and demands dictate.

> "Although the land use planning and coastal zone management programs provide for mineral development, they have been criticized for not stressing adequately the importance of minerals in overall planning for future population growth and as to national interests. The result is that current investigations of mineral deposits are discouraged by doubts about future development and mining restrictions." (U. S. Bureau of Mines, 1978, p. 14).

Given the importance of sand in the natural coastal zone processes, as well as its importance to the developing coastal economy, other sources and approaches to management must be explored by policy makers. The use of dredge spoils for fill material or beach nourishment is one area needing further consideration. Additionally, studies currently under way by the Portland District Corps of Engineers and by the Department of Civil Engineering at Oregon State University, Corvallis, may shed further light on the need and uses for coastal sand including dredge spoils.

V. IDENTIFICATION OF AREAS SUITABLE FOR SAND REMOVAL

It is difficult to comprehensively identify areas suitable for sand removal because the associated impacts are dependent upon the landform type, historic sand supply, recent erosion or accretion patterns, the surrounding natural and man-made environment(s) and the extent of the sand removal operation.

Three general types of circumstances may at times allow or necessitate the removal of sand; they are areas where:

(1) in-migrating sand is posing a threat to structures, habitat and/or property;

(2) significant accretion is known to occur (however, due to a possible zero net littoral drift and limited sources of new

sand supplied to Oregon's beaches, removal of sand even from areas of historic accretion is not generally recommended.) and;

(3) dredge spoils have been deposited or stored.

Jurisdictions should allow sand removal from ocean beach and sand dune areas only when the following factors are addressed by the developer:

(1) the removal is necessary to protect life or property;

(2) a site investigation report demonstrates that the removal will have minimal adverse impact on the environment and adjacent land uses, and

(3) attention is given to anticipated potential impacts and subsequent rehabilitation of the site.

While it is important for jurisdictions to recognize the necessity or importance of sand removal activities for mineral extraction, industrial processes, construction, and protection of property, local plans should not attempt to specifically identify sites having sand removal potential. Rather it is suggested that jurisdictions act upon sand removal applications following a review of all facts included in a site investigation report and rehabilitation program. Following such review, and given local input, sand removal proposals can be modified as necessary to satisfy the objectives of both the developer and local citizenry.

Presently, few coastal jurisdictions are in a position whereby they can affect sand removal proposals, with the exception of those projects requiring state agency permit(s). As a result of Oregon's land use program, state coordination, and the federal consistency provisions of the Coastal Zone Management Act, coastal jurisdictions are now afforded an opportunity to comment on sand removal proposals in their locale. It is strongly recommended, however, that those jurisdictions containing areas of beach and dune landforms adopt ordinances allowing them review authority of sand removal proposals falling outside the realm of state purview.

Because local governments are called upon to fill the void between state regulation of sand removal and areas not covered by state statutes, it is incumbent upon jurisdictions to adopt reasonable standards and policies to ensure that future sand removal activities are designed in a manner which meets local economic, social and environmental demands while complying with the intent of the Beaches and Dunes Goal.

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APPENDIX A

ORS 517.750 - .990
Reclamation of Mining Lands

Application for Operating
Permit or Grant of Exemption

Reclamation Plan Guideline

RECLAMATION OF MINING LANDS

517.750 Definitions for ORS 517.750 to 517.900. As used in ORS 517.750 to 517.900 and subsection (4) of 517.990, unless the context requires otherwise:

(1) "Abandonment of surface mining" means a cessation of surface mining operation that was not set forth in a permittee's plan of operation or similar written notice extending:

(a) For more than 24 consecutive months; or

(b) For a period of less than 24 consecutive months in length, determined by the department to be sufficient to characterize such cessation of the surface mining operation as an abandonment of surface mining and where the permittee fails to submit sufficient evidence to the department that such operation has not been abandoned within 30 days after his receipt of written notification from the department of its intention to declare the operation abandoned.

(2) "Board" means the governing board of the State Department of Geology and Mineral Industries..

(3) "Completion" means termination of surface mining activities including reclamation of the surface-mined land in accordance with the approved reclamation plan and operating permit.

(4) "Department" means the State Department of Geology and Mineral Industries.

(5) "Landowner" means the person possessing fee title to the natural mineral deposit being surface mined.

(6) "Minerals" includes soil, coal, clay, stone, sand, gravel, metallic ore and any other solid material or substance excavated for commercial, industrial or construction use from natural deposits situated within or upon lands in this state.

(7) "Operator" means any individual, public or private corporation, political subdivision, agency, board or department of this state, any municipality, partnership, association, firm, trust, estate or any other legal entity whatsoever that is engaged in surface mining operations.

(8) "Overburden" means the soil, rock and similar materials that lie above natural deposits of minerals.

(9) "Reclamation" means the employment in a surface mining operation of procedures, reasonably designed to minimize as much as practicable the disruption from the surface mining operation and to provide for the rehabilitation of any such surface resources adversely affected by such surface mining operations through the rehabilitation of plant cover, soil stability, water resources and other measures appropriate to the subsequent

beneficial use of such mined and reclaimed lands.

(10) "Reclamation plan" means a written proposal, submitted to the department as required by ORS 517.750 to 517.900 and subsection (4) of 517.990 and subsequently approved by the department as provided in ORS 517.750 to 517.900 and subsection (4) of 517.990, for the reclamation of the land area adversely affected by a surface mining operation and including, but not limited to the following information:

(a) Proposed measures to be undertaken by the operator in protecting the natural resources of adjacent lands.

(b) Proposed measures for the rehabilitation of the surface-mined lands and the procedures to be applied.

(c) The procedures to be applied in the surface mining operation to control the discharge of contaminants and the disposal of surface mining refuse.

(d) The procedures to be applied in the surface mining operation in the rehabilitation of affected stream channels and stream banks to a condition minimizing erosion, sedimentation and other factors of pollution.

(e) The map required by paragraph (e) of subsection (1) of ORS 517.790 and such other maps and supporting documents as may be requested by the department.

(f) A proposed time schedule for the completion of reclamation operations.

(11) "Spoil bank" means a deposit of excavated overburden or mining refuse.

(12) "Surface mining" includes all or any part of the process of mining minerals by the removal of overburden and the extraction of natural mineral deposits thereby exposed by any method by which more than 2,500 cubic yards of minerals are extracted or by which at least one acre of land is affected within a period of 12 consecutive calendar months, including open-pit mining operations, auger mining operations, production of surface mining refuse, the construction of adjacent or off-site borrow pits (except those constructed for use as access roads), and prospecting and exploration activities coming within the quantity or area specifications set forth herein or when such activities affect more than one acre of land for each eight acres of land prospected or explored; but excluding excavations of sand, gravel, clay, rock or other similar materials conducted by the landowner or tenant for the primary purpose of construction, reconstruction or maintenance of access roads and excavation or grading operations conducted in the process of farming or cemetery operations, onsite road construction or other onsite construction, or underground mines; and also excluding rock, gravel, sand, silt or other similar substances removed from the beds or banks of any waters of this state pursuant to permit issued under ORS 541.605 to 541.660.

(13) "Surface mining refuse" means all waste materials, soil, rock, mineral, liquid, vegetation and other materials resulting from or displaced by surface mining operations within the operating permit area, including all waste materials deposited in or upon lands within such operating permit area.
[1971 c.719 §2; 1975 c.724 §1; 1977 c.59 §1]

517.755 Mining operations affecting more than five acres. Notwithstanding the yard and acre limitations of subsection (11) of ORS 517.750, as soon as any mining operation begun after July 1, 1975, affects more than five acres of land the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 apply to the mining operation.
[1975 c.724 §1a]

Note: 517.755 was enacted into law by the Legislative Assembly but was not added to or made a part of ORS chapter 517 or any series therein by legislative action. See the Preface to Oregon Revised Statutes for further explanation.

517.760 Policy. (1) The Legislative Assembly finds and declares that:

(a) The extraction of minerals by surface mining operations is a basic and essential activity making an important contribution to the economic well-being of the state and nation.

(b) Proper reclamation of surface-mined lands is necessary to prevent undesirable land and water conditions that would be detrimental to the general welfare, health, safety and property rights of the citizens of this state.

(c) Surface mining takes place in diverse areas where the geologic, topographic, climatic, biological and social conditions are significantly different and that reclamation operations and the specifications therefor must vary accordingly.

(d) It is not practical to extract minerals required by our society without disturbing the surface of the earth and producing waste materials and that the very character of many types of surface mining operations precludes complete restoration of the affected lands to their original condition.

(e) Reclamation of surface-mined lands as provided by ORS 517.750 to 517.900 and subsection (4) of 517.990 will allow the mining of valuable minerals in a manner designed for the protection and subsequent beneficial use of the mined and reclaimed lands.

(2) The Legislative Assembly, therefore, declares that the purposes of ORS 517.750 to 517.900 and subsection (4) of 517.990 are:

(a) To provide that the usefulness, productivity and scenic values of all lands and water resources affected by surface mining operations within this state shall receive the greatest practical degree of protection and reclamation necessary for their intended subsequent use.

(b) To provide for cooperation between private and governmental entities in carrying out the purposes of ORS 517.750 to 517.900 and subsection (4) of 517.990.
[1971 c.719 §1]

517.770 Application of ORS 517.750 to 517.900. (1) Nothing in ORS 517.750 to 517.900 and subsection (4) of 517.990 applies to:

(a) The reclamation of lands within the surfaces and contours of surface mines as of July 1, 1972, or to vertical extensions of those surfaces and contours. The surfaces and contours of surface mines shall not include those areas over which the mining operator merely leveled terrain or cleared vegetative cover.

(b) Dredging operations conducted pursuant to ORS 517.611 to 517.700.

(c) A landowner or operator who, on July 1, 1972, is a party to a valid contract, in existence on January 1, 1971, to surface mine; but this exemption will not apply to existing contracts upon expiration, or in instances where a fiduciary relationship exists between the contracting parties, and in no case will the exemption continue after January 1, 1981.

(2) Notwithstanding paragraph (a) of subsection (1) of this section, if in the judgment of the department meaningful reclamation cannot be accomplished the department may waive the permit and reclamation requirements of ORS 517.750 to 517.900 and subsection (4) of 517.990 even though the mine surfaces and contours as of July 1, 1972, have been extended horizontally.
[1971 c.719 §15; 1973 c.709 §1; 1975 c.724 §2]

517.775 Permit fee for certain landowners and operators. Notwithstanding the provisions of subsections (1) and (3) of ORS 517.770, any landowner or operator conducting surface mining on July 1, 1972, shall pay the permit fee as provided in ORS 517.800.
[1971 c.719 §17]

517.780 Effect on local zoning laws or ordinances; local reclamation permit and fee in lieu of state permit and fee; certain operations exempt. (1) The provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 and the rules and regulations adopted thereunder shall not supersede any zoning laws or ordinances in effect on July 1, 1972; however, if such zoning laws or ordinances are repealed on or after July 1, 1972, the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 and the rules and regulations adopted thereunder shall be controlling. The department may adopt rules and regulations with respect to matters presently covered by such zoning laws and ordinances.

(2) In lieu of the permit required by ORS 517.790, an operator may conduct surface mining provided such surface mining is done pursuant to a valid permit issued by the appropriate authority of a city or county in which the mining is taking place, if such authority has adopted an ordinance, approved by the department, requiring reclamation of land that has been surface mined.

(3) City or county operated surface mining operations which sell less than 2,500 cubic yards of minerals within a period of 12 consecutive calendar months, are exempt from the provisions of ORS 517.750, 517.755, 517.770, 517.810, 517.830, 517.860, 517.865 and this section provided the city or county adopts an ordinance which shall include a general reclamation scheme for all surface mining within the boundaries of the city or county, which shall provide for the means and methods whereby reclamation is to be achieved.

(4) A city or county may determine and collect fees for any function performed pursuant to subsection (2) of this section. However, no such fee shall exceed the amounts prescribed in ORS 517.800. A city or county shall issue a permit for each regulated surface mining activity within its jurisdiction, and all such permittees are subject to the payment of any fee charged by the city or county. However, those activities described in ORS 517.770 are not required to comply with mined land reclamation plans. City or county fees shall be in lieu of any surface mining permit fees assessed by the department.
[1971 c.719 §16; 1975 c.724 §3; 1977 c.524 §1]

517.790 Operating permit required for surface mining on certain lands; application for permit; proposed reclamation plans. (1) Except as otherwise provided by subsection (2) of ORS 517.780, after July 1, 1972, no landowner or operator shall permit or engage in surface mining on land not surface mined on July 1, 1972, without having first applied for and received an operating permit from the department for such surface mining operation. A separate permit shall be required for each separate surface mining operation. Prior to receiving an operating permit from the department the landowner or operator must submit an application on a form provided by the department that contains information considered by the department to be pertinent in its review of the application, including but not limited to:

(a) The name and address of the landowner and the operator and the names and addresses of any persons designated by them as their agents for the service of process.

(b) The materials for which the surface mining operation is to be conducted.

(c) The type of surface mining to be employed in such operation.

(d) The proposed date for the initiation of such operation.

(e) The size and legal description of the lands that will be affected by such operation, and, if more than 10 acres of land will be affected by such operation and if the department considers the conditions to warrant it, a map of the lands to be surface mined that shall include the boundaries of the affected lands, topographic details of such lands, the location and names of all streams, roads, railroads and utility facilities within or adjacent to such lands, the location of all proposed access roads to be constructed in conducting such operation and the names and addresses of the owners of all surface and mineral interests of the lands included within the surface mining area.

(f) If economically practicable, a plan for visual screening by vegetation or otherwise that will be established and maintained on the lands within such operation for the purpose of screening such operation from the view of persons using adjacent public highways, public parks and residential areas.

(2) The application referred to in subsection (1) of this section must also contain a proposed reclamation plan that is acceptable to and approved by the department.

[1971 c.719 §4; 1973 c.709 §2]

517.800 Fees. (1) Each application for an operating permit under ORS 517.750 to 517.900 and subsection (4) of 517.990 shall be accompanied by a fee of $265.

(2) Annually on the anniversary date of each such operating permit, each holder of an operating permit shall pay to the department a fee of $165.

[1971 c.719 §7; 1973 c.709 §3; 1977 c.524 §2]

517.810 Bond or security deposit required of applicant; public and governmental bodies exempt; other security in lieu of bond from landowner. (1) Before issuing or reissuing an operating permit for any surface mining operation, the department shall require that the applicant for such permit file with it a bond or security deposit, conditioned upon the faithful performance of the reclamation plan and of the other requirements of ORS 517.750 to 517.900 and subsection (4) of 517.990 and the rules and regulations adopted thereunder in a sum equal to the estimated cost of the completion of the reclamation work. The applicant may deposit with the department, in lieu of a bond, cash or other security in a sum satisfactory to the department. In no event shall such bond or deposit of cash or security exceed the sum of $500 per acre of land to be surface mined under the terms of the operating permit therefor. The amount of the bond shall be determined by the department.

(2) Nothing in this section shall apply to any public or governmental agency.

(3) In lieu of the bond or other security required of the applicant in subsection (1) of this section, the department may accept a similar security from the landowner, including a mortgage or trust deed equal to the estimated cost of reclamation as determined by the department, not to exceed $500 per acre. The cost of title or mortgage insurance, or costs for title searches or examinations necessary to insure the department's security shall be the responsibility of the applicant.

[1971 c.719 §8; 1975 c.724 §4]

517.820 Extensions of time for submission of proposed reclamation plans; time limit for reclamation completion; consultation with state agencies. (1) Upon good cause shown, the department may grant reasonable extensions of time for the completion by the landowner or operator and his submission to the department of a proposed reclamation plan required by subsection (2) of ORS 517.790. Each reclamation plan submitted to the department must provide that all

reclamation activities shall be completed within three years after the termination of mineral extraction from the surface mining operation conducted within each separate area for which an operating permit is requested. Each such reclamation plan shall be approved by the department if it adequately provides for the reclamation of surface-mined lands.

(2) The department, prior to approving a proposed reclamation plan, shall consult with all other interested state agencies and appropriate local planning authorities.
[1971 c.719 §5; 1977 c.59 §2]

517.830 Inspection of operating site; approval of application for operating permit; effect of failure to approve or refusal to approve reclamation plan; appeal from denial of plan; transfer of permittee's interest. (1) Upon receipt of an application for an operating permit, the department shall cause the operating site described therein to be inspected. Within 30 days after the date on which such application is received and upon receipt of the required permit fee, the department shall issue the operating permit applied for or, if it considers such application incomplete, return the application to the applicant for correction of the deficiencies indicated by the department.

(2) Failure by the department to act upon the reclamation plan submitted with an application for an operating permit within the 30-day period referred to in subsection (1) of this section shall not be considered a denial by the department of the operating permit applied for. The department, pending final approval of a reclamation plan, may issue a provisional permit subject to reasonable limitations that may be prescribed by the department and conditioned upon the applicant's compliance with the bond and security requirements established by ORS 517.810. For all operations ongoing as of July 1, 1972, a provisional permit shall be issued except in those instances where there is reason to believe that a reclamation plan will not be approved and the operating permit ultimately denied.

(3) If the department refuses to approve a reclamation plan in the form submitted by the applicant, it shall notify the applicant, in writing, of its reasons for the refusal to approve such reclamation plan, including additional requirements as may be prescribed by the department for inclusion in such reclamation plan. Within 60 days after the receipt of such notice, the applicant shall comply with the additional requirements prescribed by the department for such reclamation plan or file with the department a notice of appeal from the decision of the department with respect to such reclamation plan. If a notice of appeal is filed with the department by the applicant, the department may issue a provisional permit to such applicant.

(4) An operating permit issued by the department under this section shall be granted for the period required to mine the land described in such permit and shall be valid, subject to payment of the renewal fee, until the surface mining operation described in the operating permit is completed or abandoned. Each such operating permit shall provide that the reclamation plan described therein may be modified upon agreement between the department and the permittee to change the reclamation plan included within the operating permit.

(5) When a person succeeds to the interest of a permittee in any uncompleted surface mining operation by sale, assignment, lease or other means, the department shall release the permittee from the duties imposed upon him under his operating permit if his successor assumes fully the duties of the former permittee with respect to the reclamation of the surface-mined lands. Upon the assumption by such person of the duties of the permittee as provided in this subsection, the department shall transfer the operating permit to the successor upon the approval of such successor's bond or security deposit as required under ORS 517.750 to 517.900 and subsection (4) of 517.990.
[1971 c.719 §6; 1975 c.724 §5]

517.840 Administration and enforcement of ORS 517.750 to 517.900. The board shall administer and enforce the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 and may:

(1) Conduct or cause to be conducted investigations, research, experiments and demonstrations and may collect and disseminate information related to surface mining and the reclamation of surface-mined lands.

(2) Cooperate with other governmental and private agencies of this state or of other states and with agencies of the Federal Government, including the reimbursement for any services provided by such agencies to the department at its request.

(3) Apply for, accept and expend public and private funds made available for the reclamation of lands affected by surface mining in accordance with the purposes of

ORS 517.750 to 517.900 and subsection (4) of 517.990.

(4) In accordance with the applicable provisions of ORS chapter 183, adopt rules and regulations considered by the board to be necessary in carrying out the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990. However, such rules and regulations shall be subject to existing rights under any permit, license, lease or other valid authorization granted or issued by a governmental entity.

[1971 c.719 §3]

517.850 Inspection of permit area. At such reasonable times as the department may elect, the department, after reasonable advance notice has been given to the permittee, may cause the permit area to be inspected to determine if the permittee has complied with the reclamation plan and the rules and regulations of the department.

[1971 c.719 §9]

517.860 Failure to comply with reclamation plan; notice of noncompliance; performance period; extension; department may perform work and assess costs against permittee or landowner. (1) If from inspections conducted pursuant to ORS 517.850, or from any other source the department shall determine that the permittee has not or is not complying with the reclamation plan or the rules and regulations of the department, it shall give written notice thereof to the permittee, specifically outlining the deficiencies. Within 30 days thereafter, the permittee shall commence action to rectify those deficiencies and diligently shall proceed until they are all corrected. However, the department may extend performance periods for delays occasioned for causes beyond the permittee's control, but only when the permittee is, in the opinion of the department, making a reasonable effort to comply.

(2) (a) If the permittee has not commenced action to rectify the deficiencies within said period of time, and after notification by the department, or

(b) If the permittee has commenced such action and fails to diligently pursue it, or

(c) If reclamation is not properly completed in conformance with the reclamation plan within three years after surface mining on any segment of the permit area has terminated, or

(d) If reclamation is not properly completed in conformance with the reclamation plan upon determination by the department that abandonment of surface mining has occurred on any segment of the permit area,

the department may perform the reclamation required by the reclamation plan, complete such reclamation and give written notice that the amount of the reasonably necessary costs and expenses so incurred is due and payable to the department by the permittee. In performing the reclamation under this subsection the department shall be limited to expending funds to complete the reclamation plan, but in no event shall the expenditure exceed $500 per acre. If the amount specified in the notice is not paid within 30 days following such notice the Attorney General, upon request of the department, shall institute proceedings to recover the amount specified in the notice.

(3) If the landowner has given security as provided in subsection (3) of ORS 517.810 and the permittee is in default as specified in subsection (2) of this section, the landowner shall be held responsible for complying with the reclamation plan of the permitee. The department shall furnish written notice of the default to the landowner and require the landowner to complete the reclamation as specified in the permittee's reclamation plan acceptable to the department. If the landowner has not commenced action to rectify the deficiencies within 30 days after receiving notice, or if he fails to diligently pursue reclamation in conformance with the plan, the department may complete the reclamation and otherwise proceed as provided in subsection (2) of this section, or the department may bring suit to compel the landowner to complete the reclamation plan.

[1971 c.719 §10; 1975 c.724 §6; 1977 c.59 §3]

517.865 Failure to faithfully perform reclamation; insufficient bond; lien; notice; priority; foreclosure. (1) If a permittee fails to faithfully perform the reclamation required by his reclamation plan and if the bond or security deposit required by ORS 517.810 is not sufficient to compensate the department for all reasonably necessary costs and expenses incurred by it in performing the reclamation required by the reclamation plan, the amount due, not to exceed $500 per acre, shall be a lien in favor of the department upon all property, whether real or personal, belonging to the permittee.

(2) The lien shall attach upon the filing of a notice of claim of lien with the county clerk of the county in which the property is located. The notice of lien claim shall contain a true statement of the demand, the insufficiency of the bond or security deposit to compensate the

department and the failure of the permittee to perform the reclamation required.

(3) The lien created by this section is prior to all other liens and encumbrances, except that the lien shall have equal priority with tax liens.

(4) The lien created by this section may be foreclosed by a suit in the circuit court in the manner provided by law for the foreclosure of other liens on real or personal property.
[1975 c.724 §8]

517.870 Adjustment of bond or security deposit of permittee upon satisfactory completion of reclamation work. Upon request of the permittee, and when in the judgment of the department the reclamation has been completed in accordance with the reclamation plan, the permittee shall be notified that the work has been found to be satisfactorily performed and is acceptable and his bond or security deposit shall be adjusted accordingly.
[1971 c.719 §11]

517.880 Order for suspension of surface mining operation operating without required permit; enjoining operation upon failure of operator to comply; completion of reclamation by department. When the department finds that an operator is conducting a surface mining operation for which an operating permit is required by ORS 517.750 to 517.900 and subsection (4) of 517.990, but has not been issued by the department under the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 or by the rules and regulations adopted thereunder, it may order such operator to suspend such operation until an operating permit has been issued by the department for such surface mining operation or until such time as the department is assured that such operator will comply therewith. If the operator fails or refuses to comply with such order, the Attorney General at the request of the department shall initiate any necessary legal proceeding to enjoin such surface mining operation and to provide for the completion of the reclamation of the lands affected by such operation.
[1971 c.719 §12]

517.890 Appeals. Appeals from determinations made by the department in carrying out the provisions of ORS 517.750 to 517.900 and subsection (4) of 517.990 and the rules and regulations adopted thereunder shall be conducted in the manner provided by the applicable provisions of ORS chapter 183 for appeals from orders in contested cases.
[1971 c.719 §13]

517.900 Information submitted by operators and landowners is confidential. Operators' reports and other information submitted by operators and landowners as required under ORS 517.750 to 517.900 and subsection (4) of 517.990, with the exception of the reclamation plan as approved by the department, shall be confidential.
[1971 c.719 §14]

PENALTIES

517.990 Penalties. (1) A person who violates ORS 517.450 shall be guilty of theft and punished as provided in ORS 164.045 or 164.055.

(2) Violation of any rules, regulations and orders made pursuant to subsection (4) of ORS 517.540 is punishable, upon conviction, by a fine of not less than $25 nor more than $250, or by imprisonment in the county jail for not more than 60 days, or both.

(3) Any person conducting a dredging operation in violation of the provisions of ORS 517.611 to 517.700 is guilty of a misdemeanor.

(4) Any landowner or operator who shall conduct a surface mining operation, for which a permit is required by ORS 517.750 to 517.900 and this subsection, without a valid operating permit therefor shall be punished, upon conviction, by a fine of not more than $1,000.
[Amended by 1953 c.188 §2; subsection (3) enacted as 1957 c.580 §11; 1971 c.743 §398; subsection (4) enacted as 1971 c.719 §18]

STATE DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES
1129 SE South Santiam Road
Albany, Oregon 97321
Telephone: 967-2039

Identification No._____

Office Use Only _____

APPLICATION FOR OPERATING PERMIT OR GRANT OF EXEMPTION UNDER ORS 517.750 - 990

1. Responsible Parties

A. Operator

Name_____

Street or Box No._____

City_____ State_____

Zip_____ Telephone_____

B. Landowner (if other than operator)

Name_____

Street or Box No._____

City_____ State_____

Zip_____ Telephone_____

3. MINERAL DEPOSIT CHARACTERISTICS

A. Description

Type of overburden_____

Approximate depth of overburden_____

Approximate depth of mine_____

Primary mineral to be removed_____

* Estimated quantity of mineral (yards)_____

B. Size

Size in acres of any areas presently affected by surface mining_____

How much of the above was affected
before 7/1/72_____

before 7/1/75_____

Has any of the above area been reclaimed?_____

If yes, how much and when?_____

Approximate acreage to be affected by surface mining during the ensuing 12 months_____

C. Volume

* Total cubic yards excavated 7/1/72 to date_____

* During ensuing permit year, what is the scheduled total cubic yards to be excavated_____

D. Status

☐ Active Date mining began _____

☐ Inactive Date mining will

☐ New begin _____

2. Identification of Site

A. ¼Sec. Section Township Range County

Distance in miles | Direction from | Nearest Community

Type of site: (Check all that apply)

☐ 1. Pit ☐ 5. Prospect

☐ 2. Stockpile ☐ 6. Refuse Disposal

☐ 3. Plant ☐ 7. Other

☐ 4. Quarry

4. Application is hereby made for: (complete only one - see instructions)

A. Operating permit - operator claims no exemptions_____

I apply for a surface mining operating permit under ORS517.790_____ date_____
(signature) Title_____

B. Grant of limited exemption based on: (check one or both)

☐ Prior mined (ORS 517.770-1a)

☐ Valid contract (ORS 517.770-1c)

I apply for a grant of limited exemption from the requirement for a reclamation plan and bond, but not the fees Signature _____
Date_____ Title _____

C. Grant of total exemption.

I apply for a grant of total exemption from the requirements of a reclamation plan, bond, and the fees under ORS 517.750(12) and 517.770 (2) because:

☐ 1. All mining activity takes place between the banks of a stream. (The vegetation line defines the bank).

☐ 2. Access road's borrow pit or quarry.

☐ 3. On-site construction.

☐ 4. The site is less than one acre, and

☐ 5. a total of less than 2,500 cubic yards of material have been, or will be, removed.

☐ 6. The site is inactive.

☐ 7. Other

_____ date_____
(signature) Title_____

D. Even though entitled to exemptions as shown above, a reclamation plan is submitted voluntarily.

Yes. No.

NOTICE

If more than 50 cubic yards of material are to be removed or placed in fill within the bed and banks of a natural waterway, a permit from the Division of State Lands, 1445 State Street, Salem, Oregon 97310, telephone: 378-3805, is required.

*INFORMATION TO BE CONSIDERED CONFIDENTIAL (ORS 517.900)

INSTRUCTIONS FOR COMPLETING THIS FORM ARE ON THE REVERSE SIDE

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
MINED LAND RECLAMATION DIVISION

RECLAMATION PLAN GUIDELINE

A. NAME, ADDRESS AND TELEPHONE NUMBER OF THE OPERATOR OR HIS AGENT:

B. NAME AND ADDRESS OF LANDOWNER:

C. LIST OF KNOWN MATERIALS FOR WHICH THE OPERATION IS TO BE CONDUCTED:

1. PROPOSED STARTING DATE:

2. PROPOSED ENDING DATE (IF KNOWN):

D. OPERATIONAL PLAN:

1. METHOD TO BE EMPLOYED:

a. SINGLE BENCH
b. MULTIPLE BENCH
c. DREDGE
d. OTHER_____

2. TYPES OF EQUIPMENT TO BE USED:

3. DISPOSITION OF OVERBURDEN:

E. WHAT WILL BE THE PLANNED SUBSEQUENT "BENEFICIAL USE" OF THE PERMIT AREA? THIS CAN INCLUDE, BUT IS NOT LIMITED TO, CONSTRUCTION SITE, SANITARY LAND FILL, PARK, WATER IMPOUNDMENT, AGRICULTURAL USE (BE SPECIFIC, EXAMPLE: GRAZING LAND, CROP TO BE PLANTED, ETC.), FOREST LAND.

F.1. (a) Reclamation will begin _____ days following completion of mining.
(b) Reclamation will be concurrent with mining. _____ yes _____no

F. 2. PROVISION FOR RECLAIMING MINED LANDS ON A CONTINUING BASIS WHERE FEASIBLE.

G. RECLAMATION PROCEDURES

1. WHAT WILL YOU DO TO INSURE GROUND STABILITY?

2. PROVISION FOR REVEGETATION. (Minimal survival rate is 75% uniformly distributed.)

(a) HOW WILL YOU SAVE AND STORE TOPSOIL?

(b) WHAT MEASURES WILL YOU TAKE TO PREVENT EITHER WIND OR WATER EROSION OF TOPSOIL DURING STORAGE?

(c) WHAT WILL BE THE AVERAGE DEPTH OF TOPSOIL REPLACED ON THE AREA TO BE RECLAIMED.

(d) HOW WILL YOU PREPARE SEED BED PRIOR TO PLANTING?

(e) WHAT TYPES AND AMOUNTS OF GRASS SEED WILL YOU USE PER ACRE AND HOW WILL THIS BE PLANTED?

(f) WHAT TYPES AND AMOUNTS OF FERTILIZER, MULCH, AND LIME WILL YOU USE?

(g) WHAT TYPES AND AMOUNTS OF SEEDLINGS AND SHRUBS WILL YOU PLANT?

(h) WHEN WILL SEEDING AND PLANTING TAKE PLACE? (SEASON OF YEAR)

H. WATER AND DRAINAGE

(a) WHAT PROVISION WILL YOU TAKE TO INSURE PROPER DRAINAGE?

(b) WHAT PROVISION HAS BEEN TAKEN FOR SILT CONTROL?

(c) IF WATER IMPOUNDMENT IS TO BE LEFT, SEE PAGE 6.

I. VISUAL SCREENING

(a) WILL YOU EMPLOY VISUAL SCREENING? (IF NO, EXPLAIN)

(b) WHAT TYPES AND AMOUNTS OF PLANTS WILL YOU USE?

(c) WHAT WILL BE THE SPACING BETWEEN PLANTS?

J. PROVISION FOR REMOVING STRUCTURES, EQUIPMENT, AND REFUSE FROM THE PERMIT AREA IN ACCORDANCE WITH THE RECLAMATION PLAN.

K. MAP OF AERIAL PHOTO REQUIREMENTS

(a) WILL AREA PHOTO BE SUBMITTED? YES _____ NO _____

SCALE_____

(b) MAP(S) REQUIREMENTS. THE MAP SHOULD SHOW, BUT IS NOT LIMITED TO:

(1) SCALE: (1" = 400' to 600')

(2) NORTH SHALL BE INDICATED

(3) QUARTER SECTION, SECTION, TOWNSHIP AND RANGE

(4) DISTANCE AND DIRECTION TO NEAREST MUNICIPALITY

(5) LOCATIONS AND NAMES OF ALL STREAMS, ROADS, RAILROADS, UTILITIES

(6) LOCATION AND NAMES OF ADJACENT LANDOWNERS

(7) ALL OCCUPIED HOUSES WITHIN 500 FEET

(8) LOCATION OF ALL PROPOSED ACCESS ROADS

(9) LOCATION OF PLANT, OFFICE AND MAINTENANCE FACILITIES

(10) SHOW BOUNDARIES OF AREA TO BE PERMITTED

(11) TYPICAL CROSS-SECTION OF PRESENT GROUND LINE AND PROJECTED GROUND LINE AFTER RECLAMATION

(12) CONTOUR INTERVAL, DATE OF MAP PREPARATION, NAME OF PERSON PREPARING MAP.

(13) AREA FOR TOPSOIL STORAGE, WASTE DISPOSAL

(14) A SEPARATE MAP SHOWING GENERAL LOCATION OF THE OPERATING AREA (NOT LARGER THAN $8\frac{1}{2}$" x 11")

(c) A REVISED MAP MAY BE REQUIRED ANNUALLY

L. IF APPLICABLE, WHAT PROVISIONS HAVE BEEN MADE FOR STREAM CHANNEL, BANK STABILIZATION AND REHABILITATION?

M. EVIDENCE, IN WRITTEN FORM, STATING THAT ALL OWNERS OF A LEGAL, EQUITABLE, FIDUCIARY OR POSSESSORY INTEREST IN THE LAND CONCUR WITH THE PROPOSED SUBSEQUENT USE FOR ANY MINING OPERATION COMMENCING SUBSEQUENT TO JULY 1, 1972.

N. OTHER PERMITS IF APPLICABLE:

DIVISION OF STATE LANDS	NO._____	DATE _____
DEPARTMENT OF ENVIRONMENTAL QUALITY	NO._____	DATE _____
COUNTY USE PERMIT	NO._____	DATE _____
OTHER (IDENTIFY)	_____	

O. OTHER COMMENTS:

_____

(SIGNATURE OF APPLICANT)

TITLE _____ DATE _____

WATER IMPOUNDMENTS

(1) HOW LARGE WILL THE SURFACE AREA BE, IN ACRES? _____

(2) WHAT PROVISIONS HAVE BEEN MADE FOR PUBLIC SAFETY?

(3) WHAT PROVISIONS HAVE YOU MADE TO PREVENT WATER STAGNATION?

(4) WHAT IS THE WATER SOURCE FOR THE IMPOUNDMENT?

(5) WILL THERE BE PUBLIC ACCESS FOR FISHING?

INSTRUCTIONS FOR CROSS-SECTION

1. THE TWO EXAMPLES SHOWN ARE "TYPICAL" CROSS-SECTIONS OF A WATER IMPOUNDMENT LEFT AFTER EXCAVATION IS COMPLETE.

2. IF ONE OF THE PLANS SHOWN IS TO BE USED, PLEASE INDICATE WHICH ONE AND PROVIDE THE FOLLOWING INFORMATION ON THE PLAN SELECTED. YOU DO NOT HAVE TO RE-DRAW THE CROSS-SECTION.

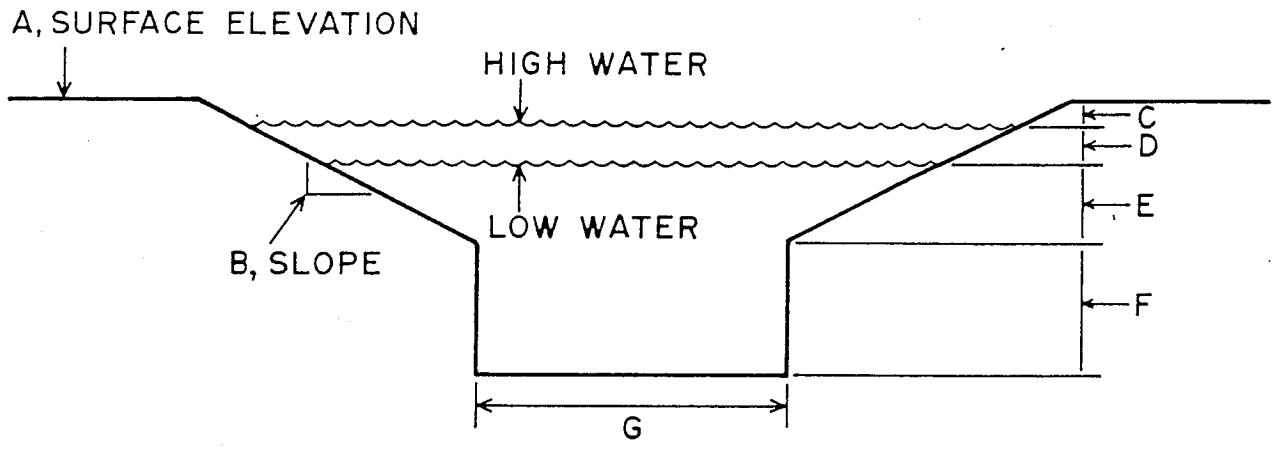
   A. SURFACE ELEVATION TO THE NEAREST 5 FEET.

   B. SLOPE OF THE BANK (MAXIMUM IS 2:1 OR 27°).

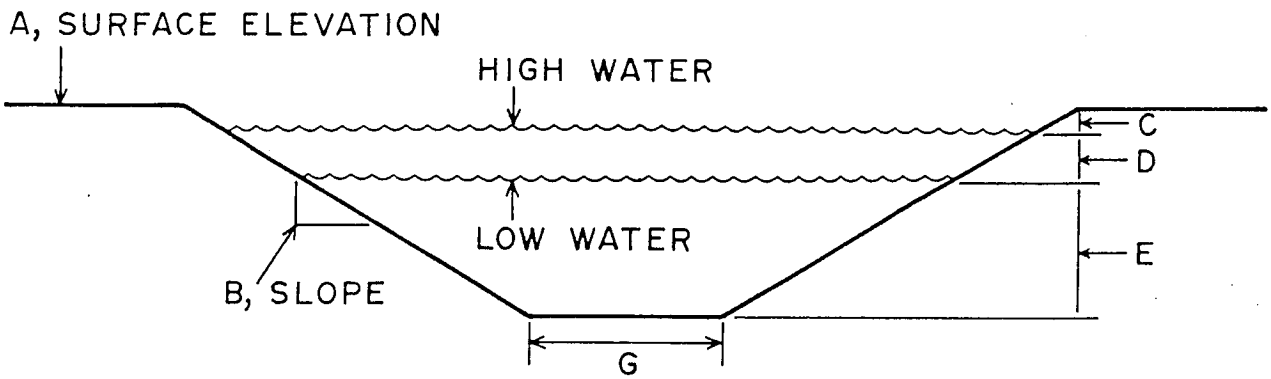
   C - G. THE DIMENSIONS IN FEET.

Typical Cross - Section(s) of Water Impound

TYPE I



TYPE II



APPENDIX B

State Statutes 390.655 and 390.725

Permit Application--Removal, of Sand, Rock, Minerals, Marine Growth or Other Natural Products of the Oregon Shore

390.655 Standards for improvement permits. The State Highway Engineer shall consider applications and issue permits under ORS 390.650 in accordance with standards designed to promote the public health, safety and welfare and carry out the policy of ORS 390.610, 390.620 to 390.660, 390.680, 390.690, and 390.705 to 390.770. The standards shall be based on the following considerations, among others:

(1) The public need for healthful, safe, esthetic surroundings and conditions; the natural scenic, recreational and other resources of the area; and the present and prospective need for conservation and development of those resources.

(2) The physical characteristics or the changes in the physical characteristics of the area and suitability of the area for particular uses and improvements.

(3) The land uses, including public recreational use if any, and the improvements in the area, the trends in land uses and improvements, the density of development and the property values in the area.

(4) The need for recreation and other facilities and enterprises in the future development of the area and the need for access to particular sites in the area.
[1969 c.601 §11]

390.725 Permits for removal of products along ocean shore. (1) No sand, rock, mineral, marine growth or other natural product of the ocean shore, other than fish or wildlife, agates or souvenirs, shall be taken from the state recreation areas described by ORS 390.635, except in compliance with a rule of or permit from the Department of Transportation as provided by this section. Permits shall provide for the payment of just compensation by the permittee as provided in subsection (5) of this section.

(2) Rules or permits shall be made or granted by the Department of Transportation only after consultation with the State Fish and Wildlife Commission, the State Department of Geology and Mineral Industries and the Division of State Lands. Rules and permits shall contain provisions necessary to protect the areas from any use, activity or practice inimicable to the conservation of natural resources or public recreation.

(3) On request of the governing body of any coastal city or county, the Department of Transportation may grant a permit for the removal of sand or rock from the area at designated locations on the ocean shore to supply the reasonable needs for essential construction uses in such localities if it appears sand and rock for such construction are not otherwise obtainable at reasonable cost, and if such removal will not materially alter the physical characteristics of the area or adjacent areas, nor lead to such changes in subsequent seasons. Before issuing a permit the department shall likewise take into consideration the standards described by ORS 390.655. The department may grant a permit to take and remove sand, rock, mineral or marine growth from the area at designated locations. The department shall also issue permits to coastal cities or counties to remove or authorize removal of sand from the ocean shore, under the standards provided by ORS 390.655, if the city or county determines that the sand accumulation on the ocean shore constitutes a hazard or maintenance problem to the city or county.

(4) The terms, royalty and duration of a permit under this section are at the discretion of the department. A permit is revocable at any time in the discretion of the department without liability to the permittee.

(5) Whenever the issuance of a permit under this section will affect lands owned privately, the Department of Transportation shall withhold the issuance of such permit until such time as the permittee shall have obtained an easement, license or other written authorization from the private owner, which easement, license or other written authority must meet the approval of the department, except as to the compensation to be paid to the private owner.
[1969 c.601 §23]

390.730 [Formerly 274.090; 1969 c.601 §18; renumbered 390.668]

390.735 [1969 c.601 §25; repealed by 1973 c.642 §13]

390.740 [Formerly 274.100; renumbered 390.665]

390.750 [Formerly 274.110; 1969 c.601 §19; renumbered 390.685]

STATE OF OREGON - PERMIT APPLICATION

REMOVAL OF SAND, ROCK, MINERALS, MARINE GROWTH OR OTHER NATURAL PRODUCTS OF THE OCEAN SHORE
Department of Transportation (DOT)

1. _____
Name & Mailing Address of Applicant

2. Location of Material: Section_____Township_____Range_____W.M._____ Aerial Map Reference_____

3. _____
Description and Amount of Material to be removed

4. Purpose of Removal_____

Any permit application for the removal of sand or rock to be used for construction purposes must be accompanied by a letter from the appropriate unit of local city or county government requesting that a permit be granted and certifying that:

(a) The sand or rock is essential to meet the reasonable needs for essential construction uses in the area;
(b) The sand or rock for such construction is not otherwise obtainable at reasonable cost; and
(c) The removal of the sand or rock will not materially alter the physical characteristics of the area or adjacent area, nor lead to such subsequent changes in subsequent seasons.

5. Method of removal and equipment involved:_____

_____

6. Location of the removal site must be plainly delineated on the ground for inspection. Please give name, address, and telephone number of the person who is to be contacted to give assistance.

Name_____Address_____Phone_____

7. Month_____Year_____; Month_____Year_____
Estimated date of the starting and completion of project.

8. The following items are to be included with the permit application:
A. Copy of deeds or other documents showing ownership and legal description or easement, license or other written authorization from owner(s) of lands from which the material is to be removed.
B. Plot plan showing detailed location of proposed removal site in relation to property boundaries and beach zone line.

Note: Data on beach zone line available in the County Courthouse or 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 DOT notification review.

9. _____
Signature of Applicant Date

_____

FOR OFFICE USE

Application Received_____By:_____
Regional Park Supervisor

Comments:

APPENDIX C

Cooperative Regional
Planning Processes
developed by the
National Parks Service

"COOPERATIVE REGIONAL PLANNING

"The plans of outside agencies and interests affect and are affected by proposed actions within units of the National Park System. Cooperative planning, therefore, is needed to integrate the park into its regional environment and to ensure that potential conflicts between interdependent actions are minimized or eliminated.

"Joint agency planning may be undertaken when a park is adjoined by Indian reservations, other Federal lands, State lands, or lands subject to State, regional or local planning or regulation. Formal written agreements to establish joint planning efforts with planning agencies and other governmental agencies shall be negotiated where appropriate.

"Cooperative planning on specific proposals will be done to ensure that various points of view are considered in formulating proposals and that potential sources of conflict are discovered and, if possible, resolved. Cooperative planning normally will be accomplished utilizing periodic informal workshops in which park planners and representatives of affected interests can frankly discuss matters of mutual concern.

"SHORELINE PROCESSES

"In natural zones, shoreline processes--erosion, deposition, dune formation, inlet formation, etc.--will be allowed to take place naturally, except where control measures, required by law or Service commitment, are necessary to protect life and property in neighboring areas.

"In historic zones, control measures, if necessary, will be predicated on thorough studies taking into account the nature and velocity of the shoreline processes, the threat to the cultural resource, the significance of the cultural resources, and alternatives, including costs, for protecting the cultural resource. Such studies must also determine if and how control measures would impair resources and processes in natural zones, in order that management may make an informed decision on the course of action to be followed.

"In development zones, management should plan to phase out, systematically relocate, or provide alternative developments to facilities located in hazardous areas that cannot be reasonably protected. New developments will not be placed in areas subject to flood or wave erosion or active shoreline processes unless it can be demonstrated that they are essential to meet the park's purpose, that no alternative locations are available, and that the development will be reasonably assured of surviving during its planned lifespan without the need of shoreline control measures. Before development

in such areas is provided the requirement of Executive Order 11968, 'Floodplain Management' must be fulfilled.

"Where erosion control is required by law, or where present developments must be protected to achieve park management objectives, the Service will employ the most natural appearing and effective method feasible.

"Most shoreline areas of the National Park System are part of larger physiographic systems, and the processes of these larger systems directly affect the management of those NPS areas contained therein. Therefore, the Service shall seek to obtain the assistance of appropriate Federal, State and local agencies in carrying out the management objectives of NPS shoreline areas.

"The Service will cooperate with State and other Federal entities to develop strategies for maintaining existing transportation and utility links on barrier islands in the event of storm damage or inlet formation.

"Where these links are interrupted by inlet formation, the Service will recommend, within the limits of practicality, reestablishment in a manner that allows the unimpeded operation of inlet formation and closures.

"Where navigation channels are established in NPS waters, the Service will work with the responsible agency to see that necessary dredging is carefully controlled and that dredged material is disposed of in such a manner as to have the least adverse impact on the aquatic ecosystem and to optimize the value of spoil deposit as wildlife habitat."

U. S. National Park Service, 1978
pp. II-5, IV-22, and IV-23

Oregon's Coastal Beaches & Dunes:

Uses, Impacts

&

Management Considerations

Oregon Coastal Zone Management Association, Inc.

This report was prepared as part of a larger document addressing various beach and dune planning and management considerations and techniques. Other segments of the document and additional materials are:

I. BACKGROUND ON BEACH AND DUNE PLANNING:

Background of the Study

An Introduction to Beach and Dune Physical and Biological Processes

Beach and Dune Planning and Management on the Oregon Coast: A Summary of the State-of-the-Arts

II. BEACH AND DUNE IDENTIFICATION:

A System of Classifying and Identifying Oregon's Coastal Beaches and Dunes

III. PHYSICAL AND BIOLOGICAL CONSIDERATIONS:

Physical Processes and Geologic Hazards on the Oregon Coast

Critical Species and Habitats of Oregon's Coastal Beaches and Dunes

IV. MANAGEMENT CONSIDERATIONS:

Dune Groundwater Planning and Management Considerations for the Oregon Coast

Off-road Vehicle Planning and Management on the Oregon Coast

Sand Removal Planning and Management Considerations for the Oregon Coast

Oregon's Coastal Beaches and Dunes: Uses, Impacts and Management Considerations

Dune Stabilization and Restoration: Methods and Criteria

V. IMPLEMENTATION TECHNIQUES:

Beach and Dune Implementation Techniques: Findings-of-Fact

Beach and Dune Implementation Techniques: Site Investigation Reports

*Beach and Dune Implementation Techniques: Model Ordinances**

VI. ANNOTATED BIBLIOGRAPHY:

Beach and Dune Planning and Management: An Annotated Bibliography

VII. EDUCATIONAL MATERIALS:

Slide show: *Managing Oregon's Beaches and Dunes*

Brochure: *Planning and Managing Oregon's Coastal Beaches and Dunes*

*Prepared under separate contract between Oregon Department of Land Conservation and Development and the Bureau of Governmental Research, Eugene.

Cover design by Jay Rasmussen, Toledo, Oregon.

OREGON'S COASTAL BEACHES AND DUNES:
IMPACTS, USES AND MANAGEMENT CONSIDERATIONS

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PREFACE

The following report presents the results of an in-depth analysis of appropriate uses and potential impact of activities within beach and dune areas as conducted by the Oregon Coastal Zone Management Association, Inc. This report constitutes one element of an overall analysis of planning for, and managing, coastal beaches and dunes as required by Oregon's Beaches and Dunes Goal.

This report was prepared by Carl A. Lindberg, OCZMA Beaches and Dunes Study Team Project Director and Christianna Crook, OCZMA Beaches and Dunes Study Team Research Associate, with assistance from other Study Team members composed of Wilbur Ternyik, Project Coordinator, Arlys Bernard, Project Secretary, and Kathy Fitzpatrick, Project Administrator.

In addition, valuable review and comments were made by the Beaches and Dunes Steering Committee composed of:

R. A. Corthell, U.S. Soil Conservation Service
Steve Stevens, U.S. Army Corps of Engineers
Sam Allison, Oregon Department of Water Resources
Peter Bond and John Phillips, Oregon Department of Transportation, Parks and Recreation Division
Bob Cortright, Oregon Department of Land Conservation and Development
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Jim Stembridge, Oregon Department of Soil and Water Conservation Commission
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Rainmar Bartl, Clatsop-Tillamook Intergovernmental Council
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Oscar Granger, Lincoln County Planning Department
Curt Schneider, Clatsop County Planning Department

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I. INTRODUCTION

The determination of appropriate uses is the final planning procedure identified within the Oregon Beaches and Dunes Goal. After completing inventories of existing beach and dune types and characteristics, coastal jurisdictions are then directed to:

> "establish policies and uses for these [beach and dune] areas consistent with the provisions of this goal." (LCDC, 1977)

Furthermore:

> "Uses shall be based on the capabilities and limitations of beach and dune areas to sustain different levels of use or development, and the need to protect areas of critical environmental concern, areas having scenic, scientific, or biological importance, and significant wildlife habitat." (Ibid)

The purpose of this report is to provide extracts of information from a wide range of sources that focus both on the impact of uses in beaches and dunes and on considerations for designing such uses so as to minimize negative impacts on the beach and dune systems. However, it is important to note that when planning for beach and dune areas, attention must be given to Oregon's eighteen other statewide planning goals prior to making the ultimate determination of appropriate land uses for land parcels. In other words, after a beach and dune area is determined to be urban or rural (Goal #14-Urbanization) planned for general land use categories (Goal #3-Agricultural Lands, Goal #4-Forest Lands, Goal #5-Open Spaces, Scenic and Historic Areas, and Natural Resources, Goal #8-Recreational Needs, Goal #9-Economy of the State, Goal #10-Housing, and Goal #17-Coastal Shorelands), then other considerations (Goal #6-Air, Water and Land Resources Quality, Goal #7-Areas Subject to Natural Disasters and Hazards, Goal #11-Public Facilities and Services, Goal #12-Transportation, Goal #13-Energy Conservation, Goal #16-Estuarine Resources, and Goal #18-Beaches and Dunes) are applied to determine the necessary or appropriate levels of uses and supporting services.

Rather than portray uses which are generally appropriate for various beach and dune formations utilizing a matrix, it was felt to be more valuable to present the rationale for why various uses and activities are, or are not, appropriate for beach and dune areas. Matrices have been prepared in the past, however, to assist with appropriate location of activities within Oregon's coastal beaches and dunes, and are included in Appendix A preceded by a conversion table which correlates the various dune classification systems developed to date. Additionally the USDA Soil Conservation Service soil interpretations for active dune land, stabilized dunes and older stabilized dunes is included in Appendix B. Actual implementation of various dune

designations and associated permissible activities may be enunciated within the local comprehensive plan policies, be addressed within implementing ordinances, and/or be reviewed on an individual basis utilizing site investigation report requirements.

II. MAJOR USE OR ACTIVITY

A. Agriculture and Forestry

Agriculture and forestry practices can have direct impact(s) on sand stabilizing vegetation as well as on the quality of surface and groundwater in beach and dune areas.

Considerations:

1. Forestry

1. All logging activities should be performed in such a manner as to protect sand stabilizing vegetation (Clark, 1977, p. 377).
2. Buffer strips of natural vegetation should be required along coastal beach and dune systems and water bodies (Clark, p. 377).
3. Slash burning should not be allowed in active or surface stabilized dune areas due to the possibilities of vegetation destruction and subsequent sand activation (Ternyik, 1978).

2. Agriculture

1. Farm operations should be monitored to protect beach and dune vegetation and groundwater from damage by fertilizers, biocides, erosion, altered runoff and sedimentation (Clark, pp. 291-296).
2. The grazing of domestic animals on foredunes should be prohibited to minimize damage to stabilizing vegetation.

B. Residential Development

The demand for shorefront residential property is constantly increasing. The residential land buyer seeks only a small parcel for which many are willing to pay dearly. In the past, residential subdivisions have been approved with little regard for natural beach and dune processes. As these developments begin to fill in, and as developmental pressures increase, the impact on beaches and dunes accelerates producing potentially deliterious results (Olsen and Grant, 1972, p. 39).

Considerations:

1. Residential development should be prohibited from locating in foredunes because they are subject to wave overtopping and/or undercutting.
2. Residential development should be discouraged from locating in deflation plains because (1) they are commonly subject to flooding, and (2) they have naturally high water tables.
3. Residential density should be based on the carrying capacity of the site and adjoining area, and should take into consideration the aesthetic qualities of the site. The carrying capacity would be a function of the physical and biological characteristics of the landform as addressed in a site investigation report or as identified during the inventory process.
4. Residential development should ensure access to beach areas. Public rights-of-way should be designed at frequent intervals and should be posted (Clark, p. 270; Olsen and Grant, p. 39).
5. Residential development proposed for flood prone areas must comply with the federal flood insurance program if the jurisdiction is a participating entity. Non-participating jurisdictions should have authority to regulate housing within flood prone areas to minimize structural damage and water pollution problems.
6. In areas of known geologic hazard, special constraints such as set-backs, etc., should be developed to minimize unnecessary protection programs. Where beachfront protection measures cannot be avoided, beach protection programs for existing waterfront development should be incorporated into a comprehensive, coordinated plan and not left up to individual waterfront residents (Battelle, 1971, p. I-35; Clark, p. 477).
7. Because the Oregon Department of Transportation, Parks and Recreation Branch, has jurisdiction over beachfront protection only in areas west of the beach zone, local jurisdictions may wish to enact provisions giving them authority to regulate beachfront protection structures outside DOT's purvue. Additionally, jurisdictions should coordinate closely with DOT on permit issuance for beachfront protection structures to ensure compatibility with adjacent areas.
8. Jurisdictions should consider designating areas for cluster developments designed so as to maximize open space in sensitive beach and dune areas (Battelle, p. I-34 and I-36).

C. Commercial Development

Commercial development along the Oregon coast provides general retail/wholesale services to developed areas and often is associated with tourist-related development. Such development can become a problem when it reaches concentrations that preclude other necessary and desired uses that seek or require an oceanfront location within a beach and dune area or when it is located in hazardous areas (Olsen and Grant, p. 40).

Considerations:

1. Commercial uses of beach and dune areas which do not require or are not substantially enhanced by an oceanfront location should be discouraged (Olsen and Grant, p. 40).
2. Land use controls should place limitations and standards on oceanfront commercial development consistent with the Shorelands Goal.
3. Commercial development should be prohibited from locating in foredunes because they are subject to wave overtopping and/or undercutting.
4. Commercial development should be discouraged from locating in deflation plains because (1) they are commonly subject to flooding, and (2) they have naturally high water tables.
5. Attention should be given to the various impacts of locating commercial development within dune areas. Such impacts include: aesthetic, pedestrian, parking lots and roads, etc. Additionally, plans should address dune stabilization and maintenance.

D. Industrial Development

For the most part, industrial development along the Oregon coast is related to agriculture, fisheries and timber. Most of these industries are located in conjunction with operating ports and transform raw materials into semi-finished materials.

Considerations:

1. Water-dependent industry should be located within or adjacent to areas presently occupied and committed to industrial use wherever possible (Clark, p. 392). Such areas should include room for expansion of industrial facilities.
2. A site investigation report should address potential impact(s) in ecologically sensitive areas. Likewise, the site investigation report should consider possible impact(s) on dune landforms such as (1) reactivation, (2) pollution of groundwater from chemical and industrial effluent (sand is a poor filtering agent for such compounds), and (3) groundwater withdrawal if appropriate. Additionally, development plans should address dune stabilization and maintenance.

E. Recreational Activities

Recreation is a necessary and valuable use of the beach and dune areas of the Oregon coast. Recreational pressures on the coast have doubled in the last decade; tourism has become the number three industry in the State. The State's coastal park and wayside day user count for 1978 exceeded twelve million people. The coastal jurisdictions containing these recreational attractions face continuing demands on the limited natural resources.

Considerations:

1. Recreational use in surface stable, conditionally stable or active prone dunes should be limited if it is the desire to maintain stable landforms. Access to beaches and dunes which traverse sensitive areas should be provided via raised boardwalks. Paved trails and parking lots are not suitable for unconsolidated sand areas as they are susceptible to inundation and undermining due to deposition and erosion activities. Access areas should be posted with explanations describing the importance of limited access routes.
2. Jurisdictions may wish to consider regulation of driftwood fires adjacent to beach grass areas to avoid destruction of beach grass resulting in reactivation of unconsolidated sands and possible erosion of sand in areas of human habitation.
3. Federal, state and local jurisdictions should cooperate to develop efficient traffic flow patterns, parking arrangements and policing requirements for areas on and adjacent to beach and dune areas, especially parks and access areas (Olsen and Grant, p. 40). This is especially important in areas of off-road vehicle use.
4. Multiple use of an area by clustered compatible recreational facilities should be encouraged to permit joint use of ancillary facilities and provide a wide range of recreational choice among users. Such clusters should not overload the carrying capacity of the area (Battelle, p. I-3).

F. Sand and Driftwood Removal

Indiscriminate removal of sand (for mining or mineral extraction) or driftwood from the beach and dune area can disrupt the natural system and initiate or accelerate erosion. Removal of driftwood diminishes the amount available for incorporation in, and frontal protection of, the foredune resulting in increased vulnerability of the foredune to erosion.

Considerations:

1. Tourists and residents should be informed of the protective qualities of driftwood in foredune stabilization. This could be accomplished through the posting of information signs (Phipps and Smith, 1977, p. 44). Additionally, citizens and jurisdictions should be aware of the Oregon Department of Transportation's Beach Log Removal Policy (Appendix C) which regulates removal of driftwood for commercial endeavors. Through the state's coordination program between local governments and state agencies as required by the Land Conservation and Development Commission, jurisdictions should participate as appropriate in reviewing such permit requests.
2. When sand removal activities are proposed, the accompanying site investigation report should address the following potential impacts (Lindberg, 1979):

a. sand flow patterns
b. sand formed lakes
c. groundwater supplies
d. aesthetics
e. wildlife habitats
f. adjacent property and associated structures.

3. Development plans should address site reclamation, dune stabilization, and maintenance. While the Department of Transportation, Division of State Lands and Department of Geology and Mineral Industries all bear some responsibility for sand removal activities, their mandates are limited. Therefore, jurisdictions may be well-advised to develop techniques allowing them the opportunity to regulate sand removal activites falling outside the scope of legislative mandate. Further, jurisdictions should consider coordination with the appropriate state agencies in the review of sand removal activities affecting their locale.
4. Jurisdictions should endeavor to ensure the safety of residents and workers in areas of sand removal by requiring the maintenance of moderate slope within excavation sites.

G. Fish and Wildlife

There are many areas of significant wildlife habitat in beach and dune areas. Although the stabilized dune forests contain the greatest species diversity, deflation plains and wet interdune areas provide unique habitat values (Burley, 1978; Pinto, et al., 1972).

Considerations:

1. The beach and dune nesting and breeding habitats should be protected during identified breeding and nesting seasons by temporary restriction of access wherever possible (Clark, p. 34; The Conservation Foundation, 1977, p. 111). (For example, pedestrian and vehicular traffic should be limited during the nesting season of the snowy plover [April - June] in appropriate beach areas.)
2. Site investigation reports should be required for developments proposed near identified critical habitats to assist in evaluating development impact and in modifying design criteria as appropriate.
3. Attention should be given to the enhancement and/or restoration of fish and wildlife habitats, particularly with regard to deflation plain areas (e.g., seeding to provide improved food and habitat for migrating and resident waterfowl).

III. ACCESSORY USES OR ACTIVITIES

A. Transportation

Transportation includes roadways (vehicular and rail), pedestrian and equestrian paths and accesses. Such traffic can disrupt the dune vegetation resulting in activation of unconsolidated sands and erosion. Additional problems associated with transportation include trespass, litter and vandalism.

Considerations:

1. In areas of unconsolidated sand, foot traffic should be serviced by wood walkways, preferably elevated (Clark, p. 270; Koppelman, 1978, p. 98). Vehicular traffic should be serviced by wood or paved roads and protected by vegetation (Clark, p. 270).
2. The use of common access pathways over dune areas by shorefront property owners should be encouraged.
3. Control the number of vehicle access points to beach areas and select access points which can maintain the natural form and profile of the beach and dune so impacted (Ruef, 1975, pp. 20-21).
4. Identify existing public access points to the beach and post these routes with explanations as to why such paths are necessary (Olsen and Grant, p. 29).
5. Provide adequte parking, disposal and sanitary facilities at heavily used access points (Olsen and Grant, p. 29).
6. Establish clear responsibility for beach litter removal and vandalism repair (Office of Coastal Zone Management, NOAA, and Department of Natural Resources, Commonwealth of Puerto Rico, 1978, pp. 88-89). Provide litter and vandalism reduction methods including (Office of Coastal Zone Management, NOAA, and Department of Natural Resources, Commonwealth of Puerto Rico, pp. 88-89; Olsen and Grant, p. 29):
    a. persuasion: there should be a continuing public education campaign.
    b. assistance: trash containers should be placed at beach access points, convenient to the public; arrangements for emptying should be made.
    c. enforcement: anti-litter and anti-vandalism laws should be enacted and strictly enforced by cooperation between appropriate local, state and federal agencies.
7. Roadways should not impinge on floodplain areas except under strict environmental constraints, such as elevated causeways to allow for movement of flood waters.
8. Roadway design should not require inordinate amounts of landfill. The natural water flow should be maintained through the use of culverts and bridges.
9. Roadways should be planned and located so as to avoid encroachment by dunes.

B. Beachfront Protection and Management

It is a natural process for sand to erode from dune and sea cliff areas. Such erosion acts to replenish beaches which are the first line of defense from storm wave attack. Consequently, protecting dunes and cliffs from erosion in one area will necessarily result in beach starvation and associated erosion problems in another. The problems and impacts of beachfront protection strategies are well explained in the Oregon Soil and Water Conservation Commission's two volume work, "Oregon Coastal Management Program: Shoreline Erosion Management Policies and Procedures," (1978). Additional information on beachfront protective devices and their impacts can be obtained from the Oregon Department of Transportation and the U.S. Army Corps of Engineers, both of which maintain regulatory authority for placement and design of such activities under certain conditions (Appendix D).

Considerations:

1. Federal, state and local agencies with shoreline construction permit and review powers should consider removal or modification of protective structures when such structures are not performing their intended functions (Koppelman, p. 103).
2. Design coastal erosion protection plans so as to allow, to the maximum extent possible, the continuation of natural geomorphic processes responsible for the maintenance of coastal landforms. It should be recognized, however, that such plans for culturally manipulated and developed shorelines may result in an adjustment of the natural processes (Koppelman, p. 96). Such coastal erosion protection plans should be developed on the basis of shoreline type, use and extent of cultural development.
3. Emphasis should be directed toward non-structural solutions to erosion control problems; structural solutions should be advanced only as supplements to a non-structural program and where there is no other alternative (Clark, p. 322; Koppelman, p. 97).
4. Jurisdictions may want to enact provisions giving them review authority for beachfront protection activities outside the purvue of the Oregon Department of Transportation and/or the U.S. Army Corps of Engineers. In some instances, jurisdictions may want to adopt certain minimum standards for beachfront protection, similar to those of ODOT and the Corps, or may wish to require certification of protection activities from a registered engineer at the developer's expense.

C. Groundwater, Sewage Disposal and Other Utilities

For the most part, human development activities require a range of support activities generally labelled as utilities. These utilities include such services as public water and sewer, telephone, electricity, natural gas and cable television. In some areas, water and/or sewage disposal is handled on site.

The placement of utility lines either above or under ground can accelerate erosion at the site if stabilizing vegetation is not properly replaced. Furthermore, temporary stabilization practices should be used during construction. Buried lines are vulnerable to wind or wave excavation at any time in the future should stabilizing vegetation be destroyed or not maintained. Other development problems, such as flooding, flotation and failure of subsurface structures, can be encountered in areas of high water tables (Crook, 1979). Some quicksand areas occasionally occur in high water table areas resulting from subsurface hydrostatic pressure and the precipitation of sand into ponded sites. The construction of underground utility lines parallel to the beach may harrass or eliminate wildlife species and habitats. Construction activites in general can harrass snowy plover if conducted during periods of nesting (April - June). Harrassment of deflation plain wildlife will also result from construction adjacent to foredunes, within the deflation plain, or in adjacent hummock dune areas. Finally, utility lines located above ground are not compatible with the natural landscape and can be detrimental to the enjoyment of the scenic values characteristic of beach and dune areas.

On site water and sewage disposal require additional consideration. High density development dependent on local wells could deplete the groundwater table and damage or kill surface stabilizing vegetation; saltwater intrusion may destroy stabilizing vegetation as well as contaminate the water supply (Ruef, p. 19). Domestic wastes in sufficient volumes can lead to eutrophication of dune lakes and marshes and may contaminate the limited groundwater supply including wells. Dune sand manifests some serious limitations as a medium for septic tank drainfields. While bacteria are adequately filtered by sand, viruses, non-natural chemical compounds, and nitrate nitrogens may not be adequately dealt with. Subsurface facilities should avoid areas of high water table. Flooding, flotation, uneven settlement, and rupture of structures is likely to occur. Further, the potential for septic tank failure is extremely high at such sites.

Considerations:

1. Utilities
   a. All utilities should be located under ground wherever possible.
   b. Utility easements should be permitted and timed to coordinate with site preparation and construction.
   c. Areas of quicksand and high groundwater tables should be avoided.

2. Water Supplies
   a. Piped water should be provided whenever possible (Clark, p. 268).
   b. When permitting private wells, the water table level necessary to sustain the stabilizing vegetation and prevent saltwater intrusion should be determined and water withdrawals limited accordingly. Controls on groundwater withdrawal should be addressed in a comprehensive water management program where appropriate (Battelle, p. I-16; Brower, et al., 1976, p. 37; Beaulieu & Hughes, 1975, p. 58; Clark, pp. 269 & 384; Ruef, p. 21; Schlicker, et al., 1974, p. 87).
3. Sewage Disposal
   a. A municipal sewer service should be used whenever possible.
   b. Sewer lines should not be located so as to be vulnerable to storm wave action.
   c. Residential density should be contolled when sewer service is not provided (Clark, p. 269).
   d. Septic tank systems should be located and maintained so as to avoid water pollution (Ruef, p. 21; Clark, p. 502).
   e. Septic tank systems should be installed only when the highest annual groundwater level is at least six feet below the absorption field. (Refer to Oregon Department of Environmental Quality subsurface sewage disposal systems for further information.)

D. Site Preparation and Construction

Man-made changes to a site are considered under this broad topical category to be one of three activities:

(1) Activities related to studying, analyzing and siting the development prior to development. Such activities include exploration, investigation, surveying and site planning. For the most part these activities are accomplished on foot with a minimum impact on the site.
(2) Activities relating to preparing the site for development such as clearing, grading, excavating and filling. These activities can affect the entire site and beyond, and generally are accomplished with the use of heavy, earth moving machinery.
(3) Activities relating to the actual construction that most developments have in common, such as stock piling of construction materials, traffic of construction personnel and equipment, and the construction of foundation and vehicle access and parking.

The construction of any development typically requires that the natural setting be modified in preparing the site. When preparing a site on a sand landform the actions involved often destroy the stabilizing vegetative cover exposing the underlying sand to the forces of erosion.

This erosion weakens the structure of the sand landform and decreases its value as a sand reservoir and buffer (Olsen and Grant, p. 31). Examples of specific actions and impacts are:

(1) The lowering of foredune increases the washover potential, salt spray kill-off and wind erosion;
(2) The disruption of dune vegetation can result in destabilization and blow-outs.
(3) The construction on certain foundations in this windblown environment may cause erosion/accretion activities similar to those of jetties by having sand accumulate on the lee side and eroded on the windward side. Certain alignment of structures may also alter wind flows causing similar erosion/accretion activities in the immediate vicinity.

The exact design of a development should be consistent with the features and limitations of a particular site. Additional information on elevated residential structures is available in "Elevated Residential Structures," (U.S.D.H.U.D., Federal Insurance Administration, 1977).

Considerations:

1. The potential impacts of erosion and accretion should be considered within the framework of the site plan (Koppelman, p. 105).
2. Developers should be required to obtain the advice of a qualified sand expert concerning minimizing the impact of the proposed development by the use of erosion control measures, such as stabilization and improved site designs (Koppelman, p. 71).
3. Schedule construction phases to avoid critical periods of hazard (storm season), important biological activity (snowy plover nesting season) and other impacts (excavation during planting season) (Clark, p. 268; Ruef, p. 20; Ternyik, 1978).
4. Restrict construction to areas inland of the foredune; where construction is permitted or exists in the foredune area, require planting and concomitant maintenance of open sand areas (Clark, p. 268; Schlicker, et al., 1973, p. 132; Ternyik, 1978).
5. Provide technical assistance and convenient information on sources of beach grass and other stabilizing measures to property owners (Clark, p. 268; Olsen and Grant, p. 31; Ternyik, 1978).
6. Require additional stabilization around existing and proposed development when needed to avoid hazard (Clark, p. 268; Olsen and Grant, p. 31).
7. Encourage secondary plantings in areas where beach grass has been used for initial stabilization to reduce fire hazards and subsequent erosion potential.
8. Review the cumulative impact of the linear arrangement of structures along the shoreline. Such alignments could lead to large scale variations in the local dynamics of ground level airflow that could likely have negative erosive effects on adjacent areas (Ruef, p. 20).

9. Exercise strict controls on erosion during site preparation and construction (Clark, p. 534). Buffer strips of natural vegetation and artificial temporary stabilization retention systems should be used to control erosion (Clark, p. 535). Ground surfaces should be stabilized immediately after any action that destroys or removes the vegetative cover and leaves the underlying unconsolidated sands exposed to erosion (Clark, p. 537; Ruef, p. 20).
10. Buildings should be built on inactive dunes, and then only if sand movement patterns and vegetation are not seriously affected. Disturbance to the surface should be minimized and stabilizing vegetation should be established and maintained (The Conservation Foundation, pp. 95 and 109).
11. The filling or draining of wetland areas in deflation plains should be restricted due to loss of wildlife habitat, water problems, and associated construction problems. If deflation plains are drained, it is likely that wetland vegetation will no longer be able to survive, and erosion potential will be increased due to wind scouring of the area.
12. Restrict development on beaches, foredunes and deflation plains. Establish building setbacks based on topographic, geologic, and meteorologic characteristics. Setbacks should be entirely landward of the shifting foredunes. They should also be far enough inland to allow for the recession of the shoreline. Development in areas of eroding shorelines should be set back to allow for safe occupancy of the structure during its estimated life. Setback requirements should not be relaxed without a favorable site investigation report in those instances where new structures are proposed at sites along a partially developed shoreline. Existing structures located seaward of the setback line should be designated as non-conforming and criteria and regulations should be developed to limit reconstruction, and/or expansion when the structure is damaged or destroyed.
13. The adverse impacts of sand erosion and accretion can be minimized by restricting developments and topographical alterations in areas of high wave and wind energy. Site investigation reports in beach and dune areas should include consideration of:

    (1) the potential for wind and wave erosion and deposition;
    (2) foundation specifications; and,
    (3) sewage disposal.

Prospective developers and buyers should be informed of the hazard potential; a disclosure of all known hazards and likelihood of obtaining building permits should be made available to all potential purchasers of land within foredune and deflation plain areas (Beaulieu, and Hughes, 1975, p. 109; Koppelman, p. 98; Olsen and Grant, p. 31; Schlicker, et al., 1972, pp. 128-130; Schlicker, et al., 1973, p. 132; Schlicker, et al, 1974, p. 53).

14. In areas of older dunes containing iron or clay banding and/or buried soils, ponding, high water table, septic tank failures, and slumping are common problems which must be addressed and dealt with.

E. Stabilization and Restoration

Restoration and stabilization programs may be desired to:

(1) stabilize a site prior to, during, or following construction;
(2) to repair storm damage in foredune and deflation plain areas;
(3) to enhance and maintain an area undergoing constant impact such as a park or an area that was developed some time ago without regard for the need to maintain control over moving sands.

Considerations:

1. Stabilization activities within active sand areas to accommodate construction should always be encouraged if the construction activity is within the limitations of the local comprehensive plan. However, it should be noted that attempts to build dunes to unnatural heights or in unnatural configurations can be counter-productive as such features may interfere with, rather than facilitate, natural processes (The Conservation Foundation, p. 97).
2. Stabilization should be performed within accepted planting seasons, utilizing accepted planting procedures and followed by an accepted maintenance schedule (Ternyik, 1979). Again, the adequacy of stabilization proposals should be evaluated within the site investigation report.

F. Aesthetics and Design

The greatest attraction of the beach and dune areas is its natural scenic beauty. Therefore a real concern is the impacts of developments on this basic attraction (Ruef, p. 21). "High-rise buildings built adjacent to a beach were found to be physchologically dominating thus detracting from the beach's appeal as a natural recreation site. A subjective element to determine when buildings dominate beaches by their height was found. Because of an individual's normal cone of vision, a building set back 2.5 times its height would not appear to confine or dominate the beach." (Office of Coastal Zone Management, NOAA, and Department of Natural Resources, Commonwealth of Puerto Rico, 1978, p. 83).

Considerations:

1. Setback: The greater the setback for development from beach and dune features (beach, foredune, bluff crest, etc.) the less is the likelihood of adverse aesthetic impact upon all shore users.
2. Height: Generally, the higher the structure (especially ones of rigid geometry), the more prominent and obtrusive it will appear. The most compatible structures would be those of one to two stories in height depending on topography.
3. Spacing: The more uneven and irregular the spacing of dwellings along the shoreline, the greater the degree of harmony with the natural setting. The clustering of dwellings surrounded by open natural areas is suggested.
4. Roof types: Roofs having ridges and slopes best mirror and harmonize with the undulating topography of the coast.
5. Exterior materials and colors: Depending on site conditions and the urban/rural context, exteriors and colors keeping with those associated with or found naturally along the coast are preferable.
6. Site landscape: Natural or re-constructed (following excavation, construction, etc.) dunes can effectively mask low and medium profile structures as well as enhance the natural setting. Site layout of buildings within given property boundaries may be varied to permit the preservation of fragile beach and dune features. Site conditions should be carefully studied to determine optimum plan alternatives. Shore vegetation should be retained for aesthetic, as well as ecological values, and for landform stability (Battelle, pp. I-17 and I-48 to I-53).

G. Off-road Vehicles

All recreational uses of the beach and dune areas can have impacts, but off-road vehicle (ORV) users have a far greater impact than their pedestrian counterparts. The ORV impacts are greater because:

(1) ORVs are of greater weight and power,
(2) the area of impact is multiplied due to the speed and range of the ORV, and
(3) the noise of the ORV's engine expands the real and perceived impact beyond the range of its physical presence.

ORV's have been observed to have the following impacts on beach and dune landforms and ecosystems:

(1) Alteration of the topography of affected dunes by increasing the down slope sand transport.

(2) Loss of stabilizing vegetation due to ORV activity, which in turn leads to increased wind erosion and sand migration. Few vehicle passes are required to begin destroying beach grasses and other plant species. Once removed, other ORV users feel the open area is a "legitimate" trail, and vegetation removal progresses. The loss of stabilizing vegetation is especially critical on the foredune because such activities can leave the foredune susceptible to winter storm wind and wave damage and erosion.
(3) During dry periods on the dunes the fire hazard in beach grass areas is extremely high and the added risk of fires from ORV emission sparks constitutes a likely ignition source (Ternyik, 1978).
(4) Excessive stress may be placed on local wildlife, livestock and residential inhabitants by unruly ORV use (Burley, 1978; Fowler, 1978, pp. 20-22).

Generally speaking, ORV traffic has the least environmental impact when it is restricted to the summer berm and intertidal zone of the beach or to existing open sand areas. ORV traffic also creates problems when it becomes so intense as to interfere with other users. ORV use can be used as a management tool where a stabilized area is planned for re-activation, or active sand landforms are the management objective. The use of ORVs can be a relatively inexpensive and harmless way of removing vegetation, and will negate the need for herbicides and/or other costly mechanical means (Olsen and Grant, p. 28).

Considerations:

1. Work with the ORV recreationalist to select ORV sites and management programs (Fowler, p. 71).
2. The access corridors to ORV areas should be controllable. The capacity to control access is important to:

    (1) limit the density of the users to the carrying capacity of the site for reasons of safety, public health, resource damage, and law enforcement;
    (2) obtain accurate user counts; and,
    (3) facilitate distribution of important information for users (Fowler, pp. 22-27; Koppelman, p. 107; Olsen and Grant, p. 28; Phipps and Smith, p. 42).

3. ORV areas should be chosen with the ability to be delineated by natural or man-made boundaries that are easily recognized and controlled (Fowler, pp. 22-27).
4. ORV activities adjacent to estuaries should be carefully montiored and controlled because such activities can result in deposition of sand into estuaries, and can conflict with habitat values (noise and harrassment). Additionally, ORV activity within estuarine areas should be consistent with the Estuarine Resources Goal and the LCDC Estuarine Classification system.

5. ORV areas, trails and beach access routes should be monitored. If a site exhibits harmful deterioration, the trail or access should be relocated and consideration given to relocation of the activity (Fowler, p. 33; Koppelman, p. 108).
6. During periods of extreme high tide, discourage ORV use of beach areas to prevent ORVs from driving up on the foredune resulting in possible reactivation of stabilized foredune areas (Koppelman, p. 108).
7. Identify nesting areas of birds considered as being a critical resource. Traffic near such areas during breeding and nesting seasons should be discouraged. Warning signs could be posted at least 300 feet from the outer perimeters of such areas (Burley, 1978; Fowler, pp. 20-22; Koppelman, pp. 108-109).
8. Consideration should be given to requiring registration of ORVs, or requiring ORV permits for ORV use within beach and dune areas. This should include fees to be used for beach and dune restoration projects, enforcement costs, and an educational program for ORV users as to their responsibilities toward the sensitivities of the beach and dune environment and other beach and dune users (Fowler, p. 72; Olsen and Grant, p. 28).

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APPENDIX A

Matrices of Uses For Oregon's
Coastal Beaches and Dunes

BEACH AND DUNE CLASSIFICATION CONVERSION TABLE

Currently there are three major beach and dune classification systems developed for the Oregon coast. The first classification was produced in 1972 by the Pacific Northwest Region of the U.S. Forest Service. This document was a resource inventory of the Oregon Dunes National Recreation Area and included both a system (called mapping units) of thirty eight classifications and a detailed set of management considerations.

The second system, published in March of 1975 by the U.S. Soil Conservation Service for the Oregon Coastal Conservation and Development Commission, contained thirteen classifications along with two matrix tables demonstrating compatibility and tolerance for managing the use of beaches and dunes.

The third classification system is a product of the Beaches and Dunes Study commissioned by the Oregon Land Conservation and Development Commission and conducted by the Oregon Coastal Zone Management Association in 1979. The system was developed to meet the requirements of the Beaches and Dunes Goal (Goal #18) and local planning needs.

In addition to the aforementioned classification systems, the U.S. Army Corps of Engineers developed a matrix for recreational uses on beaches and dunes of the Pacific Northwest in 1974.

In order to assist local decision-makers, planners and citizens in utilizing the management information generated to date, a classification conversion table is presented in Table 1. Following the conversion table are copies of the three matrices developed to date:

NRA (U.S. Forest Service) .... page 24

Soil Conservation Service ..... page 58

U.S. Corps of Engineers ..... page 61

Table 1. Beach and Dune Classification Conversion Table

OCZMA System	LCDC Dune Form Goal Designations	NRA Classification Symbols	SCS Classification Symbols
Beach	Beach	Beach	B
Foredune	Active/recently stabilized	FD	FD, FDA
Interdune Forms			
Deflation Plain	Interdune Forms	"D" Series	WDP
Occasionally Wet Interdune	Interdune Forms	"D" Series	W
Vegetated Interior Dunes			
Hummock	Active/recently stabilized	"H" Series	H
Surface Stabilized	Recently stabilized	"DS" Series	DS
Older Stable Dune	Older Stabilized	"DS" Series	ODS
Parallel Ridge	Recently Stabilized	HWS	IFD
Open Sand Interior Dunes			
Transverse-ridge	Active	"T" Series	OS
Oblique-ridge	Active	OA	OS
Recently reactivated:			
Blow Out	Active	--	--
Parabola	Active	PA	OS

Discussion of Mapping Units Which Include Geomorphic Feature, Plant Community, Wildlife, and Visual Resource Descriptions and Interpretations*

A. Introduction

In this section, a description of each mapping unit with its geomorphic features and physical characteristics, associated plant community(ies), wildlife species, and visual resources can be found. Factors important to management of these units of land are also listed. Following this narrative description are photographs of typical sites, and tables of interpretation for each mapping unit. Each table of interpretation lists the different facilities or activities (i.e., road construction, horse cross-country travel, etc.) which might occur on the unit. The major considerations or limitations that the geomorphic feature, plant community, wildlife or visual resource has upon the facility, use, or activity is briefly listed. To aid the planning team, some possible alternatives or treatments are given to overcome these limitations or considerations. These are a guide or sampling of some alternatives which could be considered and are not intended to be absolute or the only alternatives or treatments! Possible negative results from the specific alternatives or treatments are also given where applicable.

Delineations which encompassed similar geomorphic features, (landforms of similar development or erosional processes), plant communities and the related wildlife habitats were made on aerial photographs. In some cases, a mapping unit has an exclusive plant community; in others the mapping unit has two or more plant communities; or in some instances, a specific plant community grows on different mapping units. Wildlife species are more closely related to the plant communities to the geomorphic features. The delineated areas were coded and briefly described as to their physical characteristics. These, then, served as a basis, or point of reference, for all resource data collection and interpretations. Interpretations important to the management and recreational development of the area were based on an understanding of the processes and interrelationship of the sand supply, shoreline and dune topography, climatic regime, permanent and seasonal water table, vegetation, and wildlife.

In the process of making interpretations, a variety of man-caused activities, facilities or uses were observed, cause and effect relationships were established, and the interpretation and/or predictions of man's activities were then made. Three rating systems for each expected activity, facility, or use, such as road construction or campground developments, were then developed through the observations, interpretations and knowledge of each of the specialists involved.

The physical suitability ratings are based on the physical ability of the geomorphic feature and plant community to absorb the impact of a specific activity, use, or facility. The tolerance ratings are based on the ability of the wildlife or visual resource to withstand the impact of a specific facility and/or man's influence.

*From Pinto, et al., 1972.

These ratings range from 1 (most suitable or most tolerant) to 5 (least suitable or least tolerant).

B. Activity, Facility or Use Elements, Column 1:

1. Road Construction: This is a consideration of the effect of a road upon the land. A double-lane width, hard-surfaced road, resting on a minimal ballast import (5") and/or minimal culvert spacing and designed on less than 4 percent gradient was considered as a standard.

   "Turnpiking" was not considered as basic design but is recognized later as an "alternative or treatment" since it represents added road construction and design costs.

2. Parking Lots: This facility is defined as having paved spaces for no more than 50 cars. In addition to the effect which the parking lot has on the land, the reverse was also considered. Wind direction, deposition, submergence, erosion, etc., were factors that were recognized.

   Parking lots increase people concentrations on adjacent areas. This is reflected by the Human Occupancy - Day Use Activity. Both must be considered when determining the effect of a parking lot.

3. Drainfields: Specifications for drainfields established by county, State and Federal regulations served as the basis for this facility evaluation. Water tables, bedrock and/or impervious layers in excess of 8 feet below the surface were considered as suitable conditions. The contamination hazard of the ground water reservoir or estuary was also considered. It should be emphasized that this facility requires intensive onsite investigations beyond the scope of this inventory.

4. Campgrounds: This facility is defined as an overnite recreation development, exclusive of sanitation features or buildings. Natural vegetation protection and maintenance were also recognized where they applied. Plantings were considered as an "alternative or treatment." The measure of man's influence becomes the impact created by 15 people per acre during a time period of 4 hours or more.

5. Human Occupancy - Day Use: This considers concentrated day use activities and their impact on the land, waters and related resources. The measure of man's influence becomes the impact created by 50 or more people/acre during active period of 1 to 4 hours.

6. Human Occupancy - Pedestrian Access: The impact of pedestrian access, from one point to another, including cross-country and/or trail traffic, and dispersed activity was considered here. The measure becomes the impact created by 5 people per acre during the time period of 1 to 5 hours.

7. Cross-country Travel - Horses: This is defined as saddle horse movement from one point to another. "Trailing" can be expected in the densely vegetated and steeper portions of the area, while dispersion can be expected in the open sand and possibly the deflation plain areas. Where "trailing" was expected, notations were made on each geomorphic-plant community type.

8. Cross-country Travel - Vehicles: It is defined as vehicle movement (particularly Dune Buggies) from one point to another. The tendency for trailing was recognized. The establishment of trails through sensitive or densely vegetated areas was considered only as an alternative or treatment.

9. Buildings, Continuous Foundation: These are defined as being one-story, wood frame structures secured to a concrete or similar foundation.

10. Buildings, Pole Foundation: These are defined as being similar to above except secured to poles or stilts.

11. Powerline Tower Installations: This facility considered the clearing swath necessary (60-80' width), erosional status, service road, and the foundation capabilities of the soil mantle.

12. Buried Pipeline Installations: This facility considered all subsurface utility installations including water, electricity (up to 38,000 volts) and sewage. Water table levels, salt water erosion, clearing swaths (60-80' width) erosional status of the soil mantle and service road were considered.

13. Vegetative Stabilization: This facility was considered as an area suitable for "dune grass" plantations, which includes the European beachgrass, scotch broom and shorepine species.

C. Considerations and Limitations, Column 2: This column includes brief statements of the naturally occurring conditions which act as limitations to the specific activities, facilities, or uses. Recreational opportunities, such as viewing wildlife, where applicable, are also listed.

Some of the conditions mentioned are severe limitations or constraints, while others can be overcome by increased construction costs, engineering expertise, or maintenance, etc. The rating value in Column 3, provides an overall evaluation of the degree of severity of the conditions listed based on the physical resource. The rating values in columns 4 and 5 indicate the degree of severity of the conditions listed based on the wildlife or visual resource.

D. Physical Suitability Ratings, Column 3:

All physical suitability ratings were based on a projected 10-year period, including expected visitor use, average climatic events, and the usual level of man-caused impact to the soil and native plant resources

within the limits of reasonable use. All ratings were based on the physical resource considerations, only.

Most Suitable . . . . . Least Suitable

1 5

At the "most" suitable end of the range, it was felt that no severe or irreversible resource damage would occur as the result of a specific activity.

At the "least" suitable end of the scale:

1. Additional or sophisticated treatment measures would need to be employed to protect the site or prevent excessive damage to the resource, or

2. The site is too sensitive to survive without incurring irreversible damage, or

3. Damages to the improvement or facility could be expected.

The "least suitable" rating is not meant to be construed as "impossible" but only serves as the means to "red-flag" certain activities.

E. Wildlife Tolerance Ratings, Column 4:

The tolerance rating for wildlife indicates the impacts a proposed facility(ies) and/or activity(ies) would have on the wildlife species utilizing a habitat. The tolerance rating was assigned to the habitat type (the unit with which the land manager works). The tolerance ratings range from 1 (no significant effect on wildlife anticipated) to 5 (a significant detrimental effect on wildlife).

The following major considerations were used to develop the tolerance ratings:

1. The nature, magnitude and trends in present and anticipated recreational use of the Oregon Coast and N.R.A. A 5-percent average annual rate of increase (probably a minimal estimate) in recreational use of the N.R.A. was anticipated during the next 10 years.

2. The acreage, shape, and location of habitat types.

3. The life histories and behavior of wildlife species utilizing the habitats, especially endangered, rare and unique species. Tolerance ratings of 5 and 4 emphasize the need to (1) avoid the development of recreational facilities in all or certain portions of these habitats, (2) limit the type and magnitude of recreational use these habitats receive, and (3) develop sophisticated treatments and procedures when it becomes absolutely necessary to develop portions of these habitat types (work closely with wildlife biologist on a case-by-case basis).

F. Visual Tolerance Ratings, Column 5:

The tolerance ratings for the visual resource indicates the anticipated impact of proposed facilities or activities on the characteristic landscape. The entire N.R.A. is used as a base of reference. The impacts the proposed facility or activity would have on the dominant factors (form, line, texture, color and in some cases, motion) were considered. The degree of visual harmony a facility or activity has with the dominant features of the characteristic landscape is rated on a scale of 1 (generally compatible with the characteristic landscape) to 5 (starkly incongruous with the dominant features of the characteristic landscape).

G. Some Alternatives or Treatments, Column 6:

Listed here, as a guide, are some possible alternatives or treatments that correspond to the limitations and considerations listed in Column 2.

H. Possible Negative Results, Column 7:

These are the expected negative results of the alternatives or treatments listed in Column 6. Where the results are unknown, a question mark is used. In those cases where no particular negative results are expected, a dashed line is used.

MAPPING UNIT LEGEND

Map Symbol	Description
FD	Foredune
HWS	Hummocks, Occ. Wet, Stabilized
HW	Hummocks, Occ. Wet
HA	Hummocks, Dry
DG	Deflation Plain; grasses, rushes and sedges
DGL	Deflation Plain; low shrubs
DT	Deflation Plain; tall shrub thicket
DST	Deflation Plain; shorepine forest
TW	Transverse Ridge, Occ. Wet
TDA	Transverse Ridge, Dry
OA	Oblique Ridge System
PA	Parabola, Active
DS/TF	Stabilized Dune Surface; transition forest
DS/TFO	Stabilized Dune Surface; transition forest, old-growth
DS/TFC	Stabilized Dune Surface; transition forest, clearcut, 2-12 years
DS/TFS	Stabilized Dune Surface; transition forest, second-growth, 12-50 yrs.
DS/SFR	Stabilized Dune Surface; shorepine forest of stabilized dunes
DSA/TF	Stabilized Dune Surface, Eroding; transition forest
DSA/TFS	Stabilized Dune Surface, Eroding; transition forest, second-growth
DSA/SFR	Stabilized Dune Surface, Eroding; shorepine forest of stabilized dunes
PRS/TF	Precipitation Ridge - Slip Face; transition forest
PRS/SFR	Precipitation Ridge - Slip Face; shorepine forest of stabilized dunes
PRA	Precipitation Ridge - Active Slip Face
PRX	Precipitation Ridge - Active Slip Face, Threatening
SC	Conditionally Stable Slip Face
RS	Rolling, Partially Stabilized Dune Surface
FA	Flood Plain, Active
FA/SM	Flood Plain, Active; salt marsh - meadow
FS/SFR	Flood Plain, Stabilized; shorepine forest of stabilized dunes
FS/TF	Flood Plain, Stabilized; transition forest
MSM	Mountain Front; shoreline marsh
MMV	Mountain Front: marshy valley fill
MDW	Mountain Front; narrow drainageway
MSS/TF	Mountain Front, Steep side slope; transition forest
MSS/TFO	Mountain Front; Steep side slope; transition forest, old-growth
MSS/TFC	Mountain Front, Steep side slope; transition forest, clearcut
MSS/TFS	Mountain Front, Steep side slope; transition forest, second-growth
MTL/TFS	Mountain Front, Tableland; transition forest, second-growth
\!/	Marsh
L or Lake	Lakes and Ponds
—···—	Beach
Named	Rivers and stream courses
PLANT	Plantations, with years since planted
— · —	Land-use boundary
— —	Gradation boundary between plant communities
	Approximate N.R.A. boundary
	Mass movement, headwall escarpment

Foredune (FD)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Road Construction	a. "Unstable" - subject to wave erosion & log jams b. Uneven and abrupt relief - requires cuts c. Opens beach to vehicle access d. Not compatible with char. landscape e. Excessive snowy plover* harassment (rare species in State) when located parallel to beach	5	5	5	a. Riprap seaward side b. Fill depressions with ballast c. Enforce reg. & construct barriers d. None e. Locate perpendicular to beach	a. Potential for undercutting - visual impact b. Erosion on adj. areas-visual impact c. Neg. visual impact and admin. require. d. -- e. Some harassment will persist
Parking lots	a. "Unstable" b. Uneven and abrupt relief c. Inadequate size of area d. Increased airflow problem e. Not compatible with char. landscape f. Snowy plover harassment (rare species in State)	5	5	5	a. Riprap seaward side b. Fill depressions with ballast c. Landfill on inland side d. Plant larger species e. None f. None	a. Potential for undercutting persists - visual impact b. Erosion on adj. areas c. Increased runoff - neg. visual impact d. -- e. -- f. --
Drainfields	a. Slope, relief & shape unsuitable b. Inadequate size of absorption area c. Pollution hazard estuaries, ground water & wildlife	5	- ?	 1	a. Provide vault or sew. collection system b. Landfill c. Sewage collection system	a. Disposal site limitations b. Neg. visual impact c. Disposal site limitations
Campgrounds (24 hr. occup.)	a. Neg. visual impact b. Inhospitable recreat. environ.(wind & moisture) c. Inadequate size of area d. Hazard of wave breaching e. Snowy plover* harassment (rare species in State)	5	5	5 4	a. None b. Construct artificial windscreen c. Landfill d. Riprap e. None	a. -- b. Neg. visual impact c. Extend scouring action to adj. land d. Potential for unsafe cond. persists e. --
Human Occupancy (Day use)	a. Inhospitable environment (wind & moisture) b. Low carrying capacity c. Snowy plover* harassment (rare species in State) d. Vegetation sensitive to trampling	5	5	3	a. None b. Provide reinforcement c. Identify & protect areas April-June; I&E program d. None	a. -- b. Neg. visual impact c. Reduction of recreat. land base d. --
Human Occupancy (Ped. access)	a. Vegetation sensitive to trampling b. Trail-rutting susceptible c. Low carrying capacity d. Snowy plover* harassment (rare species in State)	4	3	1	a. Provide bridging or paving b. " " " " c. " " " " d. Identify & protect areas Apr-June; I&E	a. Slight change in visual b. " " " " c. -- d. Reduction of recreation base; some harassment will persist.

*The snowy plover does not use the foredune itself. It uses the driftwood tangle on the beach and the sand spits of the river and streams. Both of these areas are adjacent to the foredune. Any activity on the foredune would directly affect the snowy plover.

Foredune (FD)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Cross-country travel (horses)	a. Low carrying capacity b. Tendency for trailing c. Trail-rutting susceptible d. Snowy plover harassment (rare species in State)	4	5	2	a. Provide bridging or pave b. " " " " c. " " " " d. Identify & protect areas Apr.-June; I&E program	a. Visual impact b. Slight change in visual c. " " " " d. Reduction of recreation base; some harassment will persist
Cross-country Travel (Vehicles)	a. Vegetation sensitive to wheel traffic b. Tendency for trailing - visual c. Snowy plover harassment (rare species in State)	5	5	4	a. Bridging b. Barrier c. Identify & protect areas April-June; I&E program	a. Negative visual impact b. Modification of visual character. c. Reduction of recreation base; some harassment will persist
Buildings (Contin. founda-tion)	a. "Unstable" due to wave erosion b. Sand deposition on lee side c. Wind scouring on windward side d. Not compatible with charact. landscape	5		5	a. Riprap b. Maintenance c. Plantings d. None	a. Potential for undercutting persists; visual impact b. -- c. -- d. --
Buildings (Pole founda-tion)	a. Not compatible with char. landscape b. "Unstable" due to wave erosion c. Highest velocity wind exposure	5		4	a. None b. Riprap c. None	a. -- b. Potential for undercutting persists; visual impact c. --
Powerline Tower Install.	a. Not compatible with char. landscape b. "Unstable" due to wave erosion c. Highest velocity wind exposure d. Excessive loss of wildlife habitat and harass-ment if located parallel to beach, especially snowy plover.	5	5	5	a. Buried pipe b. Riprap c. None d. None	a. -- b. Potential for undercutting persists; visual impact c. -- d. --
Buried Pipeline Install.	a. "Unstable" due to wave erosion b. Excessive loss of wildlife habitat and harass-ment if located parallel to beach, especially snowy plover	5	5	1	a. Riprap b. None	a. Potential for undercutting persists b. --
Vegetative Stabiliz. (dunegrass)		1		1		

Hummocks, Occ. Wet, Stable (HWS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Road Construction	a. High water table (annual consid.) occ. flooding b. Increased turbulence & wind veloc.(effect on visitor) c. Marginally compatible w/char. landscape d. Alignment difficult to maintain w/o excess cuts e. Excessive loss of wildlife habitat & harassment if parallel to beach.	2	5	5 3 4	a. Turnpike or seasonal restrictions b. Plantings on adj. areas; sand removal program c. Design to fit landscape d. Low-speed roads fit to landscape e. Locate perpendicular to beach, restrict use Oct-May; I&E Program	a. Neg. visual impact b. -- c. -- d. Safety hazard e. Some loss of habitat & harassment will occur
Parking Lots	a. High water table b. Increased turbulence & wind veloc. (effect on visitor) c. Sand deposition (onsite) d. Marginally compat. with char. landscape e. Loss of habitat & harassment of wildlife	2	4	3 4	a. Land fill b. Plantings, on adj. acres, of wind screen species c. Sand removal program d. None e. Limit number of visitors; restrict use Oct-May; I&E	a. Possible subsurface drainage impeden. b. -- c. -- d. -- e. Some habitat loss & harass.will occur
Drainfields	a. High water table b. Ground water contamination hazard c. Pollution hazard to estuaries & deflation plain	4	5	1	a. Sewage collection system b. " " " c. " " "	a. Disposal site limitations b. " " " c. " " "
Campgrounds (24-hr. occup.)	a. High water table (seasonal consid.) b. Inhospitable environment (wind) c. Veg. sensitive to trampling d. Loss of habitat & harassment of wildlife	4	4	5	a. Land fill b. Construct artificial wind screens c. Barriers - plant with stronger spec d. Limit number of visitors; restrict use Oct-May; I&E	a. Slight visual impact b. Neg. visual impact c. -- d. Reduction of recreation base; some harassment will persist
Human Occupancy (Day use)	a. Veg. sensitive to trampling b. High water table c. Inhospitable environment d. Loss of habitat & harassment of wildlife	4	4	4	a. Barriers, fertilization & stronger species b. Land fill c. ? d. Limit number of visitors; restrict use Oct.-May - I&E	a. -- b. Slight visual impact c. -- d. Reduct. of recreat. base; some harassment will persist
Human Occupancy (Ped. access)	a. Veg. sensitive to trampling b. Trail rutting on steeper portions c. Wildlife harassment	3	2	2	a. Provide bridging or paving b. " " " c. I&E program	a. Slight visual impact b. " " " c. Some harassment will persist

Hummocks, Occ. Wet, Stable (HWS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Cross-country Travel (horses)	a. Tendency for trailing b. Trail-rutting on steeper portions c. Vegetation sensitive to trampling d. Loss of habitat & harassment of wildlife	3	 5	2 3 3	a. Provide bridging & paving b. " " " c. " " " d. Restrict to trails; I&E; zone activity*	a. Slight visual impact b. " " " c. " " " d. Some harassment will persist
Cross-country Travel (vehicles	a. Trail-rutting on steeper portions b. Veget. sensitive to wheel traffic c. Conflict in recreat. experience d. Loss of habitat & harassment of wildlife	4	 5	3 4 4	a. Provide bridging & paving b. " " " c. Zone specific areas d. Restrict to trails;I&E;zone act.*	a. Slight visual impact b. " " " c. " " " d. Some harassment will persist
Buildings (Cont. found.)	a. High water table b. Subject to high veloc. winds & turbulence c. Wind-scouring & deposition hazard	4		4	a. Land fill b. None c. Plantings	a. Slight visual impact b. -- c. --
Buildings (Pole found.)	a. Subject to high veloc. winds & turbulence	3		4	a. None	a. --
Powerline Tower Install.	a. Not compatible with char. landscape b. Subject to salt water corrosion near estuaries c. Subject to high-veloc. wind d. Excessive loss of wildlife habitat & harassment if parallel to beach	3	 5	5	a. Buried pipe b. Buried, corros.-resistant pipe c. None d. Locate perpendicular to beach; restrict use of service road; I&E	a. Temporary destruction of wildlife habitat b. ? c. -- d. Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. Subject to salt water corrosion near estuaries b. High water table c. Excessive loss of wildlife habitat & harassment if parallel to beach	3	 5	1	a. Corrosion-resistant pipe b. Pumping & corros-resistant pipe c. Locate perpendicular to beach-restrict use of service road; I&E	a. -- b. Safety hazard c. Some loss of habitat & harassment will occur
Vegetat. Stabiliz. (Dunegrass)		1		1		

*See wildlife overlays for critical habitat areas.

Hummocks, Occ. Wet (HW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Road Construction	a. High water table (annual consid.), flooding	4			a. Turnpike or seasonal restrictions	a. Slight visual impact
	b. Wind-scouring to water table level (offsite)				b. Plantings on adjacent area	b. Modification of charac. landscape
	c. Sand deposition				c. Plantings on adjacent areas & sand removal program	c. --
	d. Alignment difficult to maintain without excess. cuts			3	d. Low-speed roads; fit to landscape	d. Safety hazard
	e. Increased wind velocities & turbulence (effect on visitor)			3	e. Wind-screen plantings on adj. areas	e. --
	f. Excessive loss of wildlife habitat & harassment when located parallel to beach *		5		f. Locate perpendicular to beach; I&E program	f. Some loss of habitat & harassment will occur
Parking Lots	a. High water table (annual consid.), flooding	4		3	a. Landfill	a. Medium visual impact
	b. Increased wind velocities & turbulence (effect on visitor)			3	b. Wind-screen plantings	b. Change in characteristic landscape
	c. Wind-scouring hazard (offsite)				c. Plantings on adjacent areas	c. --
	d. Sand deposition (onsite)				d. Sand removal program	d. --
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harass.will occur
Drain-fields	a. High water table	5		1	a. Sewage collection system	a. Disposal site limitation
	b. Ground water contamination hazard				b. " " "	b. " " "
	c. Pollution hazard to estuaries		5		c. " " "	c. " " "
	d. "Quicksand" areas				d. None	d. --
Camp-grounds (24-hr. occup.)	a. High water table (annual consid.), flooding	5		3	a. Landfill	a. Slight visual impact
	b. Veg. sensitive to trampling (on hummocks)				b. Barriers; plant hardier species, fertilize	b. --
	c. "Quicksand" areas				c. Signing; seasonal restrictions	c. --
	d. Inhospitable environment (wind)			4	d. Construct artificial wind screens	d. Slight visual impact
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harassment will occur
Human Occupancy (day-use)	a. Veg. on hummocks sensitive to trampling	4			a. Barriers; plant hardier species, fertilize	a. --
	b. High water table (annual consid.), flooding				b. Landfill	b. Slight visual impact
	c. Inhospitable environment (wind and water)			3	c. Construct artificial wind screens	c. " " "
	d. "Quicksand" areas				d. Signing; seasonal restrictions	d. --
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harass.will occur
Human Occupancy (Ped. access)	a. Quicksand areas	2			a. Signing; seasonal restrictions	a. --
	b. Veg. on hummocks sensitive to trampling			1	b. Barriers; plant hardier species, fertilize	b. --
	c. High water table				c. Bridging or seasonal restriction	c. --
	d. Harassment of wildlife				d. I&E program	d. Some harassment will persist

* See wildlife overlays for critical habitat areas.

Hummocks, Occ. Wet (HW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Cross-country Travel (horses)	a. Seasonal high water table b. "Quicksand" areas c. Veg. on hummocks sensitive to trampling d. Loss of habitat & harassment of wildlife	2	3	1	a. Seasonal restriction b. Signing; seasonal restriction c. Barriers d. Restrict to trails; I&E. Zone* activity	a. -- b. Maintenance c. " d. Reduct. of rec. land base; some harassment will persist
Cross-country Travel (vehicles)	a. Seasonal high water table b. "Quicksand" areas c. Loss of habitat & harassment of wildlife	2	3	2	a. Seasonal restriction b. Signing; seasonal restriction c. Restrict to trails; I&E. Zone activity *	a. -- b. Maintenance c. Reduct.of rec. land base; some harassment will persist
Buildings (Contin. found.)	a. High water table b. Wind-scouring hazard & sand deposition c. Subject to high velocity winds & turbulence d. Marginally compatible w/charac. landscape	5		4	a. Landfill b. Plantings & sand removal program c. None d. Design to fit landscape	a. Modification of charac. landscape b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds & turbulence b. Marginally compatible w/charac. landscape	4		3	a. None b. Design to fit landscape	a. -- b. --
Powerline Tower Install.)	a. High water table b. Quicksand area c. Not compatible w/charac. landscape d. Excessive loss of wildlife habitat & harassment if parallel to beach	4	5	4	a. Buried pipeline b. None c. Buried pipeline d. Locate perpendicular to beach; I&E	a. -- b. -- c. -- d. Some loss of habitat & harassment will occur
Buried Pipeline Install.)	a. High water table b. "Quicksand areas" c. Excessive loss of wildlife habitat & harassment if parallel to beach	3	5	1	a. Pumping, corros. resist. pipe b. None or avoid c. Locate perpendicular to beach; I&E	a. Safety hazard b. -- c. Some loss of habitat & harassment will occur
Vegeta. Stabiliz. (dunegrass)	a. Lack of nutrients on hummocky portion	2		1	a. Fertilize	a. --
* See Wildlife overlays for critical habitat areas.						

Hummocks, Dry (HA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Wind-scouring hazard (offsite)	4			a. Plantings on adjacent areas	a. Reduction of open sand areas
	b. Undulating relief; requires cuts				b. Balanced cut & fill to fit landsc.	b. --
	c. Marginally compatible with characteristic landsc			2	c. Design to fit landscape	c. --
	d. Occas. areas of high water table & flooding				d. Fill; seasonal closure	d. Reduced recreation opportunities
	e. Sand deposition (onsite)				e. Sand removal program	e. --
	f. Increased wind velocities & turbulence (effect on visitor)			3	f. Windscreen plantings on adj. areas	f. ?
	g. Some loss of wildlife habitat & harassment		3		g. None	g. --
Parking Lots	a. Increased wind veloc. (effect on visitors)	4			a. Plantings, on adj. areas of wind-screen species	a. Reduction of open sand areas
	b. Sand deposition (onsite)				b. Sand removal program	b. " " " " "
	c. Creates runoff area & wind-scouring (offsite)			3	c. Plantings on adjacent areas	c. " " " " "
	d. Marginally compatible with charac. landscape				d. Design to fit landscape	d. " " " " "
	e. Occasional area of high water table & flooding				e. Land fill	e. --
	f. Loss of habitat & harassment of wildlife		2		f. Limit number of visitors; I&E prog.	f. Some habitat loss & harass. will occur
Drain-fields	a. Wind-scouring hazard	5		1	a. Plantings	a. Reduction of open sand areas
	b. Ground water contamin. hazard-some locations		1		b. Fill 6-12'	b. Visual impact
Camp-grounds (24-hr. occup.)	a. Veget. on hummocks sensitive to trampling	4			a. Plantings with fertilizer treatment	a. Reduction of open sand areas
	b. Harsh environment (wind)			4	b. Construct artificial windscreens	b. Negative visual impact
	c. Wind-scouring hazard & sand deposition				c. Plantings & sand removal program	c. Reduction of open sand areas
	d. Loss of habitat & harassment of wildlife		2		d. Limit number of visitors; I&E prog.	d. Some habitat loss & harass. will occur
Human Occupancy (day use)	a. Veget. on hummocks sensitive to trampling	3			a. Barriers, plantings	a. Reduction of open sand areas
	b. Wind-scouring hazard & sand deposition				b. Plantings & sand removal program	b. " " " " "
	c. Inhospitable environment (wind)			3	c. Construct artifical windscreen	c. Negative visual impact
	d. Low carrying capacity (whole area)				d. Restrict numbers of visitors	d. Administrative problem
	e. Loss of habitat & harassment of wildlife		2		e. Limit number of visitors: I&E prog.	e. Some habitat loss & harassment will occur
Human Occupancy (Ped. access)	a. Veget. on hummocks sensitive to trampling	2			a. Barriers, plantings	a. Reduction of open sand areas
	b. Trail or path-rutting suscept. on steeper port.			2	b. Plantings	b. " " " " "
	c. Some harassment of wildlife		1		c. I&E program	c. Some harassment will persist

Hummocks, dry (HA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-Country Travel (horses)	a. Low carrying capacity b. Tendency for trailing c. Trail-rutting on steeper portions d. Some loss of habitat & harassment of wildlife	2	 2	 2 3 	a. Restrict numbers b. Provide paved trails c. Plantings & barriers d. Restrict to trails; I&E	a. Administrative problem b. Negative visual impact c. -- d. Reduct. of rec. landbase; some harassment will persist
Cross-country Travel (vehicles	a. Veget. on nummocks & grassy areas sensitive to wheel traffic b. Some loss of habitat & harassment of wildlife	2	 2	3 	a. Barriers & paving b. Restrict to trails: I&E	a. Negative visual impact b. Reduct. of rec. land base; some harassment will persist
Buildings (Cont. found.)	a. Wind-scouring hazard & sand deposition b. Occas. area of high water table c. Subject to high velocity wind & turbulence d. Marginally compatible with charac. landscape	5		 4 3	a. Plantings b. Land fill c. None d. Design to fit landscape	a. Reduction of open sand areas b. Visual impact c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds & turbulence b. Increase wind turbulence & scouring c. Marginally compatible with charac. landscape	4		4 3 	a. None b. Plantings c. Design to fit landscape	a. -- b. Reduction of open sand areas c. --
Powerline Tower Install.)	a. Not compatible with charac. landscape b. Subject to high velocity winds & turbulence c. Wind-scouring hazard & high water table d. Some loss of wildlife habitat & harassment	5	 2	4 	a. Buried pipeline b. None c. Plantings d. None	a. -- b. -- c. Reduction of open sand areas d. --
Buried Pipeline	a. Wind-scouring hazard b. Occas. wet area c. Clearing would accelerate deflation plain process d. Some loss of wildlife habitat; harassment	4	 2	1 	a. Plantings b. Pumping & corrosion-resist. pipe c. Avoid destruction of hummocky portions d. None	a. Reduction of open sand areas b. Safety hazard during construction c. -- d. --
Vegetative Stabiliz. (dune-grass)	a. Fertility & moisture lacking	2		1	a. Fertility & plant adaptab. species	a. --

Deflation Plain, grasses, rushes, sedges (DG)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. High water table(annual consid.), flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat & harassment if located parallel to beach d. Not visually compatible	3	5	5	a. Turnpike, seasonal restriction b. Construct on causeway c. Locate perpendicular to beach, I&E program d. None	a. Impede subsurface drainage; vis.impact b. Negative visual impact c. Some habitat loss & harassment will occur d. --
Parking Lots	a. High water table (annual consid), flooding b. Not compatible with charac. landscape c. Subsurface drainage restrictions d. Loss of wildlife habitat; harassment	4	5	5	a. Land fill b. None c. Design through-flow d. None	a. Impede subsurface drainage; visual impact b. -- c. ? d. --
Drain-fields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries & wildlife	5 5		1	a. Sewage collection system b. " " " c. " " "	a. Disposal site limitations b. " " " c. " " "
Camp-grounds (24-hr. occup.)	a. High water table (annual consid.), flooding b. Mosquito habitat c. Loss of wildlife habitat d. Inhospitable environment (wind)	5	5	3 4	a. Land fill b. Biological control c. None d. Construct artifical windscreens	a. Slight visual impact b. -- c. -- d. Susceptible to wind damage; modification of charac. landscape
Human Occupancy (day use)	a. High water table, (annual consid.), flooding b. Mosquito habitat c. Loss of wildlife habitat; harassment d. Modification of charac. landscape	4	3 5	3	a. Land fill b. Biological control c. None d. Specialized design	a. Slight visual impact b. -- c. -- d. --
Human Occupancy (Ped. access)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	3	4	2	a. Land fill or boardwalks b. Restrict use Oct-May; I&E Program	a. Possible negative visual impact b. Reduction of recreat. base; some harassment will persist

Deflati[illegible]lain, grasses, rushes, sedges (DG)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Cross-country Travel (horses)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	3	4	2	a. Seasonal restriction b. Restrict use Oct-May; confine to estab. trails; I&E	a. -- b. Reduction of recreation base; some harassment will persist
Cross-country Travel (vehicles)	a. High water table, flooding (seasonal consid.) b. Veg. sensitive to to wheel traffic - rutting c. Wildlife harassment	3	4	3	a. Seasonal restriction b. Confine to estab. improved trails c. Restrict use Oct-May; confine to estab. trails; I&E	a. -- b. Interference with water movement c. Reduction of recreation base; some harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to high velocity winds c. Not visually compatible d. Loss of wildlife habitat & harassment	5	4	5	a. Land fill b. None c. None d. None	a. Impede subsurface drainage b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds b. Not visually compatible c. Loss of wildlife habitat & harassment	4	4	5	a. None b. None c. None	a. -- b. -- c. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Excessive loss of wildlife habitat if located parallel to beach; harassment	3	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach, construct July to Sept.; restrict use of service road; I&E	a. -- b. -- c. Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. High water table b. Excessive loss of wildlife habitat if located parallel to beach; harassment	2	5	1	a. Pumping required - corros-resis.pipe b. Locate perpendicular to beach: construct July-Sept., restrict use of service road, I&E	a. -- b. Some loss of habitat & harassment will occur
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Loss of shorebird & waterfowl habitat by speeding up plant succession	4	5	3	a. Plant with native or adapt. species b. Plant with grasses other than beachgr	a. -- b. --

Deflation Plain, low shrubs(DGL)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. High water table (annual consid), flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat & harassment if located parallel to beach d. Not visually compatible	3	5	5	a. Turnpike, seasonal restriction b. Construct on causeway c. Locate perpendicular to beach, I&E program d. None	a. Impede subsurface drainage b. Negative visual impact c. Habitat loss & harassment will occur d. --
Parking Lots	a. High water table (annual consid.), flooding b. Not compatible with charac. landscape c. Subsurface drainage restriction d. Loss of wildlife habitat & harassment	3	4	5	a. Land fill b. None c. Design through-flow d. None	a. Impede subsurface drainage b. -- c. ? d. --
Drain-fields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries & wildlife	5	5	2	a. Sewage collection system b. " " " c. " " "	a. Disposal site limitations b. " " " c. " " "
Camp-grounds (24-hr. occup.)	a. High water table (annual consid.), flooding b. Mosquito habitat c. Loss of wildlife habitat & harassment d. Inhospitable environment (wind)	4	4	4	a. Land fill b. Biological control c. None d. Construct windscreen	a. Slight visual impact b. -- c. -- d. Susceptibility to wind damage
Human Occup. (day use)	a. High water table (annual consid.),flooding b. Mosquito habit c. Loss of wildlife habitat; harassment	3	4	3	a. Land fill b. Biological control c. None	a. Slight visual impact b. -- c. --
Human Occup. (ped. access)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	2	3	2	a. Land fill or boardwalks b. Restrict use certain areas Oct-May, I&E program	a. Possible negative visual impact b. Reduction of recreation base; some harassment will persist

Deflation Plain, low shrubs(DGL)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-country Travel (horses)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	2	3	2	a. Seasonal restriction b. Restrict use of certain areas Oct-May; confine use to estab. trails; I&E program	a. -- b. Reduction of recreation base; some harassment will persist
Cross-country Travel (vehicles)	a. High water table, flooding (seasonal consid.) b. Vegetation sensitive to wheel traffic-rutting c. Wildlife harassment	3	4	3	a. Seasonal restrictions b. Confine to established, improved trails c. Restrict use of certain areas Oct-May; confine to est. trails; I&E	a. -- b. Interference with water movement c. Reduction of recreation base; harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to high velocity winds c. Not visually compatible d. Loss of wildlife habitat	5	4	5	a. Land fill b. None c. None d. None	a. Impede subsurface drainage b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds b. Not visually compatible c. Loss of wildlife habitat	4	4	5	a. None b. None c. None	a. -- b. -- c. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Excessive loss of wildlife habitat if located parallel to beach; harassment	3	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach, construct July-Sept; restrict use of service road; I&E	a. -- b. -- c. - Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. High water table b. Excessive loss of wildlife habitat if located parallel to beach; harassment	2	5	2	a. Pumping required corros.-resis.pipe b. Locate perpendicular to beach; construct Jul-Sept.; restrict use of service road; I&E	a. Safety hazard during construction b. Some loss of habitat & harassment will occur
Vegetat. Stabiliz. (dunegrass)	a. Undesirable plant composition b. Accelerate loss of shore-bird-waterfowl habitat by speeding up plant succession	4	5	3	a. Plant with native or adapt. species b. Plant with grasses other than beachg.	a. - b. --

Deflation Plain, tall shrub thicket (DT)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Road Construction	a. High water table (annual consid.), flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat & harassment if located parallel to beach d. Questionable visual compatibility	3	5	3	a. Turnpike, seasonal restriction b. Construct on causeway c. Locate perpendicular to beach; I&E Program d. Sensitive location & design	a. Interference with subsurface drainage b. Slight visual impact c. Some habitat loss & harassment will occur d. --
Parking Lots	a. High water table (annual consid.), flooding b. Marginally compatible with charac. landscape c. Loss of wildlife habitat & harassment d. Interference with subsurface drainage	3	3	3	a. Land fill b. Design & locate to fit vegetation c. Limit number of visitors; I&E prog. d. Design through-flow	a. Impede subsurface drainage b. -- c. Reduction of recreation base; some harassment will persist d. ?
Drain-fields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries	5 5	5	3	a. Sewage collection system b. " " " c. " " "	a. Disposal site limitations b. " " " c. " " "
Camp-grounds (24-hr occup.)	a. High water table (annual consid) flooding b. Pine pitch moth infestation susceptibility c. Western gall rust susceptibility d. Marginal recreat. envir. opportunity for wildlife viewing e. Loss of wildlife habitat & harassment	3	3	3	a. Land fill b. Individual tree treatment c. Tree removal or treatment d. Trails required e. Limit numbers of visitors; I&E prog.	a. -- b. Aesthetic loss c. " " d. -- e. Some habitat loss & harassment will occur
Human Occupancy (day use)	a. High water table b. Mosquito habitat c. Pine pitch moth & western gall rust & suscept. d. Loss of wildlife habitat & harassment e. Opportunity for wildlife viewing	3	3	3	a. Land fill b. Biological control c. Tree removal or treatment d. None - I&E program e. Trails required	a. -- b. -- c. Aesthetic loss d. Some harassment will persist e. --
Human Occup. (ped. access)	a. High water table (seasonal consid.) b. Wildlife harassment c. Opportunity for wildlife viewing	2	2	2	a. Land fill b. I&E Program c. Trails required	a. -- b. Some harassment will persist c. --

Deflation Plain, tall shrub thicket (DT)

acility or ctivity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-country Travel (horses)	a. High water table (seasonal consid.) b. Tendency to trail c. Wildlife harassment	2	2	2	a. Land fill b. Reinforce trails c. I&E Program	a. -- b. Slight visual impact c. Some harassment will persist
Cross-country Travel (vehicles)	a. High water table (annual consid.) b. Tendency to trail c. Wildlife harassment	4	2	4	a. Land fill b. Restrict or confine to reinforced trail c. I&E Program	a. -- b. Slight visual impact c. Some harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to wind turbulence c. Marginally compatible	4		3	a. Land fill b. Utilize natural windscreening c. Design & locate to fit vegetation	a. -- b. -- c. Custom design required for each building complex
Buildings (Pole found.)	a. Subject to wind turbulence b. Marginally compatible	2		2	a. Utilize natural windscreening b. Design & locate to fit vegetation	a. -- b. Custom design each bldg. complex
Powerline Tower Install.	a. High water table b. Not compatible with charac. landscape c. Excessive loss of wildlife habitat if parallel to beach; harassment	2	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach; I&E	a. Slight visual impact b. -- c. Some habitat loss; harassment will occur
Buried Pipeline Install.	a. High water table b. Clearing required c. Excessive loss of wildlife habitat if parallel to beach	2	5	4	a. Pumping required ; corros-resis.pipe b. -- c. Locate perpendicular to beach; I&E	a. Safety hazard during construction b. -- c. Some habitat loss & harassment will occur
Vegeta. Stabil. (dunegrass)	a. Undesirable plant composition	4		3.	a. Plant with native or adapt. species	a. --

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. High water table (annual consid.) flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat, especially snags, if located parallel to beach; harassment d. Modification of characteristic landscape	3	5	3	a. Turnpike; seasonal restriction b. Construct on causeway c. Locate perpendicular to beach; retain snags; I&E Program d. Alignment	a. Impede subsurface drainage; not compatible with charac. landscape b. Slight negative visual impact c. Some habitat loss & harassment will occur d. Cost, construction problems
Parking Lots	a. High water table (annual consid), flooding b. Alteration of characteristic landscape c. Loss of wildlife habitat, especially snags; harassment	3	4	4	a. Land fill b. -- c. Retain snags; limit number of parking lots; I&E Program	a. Visual impact b. -- c. Reduction of recreation base; some harassment will persist
Drainfields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries d. Noncompatible with charac. landscape	5	5	4	a. Sewage collection system b. " " " c. " " " d. None	a. Disposal site limitations b. " " " c. " " " d. " " "
Campgrounds (24 hr. occup.)	a. High water table, flooding b. Mosquito habitat c. Loss of wildlife habitat, especially snags; harassment	3	4	3	a. Land fill b. Biological control c. Retain snags; limit number of campgrounds; I&E	a. Impede subsurface drainage; visual impact b. -- c. Reduction of recreation base; some harassment will persist
Human Occupancy (day use)	a. High water table, flooding b. Inhospitable environment c. Loss of wildlife habitat, especially snags; harassment	3	4	3	a. Land fill b. None c. Retain snags; limit number of facilities; I&E	a. Impede subsurface drainage; visual impact b. -- c. Reduction of recreation base; some harassment will persist
Human Occupancy (ped. access)	a. High water table, flooding (seasonal consid.) b. Impenetrable vegetation c. Possibility for nature trail development d. Wildlife harassment	2	1	2	a. Land fill or turnpike trails b. Paths & trails required with reinf. c. -- d. I&E Program	a. Poss. subsurface drainage interference; visual impact b. Negative visual impact c. -- d. Some harassment will persist

Deflation Plain, shorepine forest (DST)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-country Travel (horses)	a. High water table (seasonal consid.) b. Vegetation is a natural barrier c. Wildlife harassment	2	2	2	a. Landfill or turnpike trails b. Provide reinforced trails c. I&E Program	a. Possible subsurface drainage imped.; visual impact b. -- c. Some harassment will persist
Cross-country Travel (vehicles)	a. Vegetation is a natural barrier b. Water table (annual consid.) c. Visual impacts from trailing d. Wildlife harassment	5	2	3	a. Trails required with reinforcement b. Turnpike c. -- d. I&E Program	a. Negative visual impact. b. Possible subsurface drainage impedence c. -- d. Some harassment will persist
Building (Contin. found.)	a. High water table (annual consid.) b. Slight visual impact	4		2	a. Land fill b. Custom design, careful placement	a. Visual impact b. --
Buildings (pole found.)	a. Slight visual impact	2		2	a. Custom design, careful placement	a. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Quantity of clearing required d. Excessive loss of wildlife habitat, especially snags, if located parallel to beach; harassmnt	2	5	5	a. Buried pipe b. " " c. Fit to landscape d. Locate perpendicular to beach; retain snags; I&E	a. Slight visual impact b. -- c. -- d. Some habitat loss & harassment will occur
Buried Pipeline Install.	a. High water table b. Quantity of clearing required c. Excessive loss of wildlife habitat when located parallel to beach, especially snags	2	5	4	a. Pumping required; corros.-res.pipe b. Fit to landscape c. Locate perpendicular to beach; retain snags; I&E	a. Safety hazard during construction b. Increased construction cost c. Some habitat loss & harassment will occur
Vegetative Stabiliz. (dunegrass)	a. Undesirable plant composition	4	3	4	a. Plant with natives or adapt. species	a. --

Transverse Dunes, Dry (TDA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Regul-
			Biol.	Vis		
Cross-Country Travel (Horses)		1		1		
Cross-Country Travel (Vehicles)		1		1		
Buildings (Contin. founda-tion)	a. Actively eroding landscape b. Creates wind turbulence (scouring & deposition) c. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings & sand removal program c. None	a. Reduction of open sand area b. Reduction of open sand area c. -
Buildings (Pole Founda-tion)	a. Actively eroding landscape b. Creates wind turbulence (scouring) c. Not compatible w/char. landscape	4		5	a. Planting b. " c. None	a. Reduction of open sand area b. " " " " " c. -
Powerline Tower Installa-tion	a. Wind excavation b. Not compatible w/char. landscape	5		5	a. Plantings b. Buried pipelines	a. Reduction of open sand area b. --
Buried Pipeline Installa-tion	a. Wind excavation	2		1	a. Plantings - place below water table level	a. Reduction of open sand areas
Vegetative Stabiliza. (Dunegrass)	a. Lack of moisture & fert. b. Loss of open sand area c. Not compatible w/char. landscape	3		5	a. Fert. & possibly irrigation b. None c. I & E Program	a. -- b. -- c. Loss of open sand

Transverse Dunes, Dry (TDA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Actively eroding landscape b. Wind scouring hazard (offsite) c. Increased surface runoff, ditch eros. (off-site) d. Sand deposition (on-site) e. Not compatible w/char. landscape	5	*	 5	a. Planting b. " c. Planting, and lined ditch d. Sand removal progress e. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. - e. -
Parking lots	a. Sand deposition (on site) b. Actively eroding landscape c. Not compatible w/char. landscape d. Increase in wind velocity and sand blasting (effect on visitor)	5		 5	a. Sand removal progress b. Planting c. None d. Plantings and artif. wind screen	a. - b. Reduction of open sand area c. - d. Neg. visual impact
Drain-fields	a. Wind excavation hazard b. Excessive slopes in some areas	5		1	a. Plantings b. Sew. Collection system	a. Reduction of open sand area b. Disposal site limitation
Camp-grounds (24-hr. occup.)	a. Actively eroding landscape b. Inhospitable environ. (wind & sand blasting) c. Not compatible w/char. landscape d. Sand deposition (on-site)	5		 5 5	a. Plantings b. Construct artif. wind screens c. None	a. Reduction of open sand area b. Neg. visual impact c. -
Human Occupancy (day-use)	a. Actively eroding landscape b. Inhospitable environ. (wind & sand blasting) c. Not compatible w/char. landscape	4		 4 5	a. Plantings b. Construct artif. wind screens c. None	a. Reduction of open sand area b. Neg. visual impact c. -
Human Occupancy (Ped. access)		1		1		

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Oblique Ridge System (OA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Actively eroding landscape b. Wind scouring hazard (off-site) c. Increased surface run off, ditch eros. (off-site) d. Sand deposition (on-site) e. Steep slopes, requires ext. cuts, activ. failures f. Not compatible w/char. landscape	5	*	5	a. Plantings b. Plantings c. Plantings & ditch lining d. Sand removal program e. Plantings & retaining walls f. None	a. Reduction of open sand area b. Reduction of open sand area c. Reduction of open sand area d. Reduction of open sand area e. Reduction of open sand area; visual impact f. --
Parking lots	a. Wind scouring hazard (off-site) b. Steep slopes, requires extensive excavation c. Increased surface run-off (off-site) d. Sand deposit in (on-site) e. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings c. Plantings and dispersal system d. Sand removal e. None	a. Reduction of open sand area b. Reduction of open sand area c. Reduction of open sand area d. -- e. --
Drain-fields	a. Wind excavation b. Excessive slope in most locations	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitation
Camp-grounds (24-hr. occup.)	a. Wind scouring hazard (off-site) b. Sand deposition (on-site) c. Inhosp. environment (wind & sandblasting) d. Not compatible w/char. landscape	5		5	a. Plantings b. Sand removal program c. Construct artif. wind screens d. None	a. Reduction of open sand area b. -- c. Neg. visual impact d. --
Human Occupancy (day-use)	a. Windscouring hazard (off-site) b. Inhosp. envirn. (wind & sandblasting) c. Sand deposition (on-site) d. Not compatible w/char. landscape	5		5	a. Plantings b. Construct artif. wind screens c. Sand removal program d. None	a. Reduction of open sand area b. Neg. visual impact c. -- d. --
Human Occupancy (Ped. access)		1		1		

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units

Oblique Ridge System (OA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
Cross Country Travel (Horses)		1		1		
Cross-Country Travel (Vehicles)		1		1		
Buildings (Contin. founda-tion)	a. Wind excavation b. Sand deposition & scouring c. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings c. None	a. Reduction of open sand area b. Reduction of open sand area c. --
Buildings (Pole Founda-tion)	a. Wind excavation b. Not compat. w/char landscape	5		5	a. Plantings b. None	a. Reduction of open sand area b. --
Powerline Tower Installa-tion	a. Wind excavation b. Not compatible w/char. landscape	5		5	a. Plantings b. None	a. Reduction of open sand area b. --
Buried Pipeline Installa-tion	a. Wind excavation b. Steep slopes - machinery limitation	4		1	a. Plantings b. Limit mach. size	a. Reduction of open sand area b. --
Vegetative Stabiliza. (Dunegrass)	a. Loss of open sand area b. Lack of moisture & fert. c. Not compatible w/char. landscape	2		5	a. None b. Fert. & possibly irrig. c. I & E Program	a. -- b. Modification of charac. landscape c. Loss of open sand area

Parabola, active (PA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Actively eroding landscape b. Slope & relief often excessive requiring ext. cuts c. Wind scouring hazard (off-site) d. Sand deposition (on-site) e. Increased surface runoff, ditch eros. (offsite) f. Not compatible w/chan. landscape	5	*	5	a. Plantings b. Plantings c. Plantings d. Plantings e. Plantings & ditch lining f. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. " " " " " e. " " " " "; f. -- slight visual impact
Parking lots	a. Actively eroding landscape b. Slope & relief often excessive, require. ext. excavator c. Increased surface run-off (off-site) d. Sand deposition (on-site) e. Wind scouring hazard (off-site) f. Not compatible w/char. landscape	5		5	a. Plantings b. " c. Plantings & Dispersal system d. Plantings e. " f. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. " " " " " e. " " " " " f. --
Drain-fields	a. Wind excavation hazard b. Slope & relief excession, most locations	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitation
Camp-grounds (24-hr. occup.)	a. Actively eroding landscape b. Slope & relief excessive, most locations c. Harsh site (wind & sand blasting) d. Veg. on fringe sensitive to trampling e. Not compatible w/char. landscape	5		5	a. Plantings b. Locate on more than 10% slopes c. Construct artificial wind screen d. Barriers & plantings e. None	a. Reduction of open sand area b. Decrease in density, inc. in cost c. Slight Neg. visual impact d. Interference w/natural process e. --
Human Occupancy (day-use)	a. Actively eroding landscape b. Slope & relief excessive, most locations c. Harsh site (wind & sand blasting) d. Veg. on fringe sensitive to trampling e. Not compatible w/char. landscape	5		5	a. Plantings b. Locate on 10% slope c. Construct artif. wind screen d. Barriers & plantings e. None	a. Reduction of open sand area b. Decrease in density, inc. in cost c. Slight neg. visual impact d. Interference w/natural process e. --
Human Occupancy (Ped. Access)	a. Veg. on fringe sensitive to trampling	1		1	a. Barriers & plantings	a. Interference w/natural process; slight visual impact

*No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Parabola, active (PA)

cility or tivity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis.		
oss-country avel horses)	a. Veg. on fringe sensitive to trampling	1		1	a. Signing or barriers	a. Slight visual impact
oss-country avel ehicles)	a. Veg. on fringe sensitive to trampling	1		1	a. Signing or barriers	a. Slight visual impact
uildings Contin. found.)	a. Actively eroding landscape b. Subject to high velocity winds (venturi effect) c. Not compatible with charac. landscape	5		 5	a. Plantings b. None c. None	a. Reduction of open sand areas b. -- c. --
uildings Pole found.)	a. Subject to high velocity winds b. Actively eroding landscape c. Not compatible with charac. landscape	5		 4	a. None b. Plantings c. None	a. -- b. Reduction of open sand areas c. --
owerline ower nstall.	a. Actively eroding landscape (wind excavation) b. Not compatible with charac. landscape c. Burial of powerlines	5		 5	a. Plantings b. None c. Plantings	a. Reduction of open sand areas b. -- c. Slight visual impact; potential sand movement acceleration
uried ipeline nstall.	a. Actively eroding landscape (wind excavation)	5		1	a. Plantings	a. Reduction of open sand areas
Vegeta. Stabil. Dune-grass)	a. Moisture-limiting b. Undesirable plant composition c. Not compatible with charac. landscape	3		 5	a. Irrigate, possibly b. Plant with natives or adapt. species c. I&E Program	a. -- b. Modification of charac. landscape c. Loss of open sand

Stabilized dune surface, transition forest $\frac{(DS)}{(TF)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Slope & relief require extensive cuts (some areas) b. Creates surface runoff, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water tables in some areas e. Loss of wildlife habitat; especially snags	2	4	4	a. Design to fit landscape b. Line ditches; keep below 6% grad. c. Vary alignment d. Turnpike e. Limit number of visitors; retain snags	a. -- b. -- c. Safety hazard d. Visual impact e. Reduction of recreation base
Parking Lots	a. Size limitation due to slope & relief in some areas (> 15%) b. High water table in some areas c. Loss of wildlife habitat, especially snags	2	4	4	a. Specialized design b. Turnpike or land fill c. None	a. Decrease parking stalls; increase in land base loss b. Visual impact c. --
Drainfields	a. Slope & relief variable, often excessive (>7%) b. High water table in some areas c. Visual impact from clearing	3	1	4	a. Other collection system b. Sewage collection system c. Limited clearing	a. Increased O&M costs b. Disposal site limits c. Decreased efficiency
Campgrounds (24-hr. occup.)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Moderate visual impacts d. Loss of wildlife habitat, especially snags	2	4	3	a. Locate on more than 10% gradients b. Land fill c. Careful design d. None	a. Decrease in density of units; increase in cost b. Visual impact c. -- d. --
Human Occupancy (Day use)	a. Areal size limitations due to slope & relief, some areas b. Vegetation dense & impenetrable c. Trails required d. Moderate visual impact e. Loss of wildlife habitat, especially snags	2	4	3	a. Locate on more than 10% gradients b. Provide clearings c. Provide reinforced paths d. Careful design e. None	a. Decrease in density of units, increase in cost b. Visual impact c. Visual impact d. -- e. --
Human Occupancy (Ped. access)	a. Vegetation is natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced paths b. I&E Program	a. Source of surface runoff; visual impact b. Some harassment will persist

Stabilized dune surface, transition forest (DS)/(TF)

icility or ctivity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Re
			Biol.	Vis		
ross-ountry ravel horses)	a. Vegetation is a natural barrier b. Wildlife harassment	2	3	2	a. Provide reinforced trails b. I&E Program	a. Source of runoff; slight visual impact b. Some harassment will persist
ross-ountry ravel vehicles)	a. Vegetation is a natural barrier b. Conflict in recreational experience c. Wildlife harassment	5	3	4	a. Provide reinforced & drained running surface (see Road Construction) b. None c. I&E Program	a. Source of runoff; visual impact b. -- c. Some harassment will persist
uildings ontin. ound)	a. Slope & relief variable & steep (>15%) some areas b. High water table in some areas c. Visual impact	1		3	a. Custom planning b. Land fill c. Custom design	a. ? b. Visual impact c. --
uildings Pole found.)	a. Visual impact	1		2	a. Custom design	a. --
owerline ower nstall.	a. Quantity of clearing required b. Occasional area of high water table c. Loss of wildlife habitat, especially snags; harassment	3	4	5	a. Design to fit landscape b. Buried pipe c. Locate perpendicular to stand: restrict use of service road; I&E	a. Loss of aesthetic values b. Visual impact c. Some habitat loss & harassment will occur
uried ipeline nstall.	a. Quantity of clearing required b. Occasional area of high water table c. Loss of wildlife habitat, especially snags, & harassment	3	4	3	a. Design to fit landscape b. Corros-resist. pipe; pumping req. c. Locate perpendicular to stand; restrict use of service road; I&E	a. Loss of aesthetic values b. Safety hazard during construction c. Some habitat loss & harassment will occur.
egeta. tabiliz. unegrass)	a. Undesirable plant composition b. Shading & plant composition	4	3	4	a. Plant with natives or adapt. species b. --	a. -- b. --

Rolling, partially stabilized dune surface (RS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Some areas of high water table b. Rolling, with considerable relief c. Some snag areas - critical habitat for cavity nesters d. Visual impacts	2	4	3	a. Turnpike b. Design to fit landscape c. Identify and protect specific areas d. Design to fit landscape	a. Visual impacts b. -- c. Reduction of recreation base d. --
Parking Lots	a. Some areas of high water table b. Rolling, variable relief c. Some snag areas - critical habitat for cavity nesters d. Visual impact	2	4	4	a. Land fill b. Major excavations c. Identify and protect specific areas d. Design to fit landscape	a. Visual impact b. Resource loss, visual impact c. Reduction of recreation base d. Limited parking volume
Drain-fields	a. Onsite invest. needed (high water table, slopes) b. Some snag areas - critical habitat for cavity nesters c. Visual impact from clearing	3	4	4	a. -- b. Identify & protect specific areas c. Limited clearing	a. -- b. Reduction of recreation base c. Limit efficiency
Camp-grounds (24-hr. occup.)	a. Veg. sensitive to trampling b. Gall rust susceptibility c. Some areas of high water table d. Surface area lacking e. Some snag areas-critical habitat for cavity nest.	4	4 4	2	a. Reinforce pathways; barriers b. See I&DC for treatments c. Land fill d. Specialized design e. Identify & protect specific areas	a. Admin. & enforcement; visual impact b. -- c. Visual impact d. Decrease in density; increase in cost e. Reduction of recreation base
Human Occupancy (Day use)	a. Veg. sensitive to trampling b. Gall rust susceptibility c. Some areas of high water table d. Some snag areas-critical habitat for cavity nest.	3	4 4	2	a. Reinforce pathways, barriers b. See I&DC for treatments c. Land fill d. Identify & protect specific areas	a. Admin. & enforcement; visual impact b. -- c. Visual impacts d. Reduction of recreation base
Human Occupancy (Ped. access)	a. Veg. sensitive to trampling b. Wildlife harassment	2	2 2	1	a. Reinforce pathways, barriers b. I&E Program	a. Admin. & enforcement; slight vis.impact b. --

Rolling, partially stabilized dune surface (RS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-country Travel (horses)	a. Veg. sensitive to trampling b. Wildlife harassment	3	5 3	2	a. Reinforce pathways, barriers b. I&E Program	a. Admin. & enforcement; slight vis. impact b. --
Cross-country Travel (vehicles)	a. Veg. sensitive to wheel traffic b. Wildlife harassment	4	5 4	4	a. Provide reinforced & drained running surface (See Road Construction) b. I&E Program	a. Source of runoff (some areas; visual impact) b. --
Buildings (Contin. found.)	a. Some areas of high water table b. Some snag areas - critical habitat for cavity nesters c. Visual impact	2	 2 	 3	a. Land fill b. Identify & protect specific areas c. Custom design	a. Destruction of snag areas; critical habitat; visual impact b. Reduction of recreation base c. --
Buildings (Pole found.)	a. Some snag areas - critical habitat for cavity nesters b. Visual Impact	1	2 	 3	a. Identify & protect specific areas b. Custom design	a. Reduction of recreation base b. --
Powerline Tower Install.	a. Clearing swath required b. Marginally compatible with charac. landscape c. Some snag areas--critical habitat for cavity nesters	4	 4	4	a. Design to fit landscape b. None c. Identify & protect specific areas	a. Destruction of snag areas--crit.habitat b. -- c. --
Buried Pipeline Install.	a. Clearing swath required b. Loss of sensitive & pioneering plant cover c. Some snag areas--critical habitat for cavity nesters	3	 4	4	a. Design to fit landscape b. None c. Identify & protect critical areas	a. -- b. -- c. --
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant community	3	3	4	a. Restore with natives or adapt.species	a. --

Flood plain, Active (FA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. Loss of critical wildlife habitat & harassment b. Flooding & water erosion hazard c. Water table (poor bearing strength) d. Modification of charac. landscape	5	5	5	a. None; I&E program b. Binwalls, gabions & riprap c. Ballast & land fill d. None	a. -- b. Loss of critical wildlife habitat; visual impact c. Loss of critical wildlife habitat; visual impact d. --
Parking Lots	a. Loss of critical wildlife habitat & harassment b. Flooding & water erosion hazard c. Water table (poor bearing strength) d. Modification of charac. landscape	5	5	5	a. None; I&E Program b. Binwalls, gabion & riprap c. Ballast & land fill d. None	a. -- b. Loss of critical wildlife habitat; visual impact c. Loss of critical wildlife habitat; visual impact d. --
Drain-fields	a. Estuary pollution hazard (high water table) b. Critical wildlife habitat, destruction c. Subject to water erosion	5	5	1	a. Sewage collection system b. " " " c. " " "	a. Limited disposal sites b. " " " c. " " "
Campgrounds (24-hr. occupancy)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat & harassment d. Modification of charac. landscape	5	5	5	a. Binwalls, gabion, riprap b. Land fill c. None; I&E Program d. None	a. Loss of critical wildlife habitat b. " " " "; visual impact c. -- d. --
Human Occupancy (day use)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat & harassment d. Modification of charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None; I&E Program d. None	a. Loss of critical wildlife habitat b. " " " " visual impact c. -- d. --
Human Occupancy (ped. access)	a. Subject to flooding (seasonal limitations) b. Low carrying capacity c. Critical wildlife habitat, harassment	1	3	1	a. Seasonal restriction (natural) b. Signing & regulation c. Restrict access; I&E	a. -- b. Admin. & enforcement c. Reduct. of rec. land base; some harassment will persist

Flood Plain, active (FA)

cility or ctivity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
ross-ountry ravel horses)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat, harassment	1	5	1	a. Seasonal restriction (natural) b. Restrict access; I&E Program	a. -- b. Reduct. of rec. land base; some harassment will persist
ross-ountry ravel vehicles)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat, harassment	1	5	1	a. Seasonal restriction (natural) b. Restrict access; I&E Program	a. -- b. Reduct. of rec. land base; some harassment will persist
uildings Contin. found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " ", visual impact c. -- d. --
uildings Pole found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charact. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " "; visual impact c. -- d. --
owerline ower nstall	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Not compatible with charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " ; visual impact c. -- d. --
uried ipeline nstall	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat	5	5	1	a. Binwalls, gabions, riprap b. Land fill c. None	a. Loss of critical wildlife habitat b. " " " " ; visual impact c. --
egeta. tabiliz.	a. Flooding & water erosion hazard b. Loss of critical wildlife habitat	5	5	5	a. None b. None	a. -- b. --

MAJOR IMPACTS IN MANAGEMENT*

Mapping Units		Wildlife Habitat	Mining	Grazing	General Agriculture	Logging	Urban Development Density			Recreation				Water Table Alteration	Subsurface Disposal
										Undeveloped			Developed		
Symbol	Name						Low	Med.	High	Pedestrian	ORV	Equestrian			
B	Beach	3	2A	-	-	-	0	0	0	3	3	3	0	-	0
DC	Dune complex of OS, OSC, DS, and W	2	0	0	0	0	1	0	0	1	0	0	0	1	2A
DS	Younger stabilized dunes	3	2	2	2	1	3	2	2	3	1	3	3	1	2A
FD	Recently stabilized foredunes	3	0	0	0	0	1	0	0	2	0	1	0	1	1
FDA	Active foredune	3	0	0	0	0	0	0	0	3	0	1	0	1	1
H	Active dune hummocks	3	0	0	0	0	0	0	0	3	0	3	0	1	0
ODS	Older stabilized dunes	3	2	2	2	2	3	3	3	3	2	3	3	2	1A
OS	Open dune sand	1	3	-	-	-	0	0	0	3	3	3	0	2	3A
OSC	Open dune sand conditionally stable	1	0	0	0	0	1	0	0	1	0	0	0	1	2A
W	Wet interdune	3	1	1	1	1	1A	0	0	2C	0	1	1A	1A	0
WDP	Wet deflation plain	3	0	1	3B	-	1A	0	0	2C	0	1	1A	0	0
IFD	Inland foredune	3	0	2	1	1	2	0	0	3	1	1	-	1	2A
OFD	Older foredune	3	0	2	3A	3A	3	2	1	3	2	3	-	2	1-2A

- Not applicable
0 No tolerance
1 Tolerance level low
2 Tolerance level medium
3 Tolerance level high
A Site Specific
B Specialty Crop
C Seasonal

*From U.S.D.A., Soil Conservation Service and OCCDC, 1975.

MAJOR IMPACTS IN MANAGEMENT (continued)

Mapping Units		Filling	Road Construction	Vegetative Removal	Fire Hazard	Deep Excavation	Stream Undercutting	Ocean Undercutting	Debris Removal (driftwood)	Vegetative Stabilization Enhancement (Chance of success0
Symbol	Name									
B	Beach	0	0	-	1A	-	-	3A	3A	-
DC	Dune complex of OS, OSC, DS, and W	-	0	0	1	1	0	0	-	2
DS	Younger stabilized dunes	2	2	2A	2	1	1	1	-	3
FD	Recently stabilized foredunes	-	1A	0	1	0	0	1	0	3
FDA	Active foredune	-	0	0	1	0	0	1	0	1
H	Active dune hummocks	-	1	0	2	0	0	0	-	1
ODS	Older stabilized dunes	2	3	2A	2	2	2	2	-	3
OS	Open dune sand	-	0	-	-	3	0	0	-	1-2
OSC	Open dune sand conditionally stable	-	0	0	1	1	0	0	-	3
W	Wet interdune	0	1A	2	2	0	0	-	-	3
WDP	Wet deflation plain	0	1A	2	2	0	0	-	2A	3
IFD	Inland foredune	-	2A	1A	2	2A	0	0	-	3
OFD	Older foredune	-	3A	3A	2	3A	2	1	-	3

- Not applicable
0 No tolerance
1 Tolerance level low
2 Tolerance level medium
3 Tolerance level high
A Site Specific
B Specialty Crop
C Seasonal

ACTIVITY COMPATIBILITY OR CONDITION*

COMPETING CONDITION	Wildlife Habitat / Mining (Surface)	Grazing / General Agriculture	Logging / Low Density Urban	Medium Density Urban / High Density Urban	Undeveloped Ped. Rec. / Undeveloped ORV Rec.	Undeveloped Equ. Rec. / Developed Recreation	Water Table Alteration / Subsurface Disposal	Filling / Road Construction	Vegetative Removal / Fire Hazard	Deep Excavations / Stream Undercutting	Ocean Undercutting / Driftwood Removal	Vegetative Stabilization
Wildlife Habitat	/	0	1	1	1	1	0	2	1	1	0	-	-	1	1	0	0	0	0	0	1	1
Mining (Surface)	0	/	0	0	0	0	0	2	1	2	0	1	1	1	1	2	-	2	1	1	2	0
Grazing	1	1	/	1	1	0	0	0	2	0	2	0	-	-	0	0	0	1	1	0	0	2	1
General Agriculture	0	0	2	/	0	0	0	0	2	0	2	1	-	2	0	1	1	1	0	0	0	2	1
Logging	1	1	1	0	/	0	0	0	2	1	2	0	-	2	1	1	2	0	1	1	1	2	0
Low Density Urban	1	0	1	1	1	/	-	-	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1
Medium Density Urban	0	0	0	0	0	-	/	-	1	0	1	1	1	1	1	1	1	0	0	0	0	1	1
High Density Urban	0	0	0	0	0	-	-	/	1	0	0	1	1	1	1	1	1	0	0	0	0	1	0
Undeveloped Ped. Rec.	2	2	2	2	2	2	-	-	/	1	2	2	-	-	-	1	1	0	1	0	0	2	1
Undeveloped ORV Rec.	0	0	1	0	1	0	0	0	1	/	1	0	-	-	1	1	1	0	0	0	0	0	0
Undeveloped Equ. Rec.	2	2	2	1	2	1	1	0	2	1	/	1	-	-	1	1	1	0	1	0	0	2	0
Developed Recreation	0	0	0	0	0	1	0	0	2	0	1	/	-	1	1	1	1	0	0	0	0	1	1
Water Table Alteration	1	1	1	1	1	1	1	1	1	1	1	1	/	1	-	1	1	1	0	-	-	2	1
Subsurface Disposal	2	1	2	2	2	1	1	1	2	2	2	1	1	/	1	1	1	-	1	0	0	2	2
Filling	0	0	1	1	1	1	1	1	2	1	2	1	-	1	/	1	1	1	0	0	0	0	0
Road Construction	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	/	1	1	1	0	0	1	1
Vegetative Removal	1	2	1	1	1	1	1	1	1	1	1	1	1	-	-	1	/	1	1	0	0	1	0
Fire Hazard	0	1	0	0	0	0	0	0	0	0	0	0	0	-	-	0	2	/	-	-	-	-	0
Deep Excavations	1	1	0	0	0	0	0	0	2	1	2	0	0	0	0	1	2	-	/	0	0	0	0
Stream Undercutting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	/	-	-	0
Ocean Undercutting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	-	/	0	0
Driftwood Removal	1	0	1	1	1	1	1	1	1	0	1	1	-	-	0	1	1	0	0	0	0	/	1
Vegetative Stabilization	1	0	1	0	0	1	1	1	1	0	0	1	1	-	0	1	0	0	0	0	0	1	/

DESIGNATED ACTIVITY OR CONDITION

- = Not Applicable
0 = Activities which conflict with the designated uses.
1 = Activities which may conflict with the designated use depending upon site characteristics and use intensities.
2 = Activities which do not hinder the designated use.

*From U.S.D.A., Soil Conservation Service and OCCDC, 1975.

Habitat Tolerance to Recreation Use*

Activity	ACTIVITY INTENSITY LEVEL	Habitat Types: BEACH				DEFLATION PLAIN			UPLAND DUNE				HEADLAND			INLAND WATER		ESTUARINE						MARINE	
		Bare Sand	Driftwood	Beach Grass		Marsh	Shrub	Forest	Bare Sand	Grass-Forb	Shrub	Forest	Bare	Shrub	Forest	Lake	Swamp	Bay	Jetty	Mud Flat	Rocky Shore	Sand Flat	Marsh	Ocean	Sand Flat
Camping (Informal)	L	0	1	1		1	-	-	-	3	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
	M	0	1	1		2	-	-	0	3	2	-	-	2	2	-	-	-	-	-	-	-	-	-	-
	S	0	1	2		-	-	-	0	3	2	-	-	2	2	-	-	-	-	-	-	-	-	-	-
Picnicking (Informal)	L	0	1	1		1	-	-	0	3	1	-	-	1	1	-	-	-	0	-	0	-	-	-	-
	M	0	1	1		2	-	-	0	3	2	-	-	2	2	-	-	-	0	-	1	-	-	-	-
	S	0	1	2		-	-	-	0	3	2	-	-	2	2	-	-	-	0	-	2	-	-	-	-
Sunbathing	L	0	0	0		1	-	-	0	1	1	-	-	1	-	-	-	-	0	-	0	0	-	-	0
	M	0	0	1		1	-	-	0	2	1	-	-	1	-	-	-	-	0	-	1	0	-	-	0
	S	0	0	1		-	-	-	0	3	2	-	-	2	-	-	-	-	0	-	2	0	-	-	0
Viewing	L	0	0	1			-	-	0	3	3	-	0	3	2	-	-	-	0	-	3	0	-	-	0
	M	-	-	-			-	-	0	-	-	-	0	3	2	-	-	-	0	-	3	-	-	-	-
	S	-	-	-		-	-	-	0	-	-	-	0	3	2	-	-	-	0	-	3	-	-	-	-
Outdoor Games	L	0	0	1		0	-	-	0	3	-	-	-	1	-	-	-	-	-	-	-	0	-	-	0
	M	0	-	1		1	-	-	0	3	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	S	0	-	2		-	-	-	0	3	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
Beachcombing	L	0	1	-		-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	-	0
	M	0	2	-		-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1	0	1	-	0
	S	0	2	-		-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	2	0	2	-	0
Hunting and Trapping	L	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	M	0	0	0		0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	S	0	0	0		0	1	1	-	1	1	1	0	1	1	0	1	0	0	0	1	0	1	0	0
Fishing	L	0	-	-		-	-	-	-	-	-	-	-	-	-	0	-	0	0	0	0	0	-	0	0
	M	0	-	-		-	-	-	-	-	-	-	-	-	-	1	-	0	0	1	1	1	-	0	0
	S	0	-	-		-	-	-	-	-	-	-	-	-	-	1	-	0	0	1	2	1	-	0	0
Swimming	L	-	-	-		-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
	M	-	-	-		-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
	S	-	-	-		-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
Motorized Boating*	L	-	-	-		-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
	M	-	-	-		-	-	-	-	-	-	-	-	-	-	1	-	0	-	-	-	-	-	0	-
	S	-	-	-		-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	0	-
Hiking	L	0	0	0		0	-	0	0	2	0	-	0	0	0	-	-	-	0	1	0	0	0	-	0
	M	0	0	1		0	-	1	0	3	1	-	0	1	1	-	-	-	0	-	1	0	1	-	0
	S	0	0	1		1	-	2	0	3	2	-	0	1	1	-	-	-	0	-	2	0	0	-	0
Nature Walking	L	0	0	0		0	0	0	0	1	0	0	0	0	0	-	0	-	0	0	0	0	0	-	0
	M	0	0	0		0	1	1	0	2	1	1	0	1	1	-	1	-	0	0	1	0	1	-	0
	S	0	0	1		1	2	1	0	2	2	1	0	1	1	-	1	-	0	0	2	-	2	-	0
Walking for Pleasure	L	0	0	1		0	-	1	0	2	1	-	-	1	1	-	-	-	0	-	1	0	-	-	0
	M	0	0	1		1	-	2	0	3	2	-	-	1	2	-	-	-	0	-	2	0	-	-	0
	S	0	1	2		2	-	2	0	3	3	-	-	2	2	-	-	-	0	-	3	0	-	-	0
Bicycling	L	0	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	M	0	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S	0	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Motor Vehicle Riding	L	1	-	3		2	-	-	1	3	1	-	-	1	-	-	1	-	-	1	2	1	1	-	1
	M	1	-	3		3	-	-	2	3	2	-	-	-	-	-	-	-	-	1	-	1	2	-	1
	S	1	-	3		3	-	-	2	3	3	-	-	-	-	-	-	-	-	1	-	1	3	-	1
Motorcycling	L	1	-	3		2	-	-	1	3	1	-	-	1	-	-	-	-	-	-	1	1	1	-	1
	M	1	-	3		3	-	-	2	3	2	-	-	2	-	-	-	-	-	-	-	1	2	-	1
	S	1	-	3		3	-	-	2	3	3	-	-	3	-	-	-	-	-	-	-	1	3	-	1

*Non-motorized boating is considered to have no detectable impact.

KEY: 0 = No detectable impact
1 = Slight impact--detectable impact but habitat recovers easil (<12 months)
2 = Moderate impact--recovers slowly (1 to 3 years)
3 = Severe impact--setback in succession
- = Not applicable
L = large spacing between participants
M = moderate spacing between participants
S = small spacing between participants

*From U.S. Army Corps of Engineers, 1974.

APPENDIX B

Soil Conservation Service
Soil Interpretations:
Active Dune Land, Westport and
Netarts Series

OR-SOILS-1 12/72
FILE CODE SOILS 12

SOIL INTERPRETATIONS FOR OREGON U.S.D.A. SOIL CONSERVATION SERVICE

DATE: January, 1974 GBT, GEO *Active Dune Land* SERIES SOILS: 1. *Active Dune Land*

This land type consists of wind-drifted sand in the form of dunes, ridges, or hummocks. The material is not stabilized and has no vegetation established on it. Dunes are generally 5 to 40 feet high; they have a maximum elevation of about 180 feet. The relief is a succession of irregularly distributed dunes and ridges, which rise above the intervening wind-formed valleys and swales. Dunes are bare of vegetation or the growth is not dense enough to protect the sand and to prevent it from blowing. The dunes are constantly shifting under the influence of strong ocean winds. Elevation is 0 to about 180 feet. Average annual precipitation is 60 to 80 inches, average annual temperature is 50 to 52°F.; and the frost-free period is about 202 days. Active Dune Land consists of grayish-brown, single grained, porous sand and fine sand.

This land type is used primarily for wildlife habitat and recreation. This soil occurs in the Coast Range and Valley Resource Area (A1).

(Classification: Entisol)

ESTIMATED SOIL PROPERTIES

DEPTH FROM SURFACE (in.)	CLASSIFICATION			COARSE FRACT. OVER 3 IN.	% OF MATERIAL PASSING SIEVE				LIQUID LIMIT	PLASTICITY INDEX	PERMEABILITY (in/hr)	AVAIL. WATER CAP. (in/in)	SOIL REACTION (pH)	SHRINK SWELL POTENTIAL
	USDA TEXTURE	UNIFIED	AASHO		#4	#10	#40	#200						
0-72	Fine sand or sand	SM-SP	A-2	0	100	100	60-75	10-30	Nonplastic		6.0>20.0	.05-.07	4.6-5.0	Low

DEPTH (in.)	CONDUCTIVITY (mmhos/cm)	CORROSIVITY		EROSION FACTORS		WIND EROD. GROUPS	FLOODING			HIGH WATER TABLE			HYDROLOGIC GROUP
		STEEL	CONCRETE	K	T		FREQUENCY	DURATION	MONTHS	DEPTH (ft.)	KIND	MONTHS	
0-72	-	Low	High	-	5	1	None			> 6			A

CEMENTED PAN		BEDROCK		FROST ACTION	REMARKS
DEPTH (in.)	HARDNESS	DEPTH (in.)	HARDNESS		
-		> 60		-	

SANITARY FACILITIES AND COMMUNITY DEVELOPMENT				SOURCE MATERIAL AND WATER MANAGEMENT			
USE	SOIL	RATING	RESTRICTIVE FEATURES	USE	SOIL	RATING	RESTRICTIVE FEATURES
SEPTIC TANK ABSORPTION FIELDS	1	Severe	Percolates rapidly	ROADFILL	1	Good	
SEWAGE LAGOONS	1	Severe	Percolates rapidly	SAND	1	Fair	Excess fines
SANITARY LANDFILL (TRENCH)	1	Severe	Percolates rapidly	GRAVEL	1	Unsuited	Excess fines
SANITARY LANDFILL (AREA)	1	Severe	Percolates rapidly	TOPSOIL	1	Poor	Too sandy
DAILY COVER FOR LANDFILL	1	Poor	Too sandy	POND RESERVOIR AREA	1	Severe	Percolates rapidly
SHALLOW EXCAVATIONS	1	Severe	Too sandy	EMBANKMENTS DIKES AND LEVEES	1	Severe	Low strength, piping, percolates rapidly
DWELLINGS WITHOUT BASEMENTS	1	Slight to severe	Slope	DRAINAGE	1		Not needed
DWELLINGS WITH BASEMENTS	1	Slight to severe	Slope, soil blowing	IRRIGATION	1		Not needed
SMALL COMMERCIAL BUILDINGS	1	Slight to severe	Slope, soil blowing	TERRACES AND DIVERSIONS	1		Not needed
LOCAL ROADS AND STREETS	1	Severe	Soil blowing	GRASSED WATERWAYS	1		Not needed

CONTINUATION SHEET OR-SOILS-1 12/72 Active Dune Land SERIES

RECREATION

USE	SOIL	RATING	RESTRICTIVE FEATURES	USE	SOIL	RATING	RESTRICTIVE FEATURES
CAMP AREAS	1	Severe	Too sandy, soil blowing	PLAYGROUNDS	1	Severe	Too sandy, soil blowing
PICNIC AREAS	1	Severe	Too sandy, soil blowing	PATHS AND TRAILS	1	Severe	Too sandy, soil blowing

CAPABILITY AND PREDICTED YIELDS - CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

SOIL	CAPABILITY														REMARKS
	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	
1	VIIIe														

WOODLAND SUITABILITY

SOIL	POTENTIAL PRODUCTIVITY		WOOD SUIT. GROUP	MANAGEMENT PROBLEMS					NATIVE SPECIES
	SPECIES	SITE INDEX		EROSION HAZARD	EQUIPMENT LIMIT.	SEEDLING MORTALITY	WINDTHROW HAZARD	PLANT COMPET.	
	None								

WINDBREAKS

SOILS	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE
	None								

WILDLIFE HABITAT SUITABILITY

SOIL	POTENTIAL FOR HABITAT ELEMENTS								POTENTIAL AS HABITAT FOR:			
	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLAND WILDLIFE	WOODLAND WILDLIFE	WETLAND WILDLIFE	RANGELAND WILDLIFE
1	Very poor	Very poor	Poor	-	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	-

RANGELAND

RANGE SITE NAME	SOIL	KEY SPECIES AND % COVER	POTENTIAL YIELDS		NORMAL SEASON	
			TOTAL lb/Ac	USABLE Ac/AUM	GROWING	GRAZING
		None				

FOOTNOTES

OR-SOILS-1 12/72
FILE CODE SOILS 12

SOIL INTERPRETATIONS FOR OREGON

U.S.D.A. SOIL CONSERVATION SERVICE

DATE: 1/74 GBT-GEO WESTPORT SERIES SOILS:

1. Westport fine sand, 0 to 12 percent slopes
2. Westport fine sand, 0 to 20 percent slopes
3. Westport fine sand, 12 to 30 percent slope
4. Westport fine sand, 30 to 70 percent slope
5. Westport loamy sand, 0 to 12 percent slope
6. Westport loamy sand, 12 to 30 percent slop
7. Westport-Yaquina loamy sands, 0 to 30 percent slopes
8. Westport-Duneland complex, 12 to 30 percen slopes

The Westport series consists of deep, excessively drained soils that formed in wind-deposited material on nearly level to steep stabilized dunes. The vegetation is Sitka spruce, shore pine, manzanita, evergreen huckleberry, dune grass, forbs and other shrubs. Elevation is 0 to 300 feet. Average annual precipitation is 60 to 100 inches; average annual air temperature is 50 to 53° F. The frost-free period at 32° F. is 200 to 250 days.

A mat of mosses, litter and roots is on top of the mineral soil. Typically, the surface layer is very dark grayish-brown and dark grayish-brown fine sand to loamy fine sand about 16 inches thick. The subsoil is brown to olive gray fine sand to depths greater than 60 inches.

Permeability is very rapid. Runoff is slow from all units. The erosion hazard is high for all units, assuming the vegetation is removed. The total available water holding capacity is 3 to 4 inches. The water supplying capacity is 18 to 20 inches. Effective rooting depth is over 60 inches.

Westport soils are used for homesites, wildlife habitat, and recreation. These soils are in the Northern Pacific Coast Range and Valleys Land Resource Area (MLRA-A1).

(Classification: Typic Udipsamments; mixed, mesic family)

ESTIMATED SOIL PROPERTIES

DEPTH FROM SURFACE (in.)	CLASSIFICATION			COARSE FRACT. OVER 3 IN.	% OF MATERIAL PASSING SIEVE				LIQUID LIMIT	PLASTICITY INDEX	PERMEABILITY (in/hr)	AVAIL. WATER CAP. (in/in)	SOIL REACTION (pH)	SHRINK SWELL POTENTIAL
	USDA TEXTURE	UNIFIED	AASHO		#4	#10	#40	#200						
0-60	fine sand	SM	A-2	0	100	100	65-80	20-35	non-plastic		6.0->20.0	.05-.07	5.1-6.0	low

DEPTH (in.)	CONDUCTIVITY (mmhos/cm)	CORROSIVITY		EROSION FACTORS		WIND EROD. GROUPS	FLOODING			HIGH WATER TABLE			HYDROLOGIC GROUP
		STEEL	CONCRETE	K	T		FREQUENCY	DURATION	MONTHS	DEPTH (ft.)	KIND	MONTHS	
0-60	-	Low	Moderate	-	5	1	none			> 6			A

CEMENTED PAN		BEDROCK		FROST ACTION	REMARKS
DEPTH (in.)	HARDNESS	DEPTH (in.)	HARDNESS		
-		> 60		-	

SANITARY FACILITIES AND COMMUNITY DEVELOPMENT

USE	SOIL	RATING	RESTRICTIVE FEATURES
SEPTIC TANK ABSORPTION FIELDS 1/	1,5	Slight-Mod	Slope
	2,7	Slight to Severe	Slope
	3,4,6,8	Severe	Slope
SEWAGE LAGOONS 1/	1,2,3,4, 5,6,7,8	Severe	Percolates rapidly, slope
SANITARY LANDFILL (TRENCH) 1/	1,2,3,4, 5,6,7,8	Severe	Percolates rapidly, too sandy, slope
SANITARY LANDFILL (AREA) 1/	1,5	Severe	Percolates rapidly
	2,3,4,6, 7,8	Severe	Percolates rapidly, slope
DAILY COVER FOR LANDFILL	1,5	Poor	Too sandy
	2,3,4,6, 7,8	Poor	Too sandy, slope
SHALLOW EXCAVATIONS	1,2,5	Severe	Too sandy
	3,4,6,7, 8	Severe	Too sandy, slope
DWELLINGS WITHOUT BASEMENTS	1,2,5	Moderate	Slope
	3,4,6,7, 8	Severe	Slope
DWELLINGS WITH BASEMENTS	1,2,5	Moderate	Slope
	3,4,6,7, 8	Severe	Slope
SMALL COMMERCIAL BUILDINGS	1,2,3,4, 5,6,7,8	Severe	Slope
LOCAL ROADS AND STREETS	1,5	Slight	-
	3,6	Moderate to Severe	Slope
	2,4,7,8	Severe	Slope

SOURCE MATERIAL AND WATER MANAGEMENT

USE	SOIL	RATING	RESTRICTIVE FEATURES
ROADFILL	1,5	Good	-
	3,6	Fair-Poor	Slope
	2,4,7,8	Poor	Slope
SAND	1,2,3,4, 5,6,7,8	Poor	Excess fines
GRAVEL	1,2,3,4, 5,6,7,8	Unsuited	Excess fines
TOPSOIL	1,2,3,4, 5,6,7,8	Poor	Too sandy
POND RESERVOIR AREA	1,2,3,4, 5,6,7,8	Severe	Percolates rapidly
EMBANKMENTS DIKES AND LEVEES	1,2,3,4, 5,6,7,8	Severe	Piping, percs rapidly
DRAINAGE	1,2,3,4, 5,6,7,8	-	Not needed
IRRIGATION	1,2,3,4, 5,6,7,8	-	Not needed
TERRACES AND DIVERSIONS	1,2,3,4, 5,6,7,8	-	Not needed
GRASSED WATERWAYS	1,2,3,4, 5,6,7,8	-	Not needed

CONTINUATION SHEET OR-SOILS-1 12/72

WESTPORT SERIES

RECREATION

USE	SOIL	RATING	RESTRICTIVE FEATURES	USE	SOIL	RATING	RESTRICTIVE FEATURES
CAMP AREAS	1,5	Moderate	Too sandy	PLAYGROUNDS	1,2,3,4,	Severe	Too sandy, slope
	2,3,4,6, 7,8	Severe	Slope		5,6,7,8		
PICNIC AREAS	1,5	Moderate	Too sandy	PATHS AND TRAILS	1,2,3,5, 6,7,8	Severe	Too sandy
	2,3,4,6, 7,8	Severe	Slope		4	Severe	Slope, too sandy

CAPABILITY AND PREDICTED YIELDS - CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

SOIL	CAPABILITY		Pasture AUM/Ac												REMARKS
	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	
1,5	VIe		1	3											
2,3,4,6, 7,8	VIIe		-	1											

WOODLAND SUITABILITY

SOIL	POTENTIAL PRODUCTIVITY		WOOD SUIT. GROUP	MANAGEMENT PROBLEMS					NATIVE SPECIES
	SPECIES	SITE INDEX		EROSION HAZARD	EQUIPMENT LIMIT.	SEEDLING MORTALITY	WINDTHROW HAZARD	PLANT COMPET.	
1,2,3,4,5, 6,7,8	Sitka spruce	-	-	Severe	Severe	High	High	Slight	Sitka spruce, shore pine

WINDBREAKS

SOILS	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE
1,2,3,4,5, 6,7,8	Shore pine	30	Fair	Sitka spruce	30	Fair			

WILDLIFE HABITAT SUITABILITY

SOIL	POTENTIAL FOR HABITAT ELEMENTS								POTENTIAL AS HABITAT FOR:			
	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLAND WILDLIFE	WOODLAND WILDLIFE	WETLAND WILDLIFE	RANGELAND WILDLIFE
1,2,3,5, 6,7,8	Poor	Poor	Fair	-	Poor	Poor	V.poor	V.poor	Poor	Poor	V.poor	-
4	V.poor	V.poor	Fair	-	Poor	Poor	V.poor	V.poor	Poor	Poor	V.poor	-

RANGELAND

RANGE SITE NAME	SOIL	KEY SPECIES AND % COVER	POTENTIAL YIELDS		NORMAL SEASON	
			TOTAL lb/Ac	USABLE Ac/AUM	GROWING	GRAZING
None						

FOOTNOTES

1/ Ground water pollution hazard

OR-SOILS-1 12/72
FILE CODE SOILS 12

SOIL INTERPRETATIONS FOR OREGON U.S.D.A. SOIL CONSERVATION SERVICE

DATE: March 1974 GEO Netarts SERIES SOILS:

1. Netarts fine sandy loam, 7-30% slopes
2. Netarts sandy loam, 0-12% slopes
3. Netarts sandy loam, 12-40% slopes
4. Netarts loamy fine sand, 0-30% slopes

The Netarts series consists of well drained soils formed on old stabilized sand dunes. Slopes are 7 to 30 percent. Where not cultivated, the vegetation is shore pine, sitka spruce, salal, huckleberry, rhododendron and manzanita. Elevation is 50 to 200 feet. Average annual precipitation is 80 to 100 inches, average annual air temperature is about 52°F. and the frost-free period is about 180 to 210 days.

The surface layer is fine sandy loam and loamy fine sand about 13 inches thick. The subsoil is fine sand about 39 inches thick. The substratum is fine sand many feet thick.

Permeability is moderately rapid. Runoff is slow; the wind erosion hazard is severe. The total available water holding capacity is 3.5 to 5.0 inches. Water supplying capacity is 20 to 24 inches. The effective rooting depth is over 60 inches.

These soils are used mainly for forestry, homesites, and recreation. They are in the Coast Range and Valleys Resource Area (A1).

(Classification: Entic Haplorthods; sandy, mixed, mesic family).

ESTIMATED SOIL PROPERTIES

DEPTH FROM SURFACE (in.)	CLASSIFICATION			COARSE FRACT. OVER 3 IN.	% OF MATERIAL PASSING SIEVE				LIQUID LIMIT	PLASTICITY INDEX	PERMEABILITY (in/hr)	AVAIL. WATER CAP. (in/in)	SOIL REACTION (pH)	SHRINK SWELL POTENTIAL
	USDA TEXTURE	UNIFIED	AASHO		#4	#10	#40	#200						
0-13	Loamy fine sand	SM	A-2	0	100	85-100	65-80	20-35	-	NP	2.0-6.0	.09-.10	4.5-5.0	Very low
13-52	Fine sand	SM	A-2	0	100	85-100	55-70	15-30	-	NP	2.0-6.0	.05-.07	5.1-5.5	Very low
52-65	Fine sand	SM	A-2	0	100	100	60-75	20-30	-	NP	6.0->20.0	.05-.07	5.1-5.5	Very low

DEPTH (in.)	CONDUCTIVITY (mmhos/cm)	CORROSIVITY		EROSION FACTORS		WIND EROD. GROUPS	FLOODING			HIGH WATER TABLE			HYDROLOGIC GROUP
		STEEL	CONCRETE	K	T		FREQUENCY	DURATION	MONTHS	DEPTH (ft.)	KIND	MONTHS	
0-13	-	High	High	.17	5	2	None			> 6			A
13-52	-	High	High	.20			CEMENTED PAN		BEDROCK		FROST ACTION	REMARKS	
52-65	-	High	High	.20			DEPTH (in.)	HARDNESS	DEPTH (in.)	HARDNESS			
							-		> 60		-		

SANITARY FACILITIES AND COMMUNITY DEVELOPMENT

USE	SOIL	RATING	RESTRICTIVE FEATURES
SEPTIC TANK ABSORPTION FIELDS 1/	2	Slight to moderate	- Slope
	1,4	Moderate to severe	- Slope
	3	Severe	- Slope
SEWAGE LAGOONS 1/	1,2,3,4	Severe	Slope, percolates rapidly
SANITARY LANDFILL (TRENCH) 1/	2	Severe	Percolates rapidly
	1,3,4	Severe	Slope, percolates rapidly
SANITARY LANDFILL (AREA) 1/	2	Severe	Percolates rapidly
	1,3,4	Severe	Slope, percolates rapidly
DAILY COVER FOR LANDFILL	2	Fair	Slope, too sandy
	1,4	Fair to poor	Slope, too sandy
	3	Poor	Slope
SHALLOW EXCAVATIONS	2	Slight to moderate	- Slope
	1,3	Moderate to severe	- Slope
	4	Severe	Too sandy, slope
DWELLINGS WITHOUT BASEMENTS	2	Slight to moderate	Slope
	1,3,4	Moderate to severe	Slope
DWELLINGS WITH BASEMENTS	2	Slight to moderate	Slope
	1,3,4	Moderate to severe	Slope
SMALL COMMERCIAL BUILDINGS	2	Slight to severe	Slope
	1,3,4	Severe	Slope
LOCAL ROADS AND STREETS	2	Slight	
	1,3,4	Moderate to severe	Slope

SOURCE MATERIAL AND WATER MANAGEMENT

USE	SOIL	RATING	RESTRICTIVE FEATURES
ROADFILL	2	Slight	
	1,3,4	Moderate to severe	Slope
SAND	1,2,3,4	Poor	Excessive fines
GRAVEL	1,2,3,4	Unsuited	Excessive fines
TOPSOIL	1,2,3,4	Poor	Too sandy
POND RESERVOIR AREA	1,2,3,4	Severe	Percolates rapidly
EMBANKMENTS DIKES AND LEVEES	1,2,3,4	Moderate	Piping, percolates rapidly
DRAINAGE	1,2,3,4		Not Needed
IRRIGATION	1,2,3,4	Unsuited	Droughty
TERRACES AND DIVERSIONS	1,2,3,4		Not Needed
GRASSED WATERWAYS	1,2,3,4		Not Needed

CONTINUATION SHEET OR-SOILS-1 12/72 Netarts SERIES

RECREATION

USE	SOIL	RATING	RESTRICTIVE FEATURES	USE	SOIL	RATING	RESTRICTIVE FEATURES
CAMP AREAS	2	Slight to moderate	- Slope	PLAYGROUNDS	2	Slight to severe	Slope
	1,4	Moderate to severe	- Slope, too sandy		1,3,4	Severe	Slope
	3	Severe	Slope				
PICNIC AREAS	2	Slight to moderate	- Slope	PATHS AND TRAILS	2	Slight	
	1,4	Moderate to severe	- Slope, too sandy		1,3,4	Moderate to severe	Slope
	3	Severe	Slope				

CAPABILITY AND PREDICTED YIELDS - CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

SOIL	CAPABILITY														REMARKS
	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	
1,3,4	VIIe														
2	VIe														

WOODLAND SUITABILITY

SOIL	POTENTIAL PRODUCTIVITY		WOOD SUIT. GROUP	MANAGEMENT PROBLEMS					NATIVE SPECIES
	SPECIES	SITE INDEX		EROSION HAZARD	EQUIPMENT LIMIT.	SEEDLING MORTALITY	WINDTHROW HAZARD	PLANT COMPET.	
1	Sitka spruce	150 (est)	20	Severe	Slight	Slight to moderate	Slight to moderate	Slight	Sitka spruce, shore pine

WINDBREAKS

SOILS	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE
1,2,3,4	Shore Pine	35-40	Fair	Sitka Spruce	35-40	Fair	Western Red Cedar	35-40	Fair

WILDLIFE HABITAT SUITABILITY

SOIL	POTENTIAL FOR HABITAT ELEMENTS								POTENTIAL AS HABITAT FOR:			
	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLAND WILDLIFE	WOODLAND WILDLIFE	WETLAND WILDLIFE	RANGELAND WILDLIFE
1	Very poor	Very poor	Fair	-	Poor	Good	Very poor	Very poor	Poor	Poor	Very poor	-

RANGELAND

RANGE SITE NAME	SOIL	KEY SPECIES AND % COVER	POTENTIAL YIELDS		NORMAL SEASON	
			TOTAL lb/Ac	USABLE Ac/AUM	GROWING	GRAZING
	1	None				

FOOTNOTES

1/ Ground water pollution hazard

APPENDIX C

Oregon Transportation Commission
Beach Log Removal Policy

State of Oregon TRANSPORTATION COMMISSION

BEACH LOG REMOVAL POLICY - Adopted March 30, 1976

Ocean Shore Management Goal

To assure continuation of scenic and recreational values for public enjoyment at the ocean shore and to protect marine life and intertidal resources, beach logging as a general practice shall be prohibited unless such removal can be shown to provide a significant public benefit.

Proposals for beach log removal shall be considered in light of the following beach management objectives:

1. Management to protect scenic and recreational use values of driftwood. Enhance recreation by opening access routes where necessary, improving scenic values or providing needed beach use area.
2. Management to protect the traditional practice of gathering firewood and ornamental driftwood as long as these activities are compatible with the overall recreation and scenic uses of the beach.
3. Management to provide for the orderly retrieval of branded logs by the legal owner(s).
4. Management to protect shorelines subject to erosion.
5. Management to protect clam beds, intertidal marine life and wildlife habitats.
6. Management to promote public safety by reducing critical fire hazards, reducing critical hazards to shoreline structures or eliminating other public hazards.
7. Management to assist in fish passage or flood control.

BEACH LOG REMOVAL POLICY (continued)

8. Management to provide opportunities for public participation in decision making on proposed projects.
9. Management to protect legal interest of upland property owners and the state.
10. Management to minimize adverse impacts of log loading and hauling operations.

Individual beach areas where log removal would be permitted and the time period allowed for such removal will be determined by the state after evaluation by the State Parks and Recreation Branch, consultation with local government, the upland property owner and affected state agencies (State Land Board, State Fish Commission, State Wildlife Commission, State Geology and Mineral Industries, State Department of Environmental Quality, State Department of Forestry, State Land Conservation and Development Commission) to establish interests to be protected and considered.

Adequate public notice and provision for hearings will be handled in the same manner as beach improvement applications under the State Beach Law, as set forth in ORS 390.650.

The granting of emergency permits necessary to ensure public safety or the emergency retrieval of branded logs or lumber will be handled in the same manner as emergency beach improvements under the State Beach Law, as set forth in ORS 390.650.

Removal permits would be planned and executed to minimize adverse operational impacts and with adequate provisions for public safety, liability insurance and consideration of private property rights. Regulations and supervisory control in this regard will be determined by the State.

APPENDIX D

Oregon Transportation Commission
Beach Improvement Standards

BEACH IMPROVEMENT STANDARDS

The overall policies and guidelines for the protection of public rights and interests at Oregon's ocean shore have been described by the State Legislature in the Oregon Beach Law (ORS 390.605 - 390.770) which was passed in 1967 and revised in 1969. The law identifies existing state rights in the ocean shore areas seaward of a surveyed beach zone line which are to be protected for the free and uninterrupted use of the public.

The State Highway Division (whose State Parks Branch has jurisdiction over ocean beaches as recreation areas) was given the responsibility for considering applications and issuing permits for construction seaward of the beach zone line. Because of some concurrent jurisdictions, the Highway Division includes the Division of State Lands in such beach permit reviews. Reviews may also include the State Dept. of Geology, the State Fish and Wildlife Commission, Local Government, and other governmental agencies where applicable.

The Oregon Beach Law provides basic standards to be considered in the evaluation of beach improvement permit applications. These standards are presented in ORS 390.655 as follows:

> The standards shall be based on the following considerations, among others:
>
> (1) The public need for healthful, safe, esthetic surroundings and conditions; the natural scenic, recreational and other resources of the area; and the present and prospective need for conservation and development of these resources.
>
> (2) The physical characteristics or the changes in the physical characteristics of the area and the suitability of the area for particular uses and improvements.
>
> (3) The land uses, including public recreational use, if any, and the improvements in the area, the trends in land uses and improvements, the density of development and the property values in the area.
>
> (4) The need for recreation and other facilities and enterprises in the future development of the area and the need for access to particular sites in the area.

Supplementary to the standards presented in the Oregon Beach Law, the Oregon Land Conservation and Development Commission's Beaches and Dunes Goal (Goal No. 18, Implementation Requirements, Sec. 5) prescribes the following beach improvement criteria:

> (5) Permits for beach front protective structures shall be issued under ORS 390.605 - 390.770, only where development existed on January 1, 1977. The

> Oregon Department of Transportation, cooperating with local, state and federal agencies shall develop criteria to supplement the Oregon Beach Law (ORS 390.605 - 390.770) for issuing permits for construction of beach front protective structures. The criteria shall provide that:
>
> (a) visual impacts are minimized;
>
> (b) necessary access to the beach is maintained;
>
> (c) negative impacts on adjacent property are minimized; and
>
> (d) long-term or recurring costs to the public are avoided.

In accordance with ORS 390.650, the State Highway Engineer shall grant the permit if approval would not be adverse to the public interest.

To aid in the review of these standards, the following definitions as presented in ORS 390.605 and the State Planning Goals and Guidelines apply:

> An "improvement" includes a structure, appurtenance or other addition, modification or alteration constructed, placed or made on or to the land. (ORS 390.605)
>
> "Ocean shore" means the land lying between extreme low tide of the Pacific Ocean and the line of vegetation as established and described by ORS 390.770. (ORS 390.605)
>
> "Develop" - To bring about growth or availability to construct or alter a structure, to conduct a mining operation, to make a physical change in the use or appearance of land, to divide land into parcels, or to create or terminate rights of access. (State Planning Goals and Guidelines)
>
> "Development" - The act, process, or result of developing. (State Planning Goals and Guidelines)

Pursuant to the above directives and the evaluation of more than 100 permit applications since 1967, the State Parks Branch has formulated beach improvement standards. These standards are presented in the form of concerns to be evaluated prior to reaching a decision on permit approval or denial.

BEACH IMPROVEMENT STANDARDS

Each site on the ocean shore presents different conditions and applicants have varying project needs. Evaluations point up the relative significance of the general, scenic, recreational, safety, and other interests of the public.

The physical characteristics or the changes in the area which are important to the project will be reviewed. (These may include bank alignments, topography, shoreline materials and stability, width of the beach, past erosion, storm water levels, sand movement, water currents, adjoining structures, beach access, land uses, etc.)

Public opinion in response to public notice or hearings on the subject will be considered in evaluating each of the following concerns.

Considered together, these assist in the overall decision for granting, denying, or modifying the beach permit application in accordance with the intent of the legislature.

A. GENERAL CONCERNS EVALUATED - The following general concerns will be considered:

1. PROJECT NEED - There must be a critical need or adequate justification for the project to come seaward of the beach zone line and alter the ocean shore area.

2. PROTECTION OF PUBLIC RIGHTS - Public ownership or use easement rights seaward of the beach zone line will be adequately protected.

3. PUBLIC LAWS - The applicant must comply with federal, state, and local laws and regulations affecting the project.

4. PROJECT MODIFICATIONS - There are no reasonable project modifications that would better protect the public rights, reduce or eliminate problems, or avoid long term cost to the public.

5. PUBLIC COSTS - There are no reasonable special measures which might reduce or eliminate significant public costs. Alternatives such as nonstructural solutions, provision for ultimate removal responsibility for structures when no longer needed, reclamation of excavation pits, mitigation of project damages to public interests, or a time limit on project life to allow for changes in public interest have been considered.

6. COMPLIANCE WITH LCDC GOALS - In accordance with the Statewide Land Conservation and Development Commission Goal #18 for Beaches and Dunes, permit applications for beachfront protective structures seaward of the beach zone line will be considered only where development existed on January 1, 1977. The proposed project will be evaluated against the applicable criteria included within Goal #18 and other appropriate statewide planning goals.

   The project must be consistent with local comprehensive plans where such plans have been approved by LCDC.

B. SCENIC CONCERNS EVALUATED - Projects seaward of the beach zone line should be designed to minimize damage to the scenic attraction of the ocean shore area.

1. NATURAL FEATURES - The project should retain the scenic attraction of key natural features. (Beaches, headlands, cliffs, sea stacks, streams.)

2. SHORELINE VEGETATION - The project should retain or restore existing vegetation seaward of the beach zone line when vital to scenic values.

3. VIEW OBSTRUCTION - The project should avoid or minimize obstruction of existing views of the ocean and beaches from adjacent properties.

4. COMPATIBILITY WITH SURROUNDINGS - The project should blend in with the existing shoreline scenery. (Type of construction, color, etc.)

C. RECREATION USE CONCERNS EVALUATED - The project should not eliminate significant public recreation use or access within the ocean shore area.

1. RECREATION USE - The project should avoid eliminating significant public recreation use opportunities within the ocean shore area.

2. RECREATION ACCESS - The project should avoid blocking off or obstructing important public access routes within the ocean shore area.

D. SAFETY CONCERNS EVALUATED - The project should be designed to avoid or minimize safety hazards to the public and shoreline properties.

1. STRUCTURAL SAFETY - The project should not be a safety hazard to the public due to inadequate structural foundations, lack of bank stability, or the use of weak materials subject to rapid ocean damage.

2. OBSTRUCTIONAL HAZARDS - The project should not be an obstruction to pedestrians or vehicles going onto or along the ocean shore area.

3. NEIGHBORING PROPERTIES - The project should be designed to avoid or minimize ocean erosion or safety problems for neighboring properties.

4. PROPERTY PROTECTION - Beachfront property protection projects should be designed to accomplish a reasonable degree of increased safety for the on-shore property to be protected.

E. OTHER RESOURCE CONCERNS EVALUATED - Projects seaward of the beach zone line should avoid or minimize damage to especially significant resource sites or ocean shore conditions for the following where it is applicable:

1. SIGNIFICANT FISH AND WILDLIFE HABITATS
2. ESTUARINE VALUES AND NAVIGATION INTERESTS
3. SIGNIFICANT HISTORIC AND ARCHEOLOGICAL SITES
4. SIGNIFICANT NATURAL AREAS (Vegetation or Aquatic Features)
5. AIR AND WATER QUALITY OF THE OCEAN SHORE AREA.

RIM:aw
3/28/78

Dune Stabilization & Restoration

Methods & Criteria



Oregon Coastal Zone Management Association, Inc.

This report was prepared as part of a larger document addressing various beach and dune planning and management considerations and techniques. Other segments of the document and additional materials are:

I. BACKGROUND ON BEACH AND DUNE PLANNING:

Background of the Study

An Introduction to Beach and Dune Physical and Biological Processes

Beach and Dune Planning and Management on the Oregon Coast: A Summary of the State-of-the-Arts

II. BEACH AND DUNE IDENTIFICATION:

A System of Classifying and Identifying Oregon's Coastal Beaches and Dunes

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Beach and Dune Planning and Management: An Annotated Bibliography

VII. EDUCATIONAL MATERIALS:

Slide show: *Managing Oregon's Beaches and Dunes*

Brochure: *Planning and Managing Oregon's Coastal Beaches and Dunes*

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DUNE STABILIZATION AND RESTORATION: METHODS AND CRITERIA

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PREFACE

The following report presents the results of an in-depth analysis of sand stabilization methods for use on beach and dune areas on the Oregon Coast. This report was prepared under the auspices of the Oregon Coastal Zone Management Association and constitutes one element of an overall analysis of planning for, and managing, coastal beaches and dunes as required by Oregon's Beaches and Dunes Goal.

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I. INTRODUCTION

Sand dune stabilization is one dune management option. It is a necessary tool that when used properly can assist planners and developers in achieving the objectives of the Beaches and Dunes Goal. Dune stabilization should be used only where appropriate to accomplish a useful purpose, however.

Current knowledge and techniques are adequate to solve most wind erosion problems utilizing various stabilization techniques. The Oregon coast still benefits from the massive dune stabilization effort of the Warrenton Soil and Water Conservation District in Clatsop County. In recent years, however, dune stabilization projects in the Coos Bay dune sheet south of Florence have exceeded the Warrenton project.

Even though the technical knowledge is sound, not all Oregon coastal stabilization projects were necessary or desireable. Careful evaluation of site investigation reports in the future should help to avoid unnecessary stabilization endeavors. In short, dune stabilization projects should be used to accomplish the following:

(1) Protect natural features, lakes, wetlands, forests, estuarine habitats, etc.
(2) Protect manmade improvements such as highways, parks, shipping channels, structures, etc.
(3) Create deflation plain wetland habitat or upland habitat.
(4) Provide needed beach access.
(5) Serve as a tool to overcome hazardous situations in an effort to allow for beach and dune uses consistent with the Beaches and Dunes Goal.

Dune stabilization projects should not be used to promote the following:

(1) Creation of social program jobs.
(2) Creation of total vegetative cover for no valid given reason.

Where possible, dune stabilization efforts should be kept to the minimum amount required to accomplish the protection or enhancement needed. It should be required that consideration be given to small island or protective strip plantings as opposed to the Warrenton Dune project total vegetative cover approach. In some areas, after careful study, it may be appropriate to remove vegetation inappropriately placed in years past.

The bottom line in dune stabilization is think before you act, because stabilization actions can have a drastic impact on the entire dune sheet involved. Always bear in mind that all forms of dune stabilization are but a thin blanket of security over a still living dynamic landform waiting to be reactivated.

II. USE OF DUNE MANAGEMENT AREAS

It is suggested that due to the living, always moving, nature of coastal dune systems, that they be divided into identified management areas. A dune management area is a region established on the basis of significant natural or manmade boundaries that clearly separate it from interaction with surrounding well-defined zones of contiguous landform types such as foredune, deflation plain, open dunes and older stabilized dunes. The same management area should also be divided into defined areas of proposed future use reflecting the carrying capacity of that area in concert with the needs and long range objectives of the entire dune sheet.

Although not specifically addressed by the Beaches and Dunes Goal, such an approach would greatly assist in managing dunes for health and safety of human inhabitants and for the integrity of the overall dune system.

Dune management areas can be easily identified by focusing on existing natural or manmade boundaries such as highways, rivers, estuaries, etc. These barriers prevent major dune changes taking place in one area from affecting the adjoining areas. For example, in Lane County, a dune management area might be described as:

> from Siltcoos Outlet where it meets the Pacific Ocean upstream to U. S. Highway 101, then north using the Highway 101 as the eastern boundary to the south bank of the Siuslaw River, then downstream to the Pacific Ocean along the bank line, then south along the ocean beach back to the point of origin.

A dune management area in Coos County might be described as:

> from where Coos Bay meets the Pacific Ocean along the north bank upstream to U. S. Highway 101 at Menasha Causeway, then north to Tenmile Outlet, then downstream to the Pacific Ocean, and south along the beach to the point of origin.

The dune management area approach was addressed by the U. S. Army Corps of Engineers in their 1974 Coastal Reconnaisance Study which presents an excellent, detailed example of the technique and benefits from such an analysis. One example of this approach is the Corps' evaluation of the Coos Bay North Peninsula Area. The Table of Contents for this section clearly illustrates the systematic approach for management proposed by the Corps (see Figure 1). Careful study of the evidence developed in such a thorough approach allows for value judgements leading to specific use recommendations as shown in Figure 2.

The clear advantage in this approach is the visual identification of management objectives and a factual written background forming the basis of decision-making. Regardless of whether dune landforms are identified as management areas composed of various management units,

it is essential that dune stabilization efforts take into consideration the potential impact(s) of stabilization on the overall dune sheet or management area.

SITE NO. 9

COOS BAY NORTH PENINSULA AREA

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Figure 1. An example of the approach used by the U. S. Army Corps of Engineers in identifying dune management areas and units (U. S. Army Corps of Engineers, 1974, p. 303).

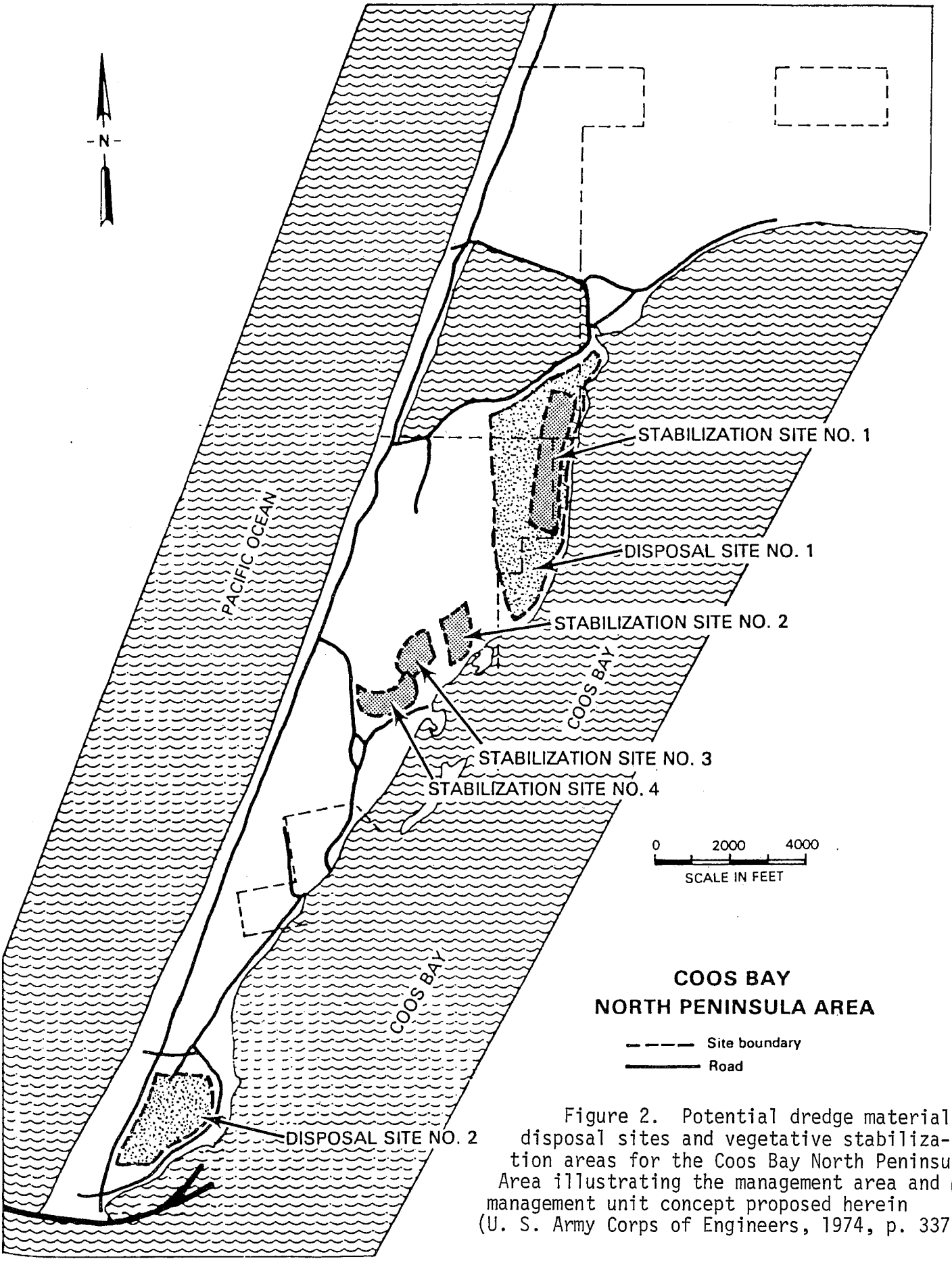


Figure 2. Potential dredge material disposal sites and vegetative stabilization areas for the Coos Bay North Peninsula Area illustrating the management area and management unit concept proposed herein (U. S. Army Corps of Engineers, 1974, p. 337).

III. STABILIZATION METHODS - VEGETATIVE

Due to the distinctly different growing conditions and physical problems associated with beaches and dunes such as proximity to the ocean, wave energy, wind exposure, soil fertility, etc., vegetative stabilization of dune landforms is discussed based on classification of the dune landform location. The following four major classifications are addressed:

(1) Foredune area--that area from the high tide line to the toe of the slope on the lee side of the foredune. In the event that a foredune is not present, the area 200 yards back from the high tide line is considered as the frontal area.
(2) Deflation plain area or wet inner dune area.
(3) Inner open dune areas not subject to ocean influence.
(4) Older stabilized dunes.

A. Foredune Area

Foredune areas along the Oregon coast will continue to be built on regardless of the potential risk. Recent court decisions in Lincoln County regarding Salishan Spit, and the City of Manzanita's decision to take an exception to allow buildings on the foredune area are only two examples. It is therefore the purpose of this section to suggest a sound vegetative management program to minimize the potential for hazard in such areas where development has occured or is allowed to locate.

For the purpose of this discussion, the foredune area is divided into three sections in order to address varying growing conditions: the frontal area, the top surface, and the lee side or reverse slope. These areas of the foredune are generally illustrated in Figure 3.

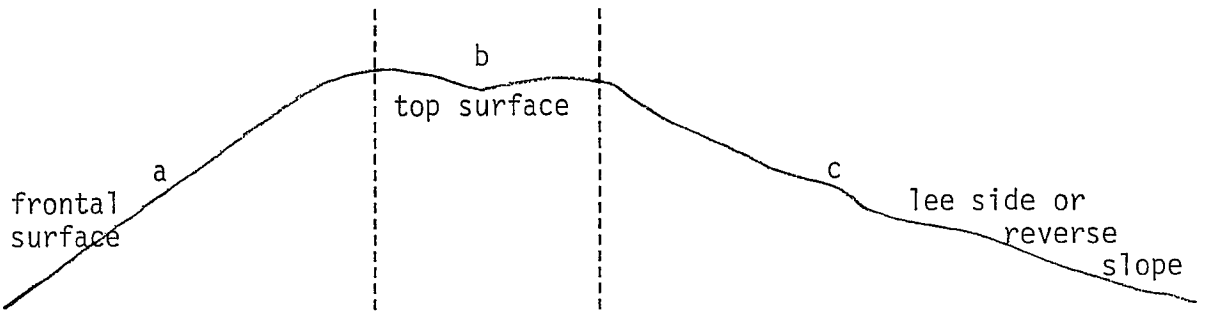


Figure 3. Cross section of a foredune illustrating the (a) frontal section of the foredune or frontal slope dune area facing the beach; (b) the top surface of the foredune or frontal area; and (c) the lee side of the foredune (that portion that receives protection from the wind).

1. Front of the Foredune

The front section of a foredune or frontal slope is best stabilized using European beachgrass (Ammophila arenaria) as indicated in Figure 4. Planting procedures would follow specifications for planting as noted

Planting procedures would follow specifications for planting as noted in Tables 1-3.



Figure 4. European beachgrass planting on foredune frontal area. Note planting pattern and density required to minimize erosion on this severely exposed site.

If the forward slope is steep or the problem is stabilizing coastal sand sea cliffs, then the density of planting and fertilizer requirements differ from the specifications noted in Tables 1-3 as follows:

Density: Density of planting should be at a spacing of 12" x 12" between hills and four to five culms per hill.

Fertilizer: Fertilizer rate would increase to 400 lbs. of 21-0-0 per acre. Application must take place immediately after planting. Failure to fertilize on the day of planting will result in all fertilizer ending up at the bottom of the slope where it is not needed.

Site Preparation: It should be recognized that failure to adequately control water erosion at the base of the foredune or sea cliff areas, makes it totally useless to stabilize frontal or top foredune areas. The water erosion from wave energy can cause massive slope failures and eventually wash away all the grass planted.

Where natural or manmade breaches in the foredune occur, the placement of sand fences parallel to the dune will normally collect enough wind-blown sand to repair the hole or depression. These fences should be used until the breached area is level with the average height of the foredune. Fence installation should be four foot lath woven wire fence with six foot steel fence posts every ten feet. Front fence should be braced at the end posts and at twenty foot intervals. Placement of two fences twenty to thirty feet apart is essential.

Table 1. Recommended specifications for planting European beachgrass (*Ammophila arenaria*). Specifications are also applicable to American beachgrass (*Ammophila breviligulata*) and Sea Lyme-grass (*Elymus mollis*)

INSPECTION:	1. Inspections should be made by the Contracting Officer or his authorized representative. A representative cross section of not less than 5% of the planted areas should be inspected to ensure compliance with the contract requirements.
	2. Nonconformance with any specifications classifies a plant hill as unsatisfactorily planted. A tolerance of 5% or 5 unsatisfactory plant hills per 100 is satisfactory. However, any amount over 5% should be applied as an equal percentage reduction of the acreage planted (payments being made on the basis of net acreage). When the deficiencies are 10% or over, the contractor should be expected to take steps to correct them.
PLANTING STOCK:	1. The stock to be planted is European Beach Grass (*Ammophila arenaria*). The source and quality of the planting stock should be approved by the Contracting Officer or the authorized representative.
DIGGING, STRIPPING AND TRIMMING:	1. The plants should be thoroughly cleaned by shaking sand and silt from the roots. Dead stalks and trash should be removed from the culms by stripping. The underground stems should be broken back so that one or two nodes remain. The grass culms should be sorted and tied into bundles weighing approximately 10 pounds; tops should be cut back so that the overall length of the planting stock measures about 20 inches.
PLANTING:	1. The grass is planted in hills with three live culms per hill.
	2. The spacing between hills should average 18 inches.
	3. The grass should be planted to a depth of 12 inches, with sand or silt for cover compacted to exclude air from the roots (nodes). The top of the plant should be upright and extend approximately eight inches above the ground.
	4. No planting should be done on any area until the moisture is within three inches of the ground surface. Nor should any planting be done when the temperature exceeds 60 degrees F. or when freezing conditions prevail.

Table 1, continued.

	5. All areas planted should be fertilized with coarse particle ammonium sulfate commercial fertilizer, applied at a rate of forty two pounds of available nitrogen per acre. Fertilizer should be applied when the wind is calm and the rain is steady; irrigation may be substituted for rain. The fertilizer should be applied at the time directed by the Contracting Officer of the authorized representative.
STORAGE:	1. The planting stock should be planted within eight hours of removal from the nursery areas or heeling-in beds. The heeling-beds should be a well-drained damp trench with the roots (nodes) covered to a depth of at least eight inches. Stock should not be held in heeling-in beds for a period exceeding two weeks. The supply of stock at the planting site must be kept in a cool shady place or otherwise protected against damage from excessive drying.
TRANSPORTATION AND HANDLING:	1. The planting stock should be handled and transported by any method that does not damage the planting stock or area.

Table 2. Basic recommended native plant material chart for dune stabilization

	SPECIES	C	S	BR	B&B	Seed	1-0	2-0	2to10	Size	A-1	A-2	A-3	A-4	CA	FC	SP	Season
Dune grasses	Ammophila arenaria - European beachgrass	x		x				x		20"	x	x	x	x	x		18"x18"	Nov. 15 - March 15
	Ammophila breviligulata - American beachgrass	x		x				x		20"	x	x	x	x		x	18"x18"	Nov. 15 - April 15
	Elymus mollis - sea lyme grass	x		x				x		20"	x					x	18"x18"	Nov. 15 - Feb. 15
	Poa macrantha - seashore bluegrass		x			x				15 lb.			x			x	cc	Sept. or Apr.-June
	Lupinus littoralis - seashore lupine		x			x				7 lb.	x	x	x	x		x	cc	Sept. or Apr.-June
	Lathyrus maritimus - purple beach pea		x			x				15 lb.	x	x	x	x		x	cc	April - June
Marsh	Carex obnupta - slough sedge	x		x						12"		x			x		18"x18"	April - July
	Deschampsia caespitosa - hairgrass	x		x						12"		x			x		18"x18"	April - July
	Juncus acuminatus - sharp fruited rush	x		x						12"		x				x	18"x18"	April - July
	Juncus effusus - tussock	x		x						14"		x				x	18"x18"	April - July
Woody	Lupinus arboreus - tree lupine		x			x				30 lb.	x	x	x	x		x	cc	April - June
	Gaultheria shallon - salal		x		x			x		1 gal.		x	x	x	x		3'x3'	Dec. - Feb.
	Vaccinium ovatum - evergreen huckleberry		x		x			x		1 gal.		x	x	x	x		3'x3'	Dec. - Feb.
	Cytisus scoparius - scotch broom		x	x			x			14 "		x	x	x		x	8'x8'	Dec. - March
	Myrica californica - wax myrtle		x		x			x		1 gal-10'		x	x	x	x		8'x8'	Dec. - Feb.
	Picea sitchensis - sitka spruce		x	x	x			x		12"-10'		x	x	x	x		8'x8'	Dec. - Feb.
	Pinus contorta - shore pine		x	x	x			x		12"-20'		x	x	x	x		8'x8'	Dec. - Feb.

C - colonizer-initial stabilizer
S - secondary-permanent S
BR - bare root stock
B&B - balled and burlapped
1-0 - one year old
2-0 - two year old
2 to 10 - two to ten years old
Size - height or pounds per acre
A-1 - foredune or frontal areas
A-2 - deflation plain or wet interdune
A-3 - open sand areas
A-4 - older stabilized dunes
CA - commercially available
FC - field collection
SP - spacing inches, feet, cc-complete cover
Season - planting dates (optimum)

Table 3. Transplants needed with varied spacing requirements

Transplant Type	Spacing	1,000 sq. ft.	1 Acre	100 Acres
Beachgrass - 3 culms per hill	12"x12"	3,004	130,680	13,068,000
Beachgrass - 3 culms per hill	18"x18"	1,335	58,080	5,808,000
Beachgrass - 3 culms per hill	24"x24"	751	32,670	3,267,000
Beachgrass - 3 culms per hill	30"x30"	480	20,880	2,088,000
Beachgrass - 5 culms per hill	12"x12"	5,006	217,800	21,780,000
Woody species - 1 transplant per hill	3'x3'	111	5,840	484,000
Woody species - 1 transplant per hill	6'x6'	28	1,210	121,000
Woody species - 1 transplant per hill	8'x8'	16	680	68,000
Woody species - 1 transplant per hill	12'x12'	7	302	30,200

Note - A word of caution: Always order 3% more to offset heavy planting.

Maintenance: Continual maintenance is required on beach grass for about the first two years; after that, only periodic maintenance is required. If a large blow-out develops, the most effective maintenance procedure is to replant with beach grass and then spread brush on the steep edges. Refertilizing all weak areas seems to bring back sufficient cover if the plant root systems have not been uncovered.

2. Top Surface of the Foredune or Frontal Area

Normally the top surface of the foredune experiences severe wind erosion and sand accretion. For this reason, European beachgrass is the recommended plant material for vegetative stabilization. Like the steep frontal areas, 12" x 12" spacing and fertilizer application of 400 lbs. per acre of 21-0-0 are recommended (see Tables 1-3).

Secondary plantings of other species are not recommended due to the hostile environment normally present at these sites. Annual application of 200 lbs. per acre of 21-0-0 applied in March during the rains will provide adequate maintenance.

3. Lee Side of the Foredune

The reverse slope or back area, if open sand, should be stabilized using European beachgrass planted to standard specifications (e. g., three culms per hill using 18" x 18" spacing, see Tables 1-3).

Planted in well established beach grass stands, the following secondary plant material will provide some permanent vegetative cover and alleviate some of the fire hazard associated with old, dense stands of beach grass. Refer to Table 2 for planting specifications pertaining to the following secondary plant material.

Gaultheria shallon	salal
Vaccineum ovatum	evergreen huckleberry
Pinus contorta	shore pine

In addition, the following plant species can be seeded and will provide some fire protection:

Lathyrus maritimus	purple beach pea
Lupinus littoralis	seashore lupine
Lupinus arboreus	tree lupine

Figure 5 illustrates a man-created foredune resulting from the Warrenton Soil and Water Conservation District project. The foredune was created using a combination of the stabilization techniques described herein, including sand fences and plantings of European beachgrass. The foredune, established in 1935, has continued to maintain itself while affording protection to inland areas.



Figure 5. Man-created foredune in the Warrenton Soil and Water Conservation District dune stabilization project several years after initial European beachgrass plantings. Note the vigorous growth resulting from the fertilizing effect of the annual wind-blown beach sand entrapped by the beach grass.

B. Deflation Plain or Wet Interdune Area

Most of the vast open sand deflation plains along the Oregon coast have become vegetated by natural plant invasion. This natural plant succession process is the result of the introduction of European beachgrass from Holland in the early 1900's. Plantings and natural spreading of this species quickly resulted in the establishment of foredunes that created living barriers cutting off the supply of wind-blown beach sand to the interior areas. Wind erosion in areas back of the foredune scoured the areas down to the water table creating a perfect seed bed. Wind-blown and animal carried seeds quickly became established in these plains of deflation, and entire areas were soon vegetated. The introduction of beaver in the Oregon Dunes National Recreation Area hastened this process of vegetation establishment by damming up drainages which raised the water table and created conditions even more attractive to vegetative establishment.

In some areas of the Oregon coastal dunes, open areas of sand behind the foredune still exist. Other open sand areas may appear on the scene as a result of man's interference with the dune system or natural causes such as fire.

Due to the high water table which characterizes the deflation plain areas, very little building activity is expected to occur in this area. Further, septic tank problems, interference with waterfowl habitat, and

HUD Floodplain Insurance Program regulations will probably make it difficult to build on this landform. However, stabilization efforts may be needed to protect some adjoining feature or to provide the opportunity for creation or enhancement of wetland habitat. With this in mind, the following vegetative stabilization methods are recommended.

1. Wildlife Habitat and Permanent Vegetation Stabilization

Carefully selected areas that have scoured down to the summertime water table can be seeded with a mixture of grasses and legumes to accomplish the creation or enhancement of wildlife habitat or stabilization of areas to protect adjoining features. Such seedings should take place in late May or early June, depending on wind conditions. Planting too early can result in a planting failure due to the lowering water table withdrawing moisture from the plant roots. Such planting failures are usually irregular, causing uneven erosion and deposition over the entire area, and compounding the problem of revegetating the area sometime in the future.

The seed and fertilizer mixtures recommended have proved successful for many years in the Oregon Dunes National Recreation Area, as is evidenced in Figures 6 and 7.



Figure 6. Deflation plain planting for establishment of wildlife habitat three weeks after seeding. The seeding was the result of a cooperative effort between the land owner, the U. S. Forest Service, and the Oregon Fish and Wildlife Department, and was conducted near the Siltcoos Outlet, Lane County, Oregon.



Figure 7. Five-month old deflation plain planting for supplemental waterfowl feed, South Jetty Road, Florence, Oregon. Note stand of barley that will soon be flooded by winter rains.

Suggested Seed Mixture:

Species	Common Name	lbs./acre
Hordeum	barley	100
Lolium perenne	perrenial ryegrass	7
Festuca arundinacea	alta fescue	22
Lotus corniculatus	birdsfoot trefoil	4

All seeds suggested are available from commercial seed sources. In addition, any one of the three native species listed in Table 2 for possible use in deflation plain plantings could be added to the mixture noted above. However, all three species must be field collected. Since collection sites are not identified, commercially available seed is the least costly approach at this time.

Fertilizer applied at the time of seedings should be at a rate of 200 lbs per acre of 13-13-13. The seed and fertilizer are usually applied using a tractor drawn double disc drill and fertilizer spreader. One should be aware that pockets of semi-quicksand exist in the deflation plain areas; in the past costly delays have been experienced by equipment sinking.

2. Pacific Flyway Supplemental Feed Plantings

In this application, permanent grasses are not seeded. Instead barley (Hordeum) is seeded annually at a rate of 100 lbs. per acre in an attempt to provide feed for migrating waterfowl. Since seed production is desired, the recommended fertilizer rate is 400 lbs. per

acre of 15-15-15. If the site is used year after year, then site preparation in the form of discing is advisable prior to planting. In most areas, slough sedge (Carex obnupta) usually invades the planted areas. Thousands of migratory waterfowl have benefited from this type of dune stabilization efforts in the Oregon Dunes National Recreation Area.

C. Marsh Creation

The opportunity exists in sand spit deflation plains that are tidaly influenced or where dredge material storage areas are located for marsh creation or enhancement (see Figures 8, 9, and 10). Four plant species have been tested by the U. S. Army Corps of Engineers Waterways Experiment Station for this purpose. In this regard, Ternyik (1978) developed specifications for planting four marsh species (see Table 4) as follows:

Carex obnupta	slough sedge
Deschampsia caespitosa	hairgrass
Juncus acuminatus	sharp-fruited rush
Juncus effusus	tussock

Note that the specifications deal only with transplanted materials rather than seeding. Ternyik (1978) indicated total failure after extensive seeding research efforts. It should be clearly understood that these recommendations are for freshwater marsh creation sites only.

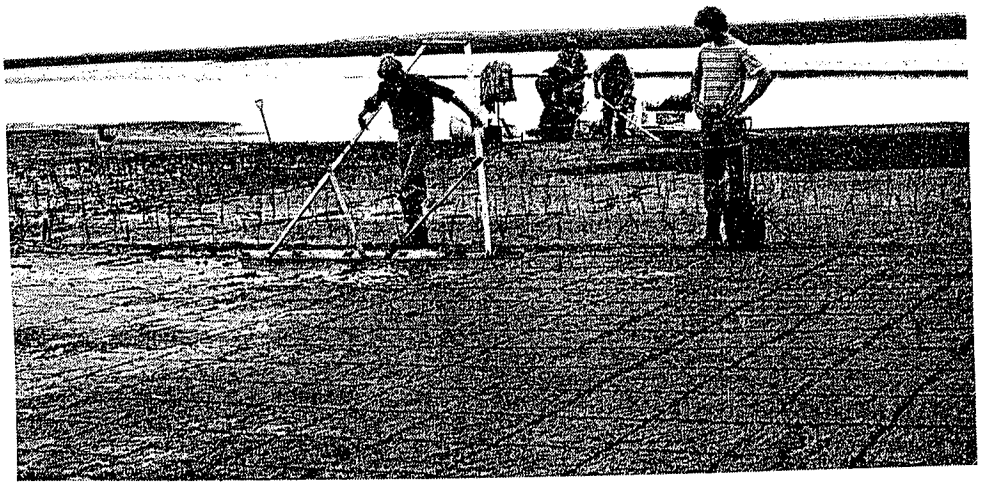


Figure 8. Marsh planting operations at Millers Sand Island, Clatsop County, Oregon. Note method of marking required spacing.



Figure 9. Hand planting slough sedge (Carex obnupta) for marsh habitat establishment, Millers Sand Island, Clatsop County, 1976.



Figure 10. First season's growth of hairgrass (Deschampsia caespitosa) planting for establishment of new marsh habitat, Millers Sand Island, Clatsop County, Oregon.

Table 4. Recommended specifications for planting hairgrass (Deschampsia caespitosa). Specifications are also applicable to slough sedge (Carex obnupta), sharp-fruited rush (Juncus acuminatus), and tussock (Juncus effusus).

INSPECTION:	1.	Inspections should be made by the Contracting Officer of authorized representative. A representative cross section of not less than 5% of the planted areas should be inspected to ensure compliance with the contract requirements.
	2.	Nonconformance with any specifications classifies a plant hill as unsatisfactorily planted. A tolerance of 5% or 5 unsatisfactory plant hills per 100 is satisfactory. Any amount over 5% should be applied as an equal percentage reduction of the acreage planted (payments being made on the basis of net acreage). When the deficiencies are 10% or over, the contractor should be expected to take steps to correct them.
PLANTING STOCK:	1.	The stock to be planted is hairgrass (Deschampsia caespitosa). The source and quality of the planting stock should be approved by the Contracting Officer or authorized representative. Age of planting stock should not exceed two years.
DIGGING AND TRIMMING:	1.	The plants are dug by passing a shovel under the root system and prying upward. Plants should then be dipped in water to clean the root system. The plant is then separated into sprigs of four to seven culms. The tops should be cut back so that the overall top growth length of the planting stock is eight to nine inches. The roots should be cut back so that the overall length does not exceed five to six inches. Plants should not be tied into bundles.
STORAGE:	1.	The planting stock should be planted within four hours of removal from the nursery areas or intertidal storage areas. All transplants should be stored in ventilated plastic containers that allow free flow of tidal water. Containers should be placed in holes dug in the upper one-third of the tidal range. Tidal waters should cover the plants at high tide. Root systems should be protected from excessive drying at all times. Plants should not be stored in tight containers; nor should they be stored over seven days.
TRANSPORTATION AND HANDLING:	1.	The planting stock should be handled and transported

Table 4, continued.

		by any method that does not damage the planting stock or surrounding marsh areas. Planting stock root systems must be kept cool and moist at all times. Main plant stems must not be broken. Dry root systems or broken main stems are grounds for rejection of planting stock prior to planting.
PLANTING:	1.	The grass should be planted in hills and there should be four to seven live culms (stems) per hill. All culms should have a minimum top height of eight inches.
	2.	The spacing between hills should average one-half meter.
	3.	The grass should be planted to a depth of five to six inches. The sand or silt used for cover should be firmly compacted to prevent float outs. The opening must be large enough to prevent J rooting. The top of the plant should be upright and should extend seven to eight inches above the ground.
	4.	No planting should be done on any area until tidal waters have been off the surface for one hour. Nor should any planting be done when temperature exceeds 65 degrees F. or when freezing conditions prevail. The Contract Officer or representative should have full authority to halt work when conditions become unfavorable.
	5.	Planting should be done by hand or by machine provided that machines used do not cause excessive damage to the benthic community. The Contracting Officer or representative should make the decision on an allowable method.
FERTILIZATION:	1.	All areas planted should be fertilized with commercial fertilizer 12-12-12 applied at the rate of 800 lbs. per acre. The fertilizer should be applied no sooner than two weeks after planting and on a day when the wind is calm. Fertilizer can be broadcast by hand or machine. The fertilizer should be applied at the time directed by the Contracting Officer or representative.
CHANGES:	1.	Any changes in the specifications should take place only after the Contractor has received written orders from the Contracting Officer.

C. Inner Open Dune Areas

Contrary to popular belief, the open dune areas present less of a problem for establishing vegetative stabilization than older stabilized dunes. The reason for this is that the landform can be changed before plantings begin. Physical changes, such as leveling, filling, slope alteration, etc. can be accomplished without disturbing the existing plant community root systems since the area is void of vegetation to begin with. In addition, debris from construction activities such as preconstruction clearance, is not present. However, due to the multitude of different individual site problems, great care must be taken to select the proper stabilization program for the individual project proposed. This information should be in the content of the site investigation report. In addition to proper plant species selection and planting techniques, site preparation is advisable. Vast areas of open sand have been successfully stabilized with dramatic results as was the case in Clatsop County as a result of the Warrenton Dune Stabilization Project illustrated in Figures 11 and 12.

Due to the size of the job and short planting seasons, a tightly followed work schedule must be adhered to. While it is true that this is one of the easiest dune forms to stabilize, it is also the area with the best opportunity for making costly mistakes. Foolish mistakes such as planting out of season, use of poor plant material, failure to contour, or improper fertilizer programs, will lead to predictable stabilization failures costing hundreds of thousands of dollars. Added to this is a normally unsightly mess that is extremely difficult to restabilize. For this reason, pay strict attention to the recommendations covered in this section.

In general, stabilization procedures are as follows:

Site preparation: Site preparation, if needed, may consist of leveling extreme humps, ridges, or steep slopes utilizing a dozer. Hummocks are normally left intact, or sometimes are created in order to give the area more character. In most cases, it is desirable to maintain the general contour of the dunes with only slight surface modification. Rough dune areas usually require a greater amount of hand planting and special treatments leading to increased costs of initial stabilization and maintenance.

Planting technique: Initial stabilization of open dune areas along the Oregon coast is normally accomplished by planting European beachgrass (Ammophila arenaria) (see Tables 1-3). In recent years, due to increased labor costs, all large areas (five acres or more) are planted by machine. One operator on a tractor and four skilled people feeding two planting units can, under optimum conditions, plant 180,000 culms of beach grass in one day (see Figure 13). The same amount would take a crew of 25 to 30 hand planters. Bear in mind that a 100 acre dune stabilization project planted to European beach grass will require 5,800,000 culms of beach grass. The source and availability of the planting stock must be identified well in advance of the proposed project and should be included within the site

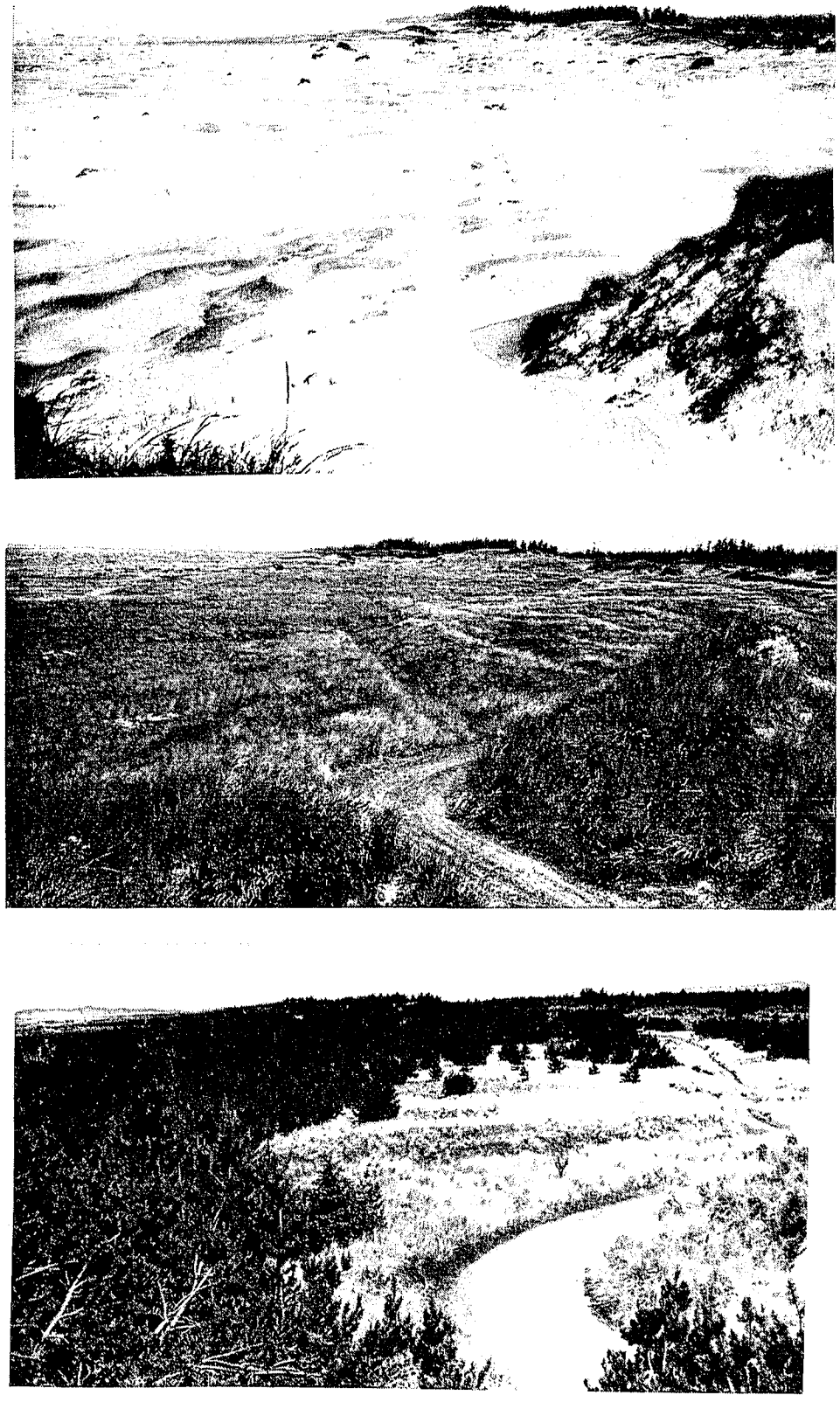


Figure 11. The Warrenton dune stabilization project near Delaura Beach, 1937, 1942 and 1955. Photographs illustrate area prior to stabilization efforts, following initial stabilization with European beachgrass and secondary plantings, and after plantings of shore pine.





Figure 12. The Warrenton Soil and Water Conservation District stabilization project after initial plantings of beach grass, 1937. Note that the deflation plain and open dune areas have all been treated with beach grass. Lower photo illustrates the same area five years following initial stabilization. The stabilization effort has resulted in complete protection of the Sunset Lake Beach access road. Note the solid band of plantings of scotchbroom providing a fire break.



Figure 13. Machine planting of European beachgrass in open dune area.

investigation report.

Contoured Plantings: Large areas with severe wind exposures and bowl areas should be planted in irregular patterns as illustrated in Figure 14. If hand planting, rows should be alternated from diagonal to parallel. When machines are used, rows should not be parallel to prevailing winds (see Figure 15). Plantings that are done without regard to wind patterns and the appropriate pattern planting can blowout within 24 hours (see Figure 16).

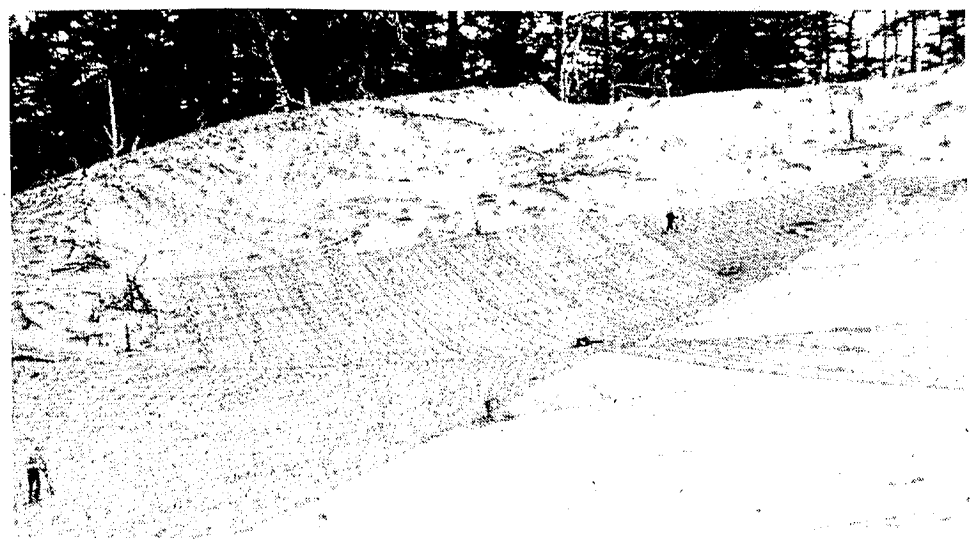


Figure 14. Use of pattern planting to avoid in-row blowout of initial beach grass plantings, Carter Lake, Douglas County.



Figure 15. U. S. Forest Service dune stabilization project at North Bend, Oregon, illustrating initial beach grass machine planting four months after planting. Note the contoured rows planted to prevent in-row erosion.

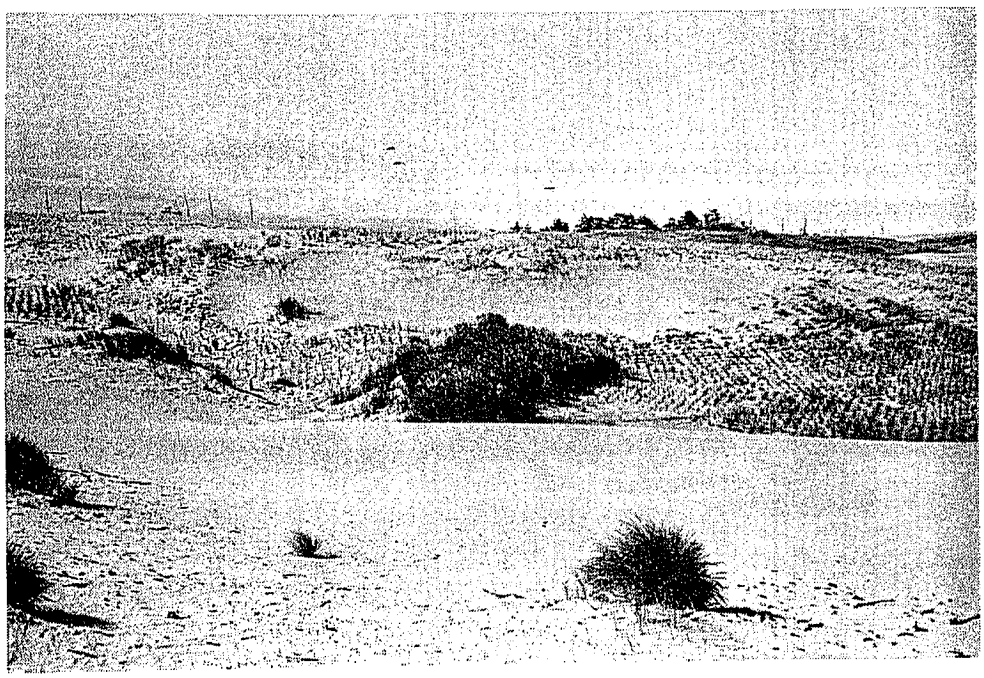


Figure 16. A blowout failure on the northwest edge of an European beachgrass planting in Lane County. Failure to restabilize this blowout could lead to eventual destruction of the entire planting.

Planting dates: Planting dates are critical in open sand areas. While the ideal season is November 15th to March 15th, the best success is with plantings put in by January 31. There are, however, exceptions to this rule in open sand areas. If summer winds have created a multitude of transverse-ridge dunes, and winter winds have not yet begun, it is better to postpone planting until the natural leveling process has taken place. If the area is exposed only to southwest winds, then late plantings in February and March can avoid possible damage from severe southwest wind storms of 45 to 80 miles per hour. In areas subject to northwest winds, plantings should be performed in early November to January 15th for best results.

Fertilization: Fertilizer application is a critical factor in establishing dune vegetation as illustrated in Figure 17. The timing of fertilizer application with regard to rains can be critical in the success or failure of a stabilization project. Steep banks or slopes must be fertilized at the time of planting; other areas should be fertilized within two weeks of planting. Fertilizer application prior to planting can be successful, however, if it becomes dry and windy, the fertilizer will shift from the higher elevations to the lower spots and in some cases may blow off the area entirely. It is therefore best to fertilize during rain storms when the wind is less than five miles per hour.



Figure 17. Two year old planting of European beachgrass at Siltcoos Outlet, Lane County. Light area in center of photograph received zero fertilizer application while the rest of the planting received the normal 200 lbs. per acre 21-0-0 application at time of planting.

The method of fertilizer application can also be crucial to the success of the project. Hand broadcasting of fertilizer is the

surest method of obtaining the total desired coverage. Spreading by airplane, while fast and cost efficient, can result in problems with drifting. Fertilizing by tractor is not feasible in large areas as the weight of the tractor destroys the planted vegetation. Ideally, aerial application by helicopter should be used in large projects.

Recommended rates and mixtures for beach grass plantings is 200 lbs. of ammonium sulphate 21-0-0 per acre. However, in all plantings put in after February 15th, or on steep banks, the rate should be 400 lbs. of 21-0-0 per acre. Careful selection of a coarse grain fertilizer can help alleviate windshift problems.

Finally, if for some reason secondary permanent plantings are not put into the initial beach grass planted areas, a continuing annual fertilizer program is a necessity. Failure to do this can result in a threat to the entire stabilization project and any development investment put in (see Figure 18).

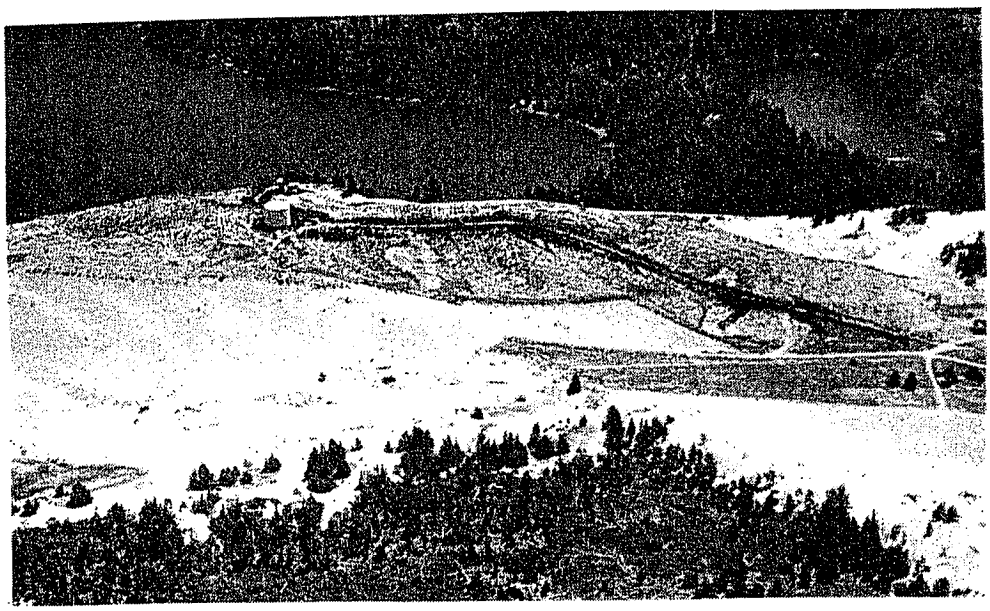


Figure 18. Dune stabilization project threatened with total failure due to lack of fertilizer. No secondary permanent plantings were made and beach grass has starved out. The water tower, pipes and road are threatened by the lack of a vegetative maintenance program in this situation at Clear Lake in Lane County.

Irrigation: If irrigation is not available and winter rains cease, the fertilizer will be displaced in a windshift pattern. All depressions will receive the fertilizer and higher elevations where it is most needed will have none. Water is necessary to make the fertilizer available to the root system; if this does not occur, there will be no new growth and massive blowouts can occur.

Secondary plantings: After the area has been initially stabilized with European beachgrass, it is only conditionally stable -- the dune area has been temporarily tamed by a blanket of grass. Any disturbance to the grass cover can initiate the erosion process. Therefore, permanent secondary plantings should be added into the sand stilling grass stands following the second growing season. Secondary plantings can be either woody species or permanent grasses and legumes (see Table 2). Figures 19 and 20 illustrate secondary stabilization options. A constant vegetation maintenance program should be a part of the development and stabilization plan. Because open dune areas are generally removed from ocean salt spray influence, a wide variety of plant materials can be used for secondary plantings. Plant size will depend on wind exposure.



Figure 19. A secondary planting of permanent grasses and legumes in an European beachgrass stabilized area in Clatsop County. Such secondary plantings provide excellent fire protection and permanent stabilization of the entire area.



Figure 20. A secondary planting of woody species in an European beachgrass stabilized area, Wax Myrtle Campground, Lane County. Open grass areas provide for varied habitat.

In contrast to the general stabilization procedures noted thus far, specific specifications for secondary or permanent stabilization in inner open dune areas is presented in the following discussion.

In most areas, the beach grass plantings are two years old, when follow-up plantings of 1-0 scotchbroom (Cytisus scoparius) and 2-0 shore pine (Pinus contorta) are planted on eight foot centers. Planting season is normally December to February. The scotchbroom is used as a temporary plant with varied benefits. First, its growth is more rapid than the pine so it provides early wind protection for about eight years. Since it is a legume, it provides some nitrogen while also providing good upland bird cover and feed. Finally, it is very fire resistant.

The scotchbroom is usually shaded out by the shore pine between the 10th and 12th year. This method results in a dense shore pine forest habitat with natural intrusion of other woody species from nearby plant communities. Great care should be taken to plan for vegetative firebreaks in large plantings of this kind. Two species are most commonly used. The best is purple beach pea (Lathyrus maritimus) seeded in a permanent grass mixture; seed treatment is H_2SO_4 or scarify. Fires with intense heat rarely burn over twelve feet into a stand of this plant. The other plant is scotchbroom (Cytisus scoparius) 1-0 nursery-grown stock planted on three foot centers in solid bands 50 feet wide. The latter is very expensive due to nursery costs.

The second method used mainly in the Clatsop Plains project is first discing of beach grass followed by seeding to permanent grass mixture (see Figure 21). Due to undependable rain in the Spring, a fall planting should be considered. Seed mixture for upland drier sites is as follows:

Suggested Seed Mixture:

Species	Common Name	lbs./acre
Lupinus littoralis	seashore lupine	7
Poa macrantha	seashore bluegrass	15
Lathyrus maritimus	purple beach pea	15
Festuca rubra	creeping red fescue	8

If the above first three native species are not available, then an alternate mixture of seed normally available on the commercial market would be as follows:

Alternative Seed Mixture:

Species	Common Name	lbs./acre
Festuca rubra	creeping red fescue	8
Lolium multiflorum	annual ryegrass	5
Vicia villosa	hairy vetch	25
Festuca arundinacea	alta fescue	10

All seedings should receive fertilizer application at 300 lbs. 12-12-12 per acre.

When selecting sites for upland habitat improvement, one should consider the complete habitat for all expected users. A mixture of forest, grasslands, and open sand is most desireable. The upland dry dune sites lend themselves to complete multiple use management for wildlife habitat and human recreation. Long range effects of creating new vegetative habitats should be carefully analyzed before planting.

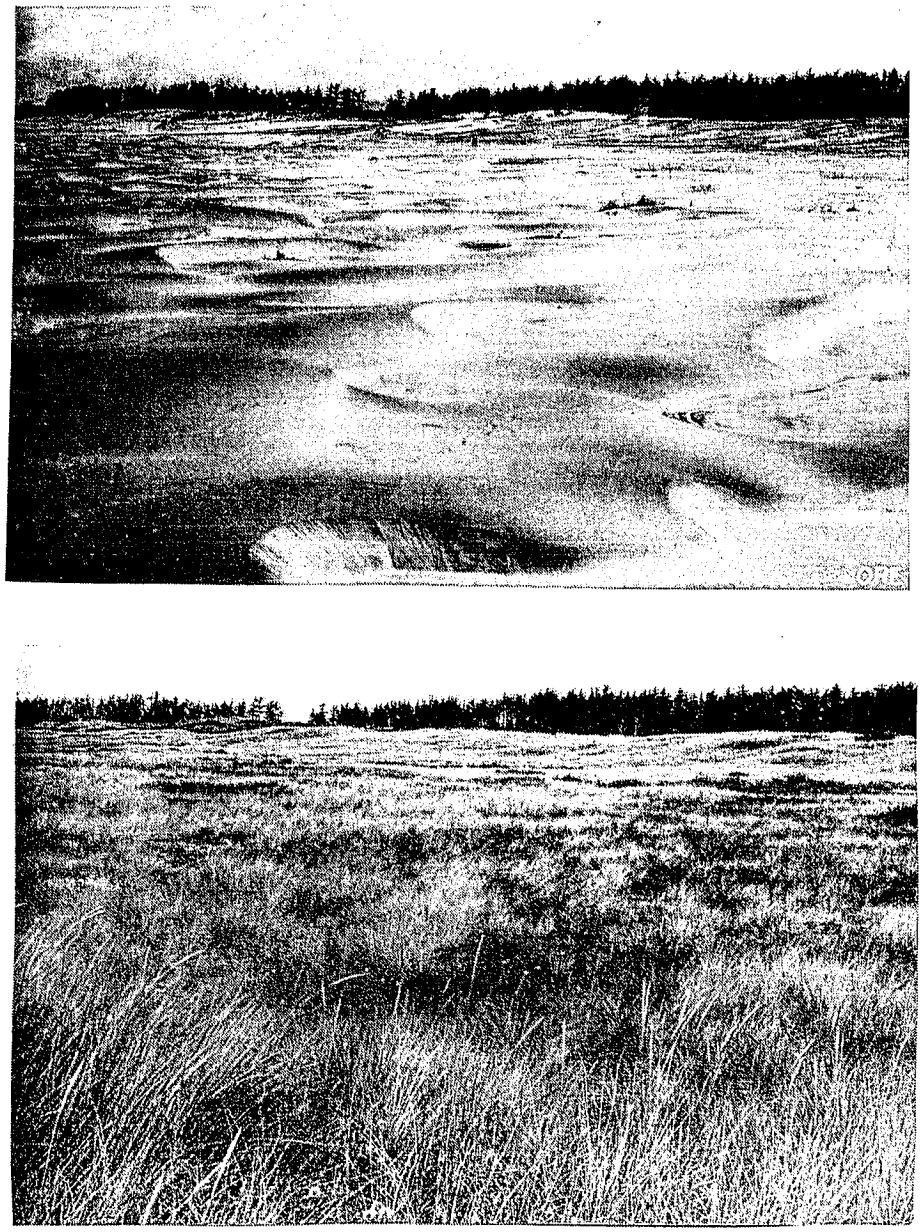


Figure 21. The Warrenton Soil and Water Conservation District dune stabilization project before stabilization in 1937 and after plantings of initial stabilization and secondary plantings of permanent grasses and legumes. Area is now set aside for wildlife habitat.

Other considerations that must be addressed when stabilizing inner open dune areas are as follows:

(1) Because of varying growth rates due to unpredictable weather conditions, it is recommended that no construction take place until a vegetation expert advises that the area is ready to accommodate safely construction activities. The period of time normally required is a minimum of two years.

(2) If complete stabilization has not taken place, drifting sand trapped in streets may completely plug city storm drain systems, as illustrated in Figure 22. This can be avoided by constructing curbs after stabilization is complete.

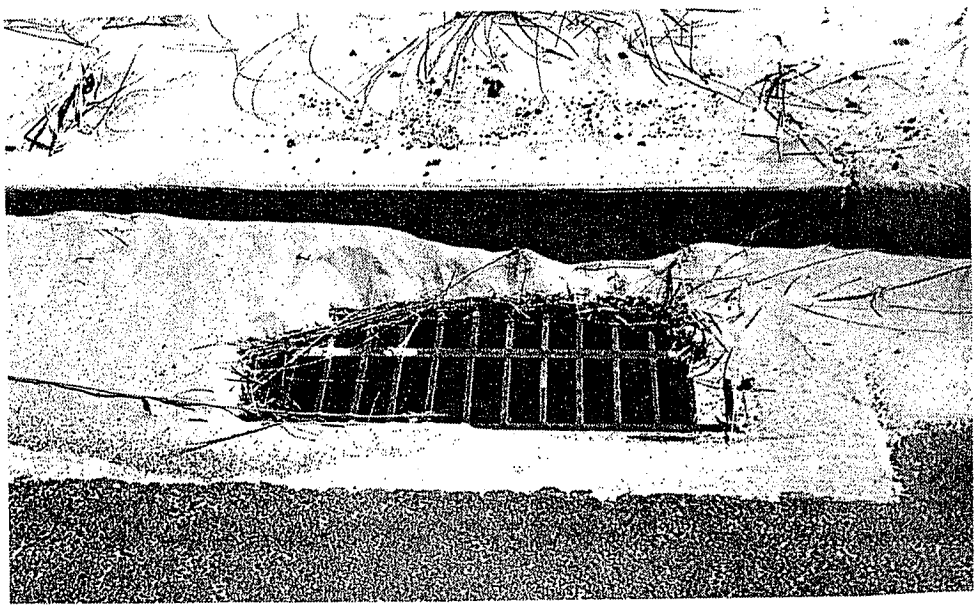


Figure 22. The result of insufficient sand stabilization in a development project. Sand build-up in streets will be flushed into city storm drain systems when rains occur; could lead to serious failure of storm drain system completely off the property.

(3) The most common problem associated with use of Tables 1 and 3 is the lack of understanding of the term "beach grass culm". Figure 23 illustrates what is meant by a culm. The mistake of identifying a clone as a culm leads to costly overplanting with little or no added benefit.

(4) Firebreaks in older stands of beach grass are a necessity. Structures built in areas of beach grass stabilization should have all beach grass within five feet removed or fire retardant species should be introduced by seeding.

The open dune management recommendations as presented herein, when followed carefully, can provide for man's use of dynamic dune forms. An excellent example of what can be accomplished by adhering to stabilization

criteria and maintenance requirements is reflected by the development of Salishan, Lincoln County (see Figure 24).

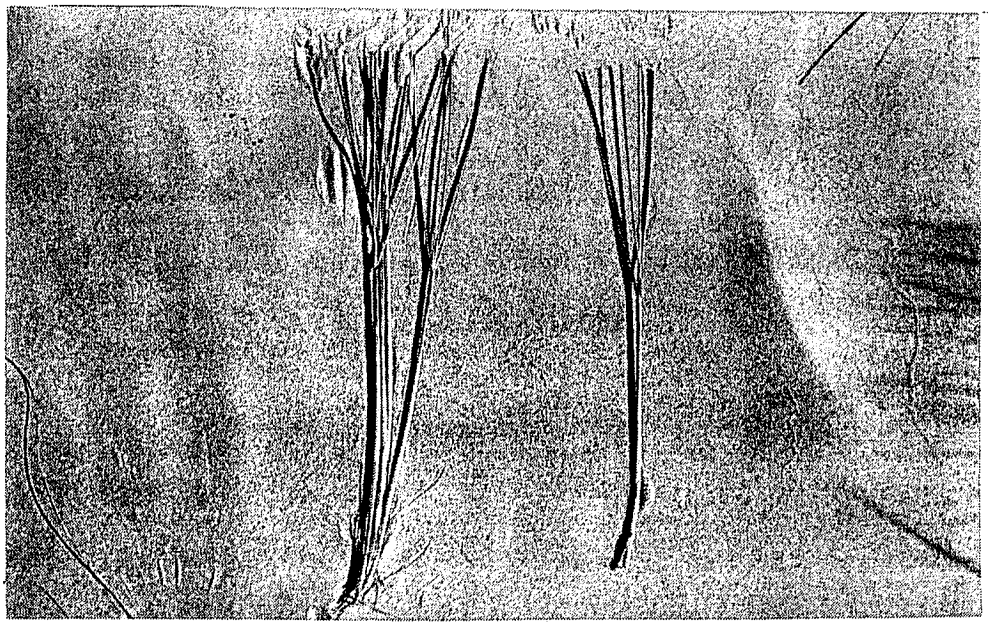


Figure 23. An illustration of the difference between one culm or single stem of beach grass, and several culms attached forming a clone. All plant requirements shown in work specifications will indicate number of culms required.



Figure 24. A comparison (1962 and 1979) of the Salishan development, Lincoln County, illustrating the site prior to stabilization and following initial and secondary stabilization efforts.

D. Older Stabilized Dunes

This area, because of its stable appearance, is where most development pressures are likely to occur. In defining older stabilized dunes, most people include well stabilized dunes with a 100 year old climax vegetative cover even if there has not been significant soil development. This leads to the misplaced confidence that no substantial stabilization problems exist.

Actually, in some of the older vegetated ridge systems or sea cliff back areas, major problems can be encountered. Older, mature woody species, because of a usually low water table, tend to develop extensive root systems. Construction activities even 40 feet away can kill portions of this vegetation. Stands of large trees such as shore pine (Pinus contorta) and sitka spruce (Picea sitchensis) contain tremendous weight and cause slope failures when construction takes place down hill from them. Due to summertime drying effect these areas are subject to extreme danger from fire. Too much vegetation removal of trees can cause large scale blow downs of forest vegetation. Removal of forest duff or brush can cause increased groundwater evaporation killing stands of 40 foot to 100 foot trees.

As an example, the Rhodo Dunes Golf Course east of Florence, contained an area of older stabilized dunes dividing the fairways. Present was a dense cover of salal (Gaultheria shallon), huckleberry (Vaccinum ovatum), manzanita (Arctostaphylos columbiana) and forty foot shore pine (Pinus contorta). Customers lost their golf balls in this dense cover and were unhappy. The owner's solution was to remove all the brushy species and leave the beautiful stand of pine trees. All the pine trees died the first summer because of water loss to evaporation. Placement of bark mulch three inches to four inches thick can prevent this kind of water evaporation problem.

Most problems associated with development in older stabilized dunes can be avoided by careful selection of development sites (see Figure 25). Extreme care should be taken to consider vegetation needs. The vegetation should be part of all structure, roadway, and utility locations. If changes to the development plan are made during construction, the advice of a vegetation specialist should be sought so as to assess the possible impacts of those changes. This is very important to the developer's interest; one hasty decision to re-route a road without consulting a vegetation expert can cost thousands of dollars. As a general practice, roads should be kept off the side hills and should be designed to avoid the creation of wind tunnels. Likewise, it is important to be aware of existing root structures and to avoid subsurface damage to vegetation in the area. Finally, the overcut of vegetation can result in massive blow downs of existing forest cover.

Stabilization efforts in older stabilized dunes are similar to open dunes in back areas. However, if development creates minimum disturbance to the vegetative cover, problems are usually minimal. All large areas opened-up to possible wind erosion should be restabilized using methods outlined in the section on open dune areas. The only exception to this would be use of taller, older woody plant materials.

This is possible because of the dense climax vegetation usually present on older stabilized dune landforms. The maximum size of woody species suggested for use are presented in Table 2. If any severe winds are expected because of exposure, a sand fence should be installed for the first year. In addition, all woody species over four feet in height should be staked and wired to prevent wind tip. Large woody species also require topsoil to retain enough moisture while establishing their new root systems.

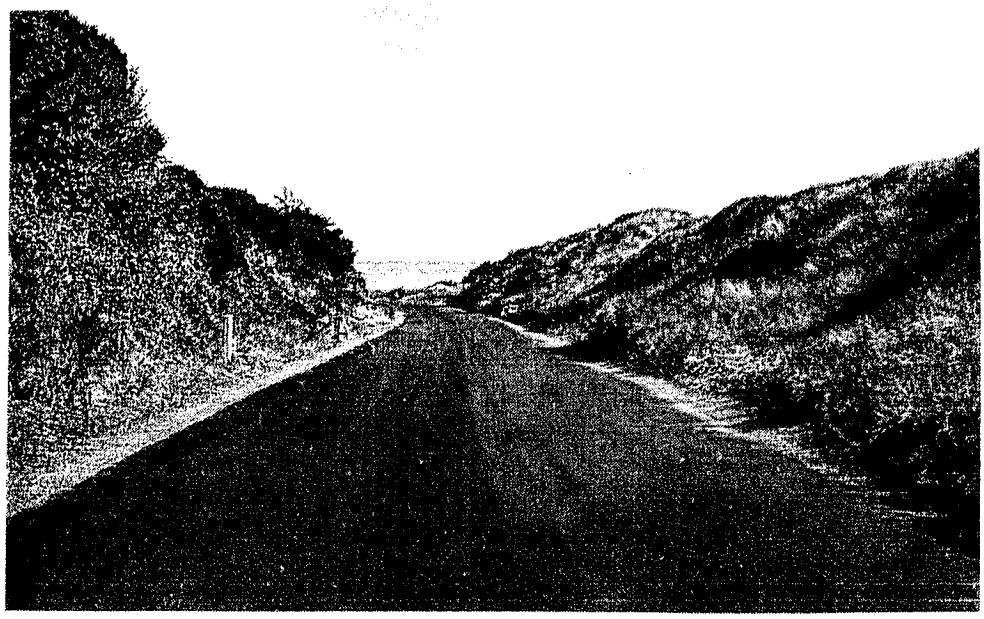


Figure 25. The road pictured above in Lane County was located so as to avoid the necessity for massive vegetation restoration and to protect the visual appearance of the area.

IV. STABILIZATION METHODS - TEMPORARY

On occasion, temporary stabilization may be necessary. However, it should be fully understood that temporary stabilization methods are, as the word implies, temporary. Care should be taken not to allow the use of temporary stabilization methods as a substitute for permanent stabilization.

The methods identified herein have been used on the Oregon coast for years with varying degrees of success. Careful selection of the correct method(s) is essential to avoid possible major wind or water erosion problems during the construction period of a project.

A. Brush Matting

An accepted temporary measure in the past, brush matting entails the complete coverage of an open area by placing a four to six inch mat of branches and leaves on the area (see Figure 26). The material can be obtained from coastal greenery trade reject material. This technique is generally unsightly and later on becomes a difficult planting bed for permanent species. Consequently it is not recommended as a viable temporary stabilization measure.



Figure 26. Use of brush mat to stabilize beach grass planting blowout, south bank of the Siuslaw River, Lane County.

B. Oil Penetration

Oil is used as a sand stabilizer mainly at cuts associated with highway or railroad construction. It is strictly a temporary measure, and is easily destroyed by human or animal activity. At The Dalles, Oregon, the Oregon State Highway Commission tried to stabilize a 100 acre active dune with this method. After two attempts and several years time lapse, the open dune area is now double in size. Failure

at any portion of the area treated can result in rough, uneven terrain increasing the cost of follow-up stabilization efforts.

C. Wire Net

Chicken wire netting is normally used to hold down either brush or straw matting on steep slopes. While the application is effective, it contributes to higher costs in vegetative stabilization efforts that follow due to the difficulty of planting through the wire. While wire net stabilization is almost always done during the summer season when vegetative efforts are impossible, it is also an effective method of getting immediate relief from wind erosion. The wire must be laced together and staked down at ten foot intervals to be effective.

D. Straw Mat

This method entails the placement of a three to four inch cover or rye grass straw over the entire area to be stabilized (see Figure 27). The work must be done on a calm day with no wind. On large areas the straw is punched into the sand with a sheepfoot roller or large farm disc. On cut banks or areas of extreme wind exposure, wire netting may have to be used to secure the straw. Permanent grasses and legumes can be seeded directly into the cover in the fall.



Figure 27. Use of straw mulch to provide temporary sand stabilization in development project.

E. Rock, Gravel, Clay or Topsoil

Normally four to six inches of these materials are applied. This treatment is strictly temporary on slopes due to traffic damage or water erosion problems unless followed-up by permanent plantings. However, on flat areas, this practice sometimes leads to natural vegetation stabilization. Rock or gravel is the preferred material for narrow

disturbed areas between new roads and existing vegetation. It will not ignite from carelessly thrown cigarettes and can also serve as a good fire break in residential areas. The width of a rock or gravel fire break should be at least five feet and four inches in depth.

F. Bark

In recent years, fir or hemlock bark has been used for temporary stabilization. This material is much more tolerant of traffic than rock. However, on steep banks the same problems exist. Bark can be applied by hand or blown-on out of the transportation truck. This material, though expensive, provides an attractive visual appearance (see Figure 28). It is also an excellent material to prevent moisture loss from sand underneath. Bark is available in several sizes, from bark rock (a coarse one to three inch bark) down to bark mulch (a finely ground soil-like material). Bark rock should be used on areas of strong wind exposure and bark mulch sould be used in back or protected areas.



Figure 28. The use of ground bark to provide out of season stabilization in late European beachgrass planting, Lane County, Oregon.

Three cautions should be noted when using bark for stabilization:

(1) The entire area must be covered or adjoining sand will quickly fill all the voids and speed up the sand transport (see Figure 29).

(2) The bark should be kept back at least five feet from all wooden structures. Bark poses a significant fire hazard to wood structures or adjoining vegetation and can smolder for hours before igniting into full flame.

(3) Do not place unperforated plastic sheeting under bark cover. Because bark is bouyant, the heavy winter rains will result

in displacement of the bark. Additionally, bark placed on plastic on slopes has a tendency to slide to the bottom of the slope, especially during the rainy season.



Figure 29. An example of a bark stabilization failure, off site sand has filled all the voids and created a smooth, hard surface that accentuates sand transport.

G. Log Placement

In recent years, cut banks have been stabilized with beach logs to accomplish stabilization that some find visually attractive. If large voids exist between the logs, vegetation should be planted. The weight of the logs helps prevent natural slumping (see Figure 30).

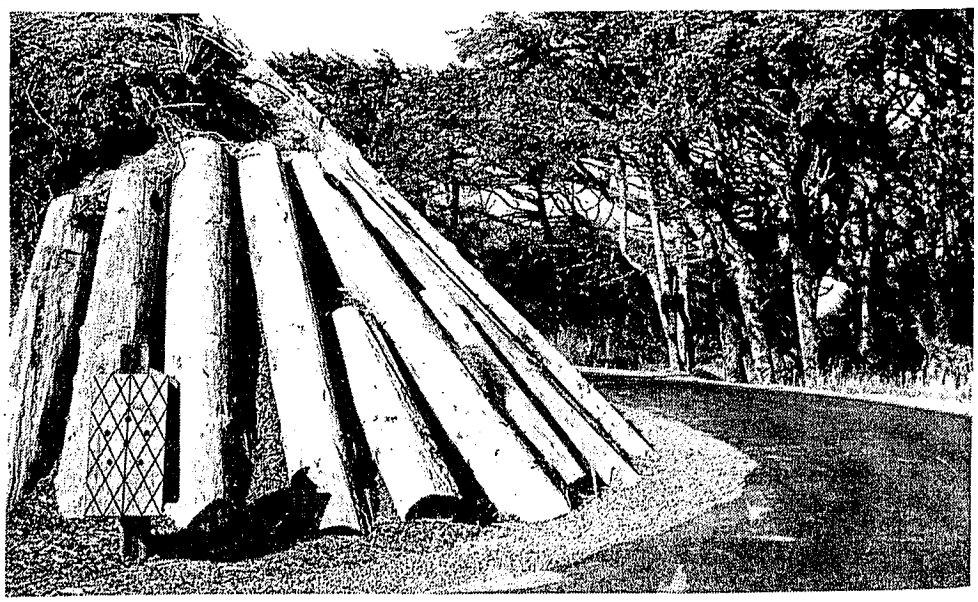


Figure 30. An illustration of the use of logs to stabilize a cut bank in a development project, Lane County, Oregon.

H. Lath and Wire Sand Fencing

Sand fencing is an important temporary stabilization method used for years on the Pacific Coast. It is normally used to gain temporary relief from large windblown movements of sand from open dunes areas or recently disturbed areas. Sand fences have also been used to create foredunes or fill breaches (Figure 31). In some cases, fences have been used to raise roadbeds across soft, wet deflation plains where equipment could not work (Figure 32).

The fencing material ranges from 1" x 4" individual pickets to 4' wire and lath snow fence (see Figure 33). Fence installations are effective when placed in two parallel rows about thirty feet apart. Proper position of the fences is critical if desired results are to be obtained. Improperly placed they may result in inundation of areas needing protection. Fences should be installed using six foot heavy duty steel posts driven into the sand eight feet apart; end posts should be anchored in three directions. The fence wire should be firmly attached to each post at the top, middle and bottom.



Figure 31. Warrenton Soil and Water Conservation District, Clatsop County, dune stabilization project illustrating use of sand fences to create foredune.

Fences four feet in height placed thirty feet apart across prevailing winds have in some cases filled-in in one week. The lee side of such a fence will sometimes experience fifty feet of sloping sand from accretion. It is consequently recommended that fences be used only where experienced advice is available, since the results of sand fence placement can be phenomenal.



Figure 32. Illustration of sand fencing used to raise a roadbed across a wet deflation plain near Florence, Oregon.

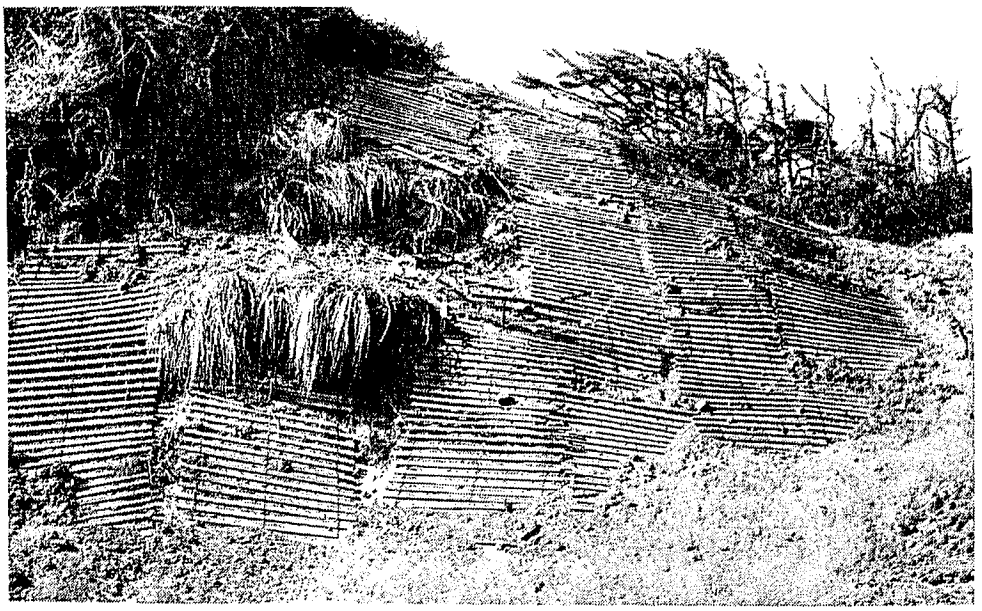


Figure 33. Snow fencing placed flat on the ground can provide temporary stabilization on cut banks, such as that performed above in Lane County, Oregon.

V. CONCLUSION

In the final analysis, all areas covered by the Oregon Beaches and Dunes Goal can, with proper procedures, be stabilized. In fact, dune stabilization has been successfully accomplished throughout the world since the days of the Roman Empire. The question we face in Oregon today is not whether to stabilize dunes, but rather is stabilization appropriate given the direction of the Beaches and Dunes Goal? This question must be answered with findings-of-fact that will substantiate the compatibility of the proposed dune stabilization project with the local comprehensive land use plan and the Oregon Beaches and Dunes Goal.

Further information pertaining to dune stabilization is found within the following publications:

Beaches and Dunes of the Oregon Coast, 1975, by the USDA Soil Conservation Service and Oregon Coastal Conservation and Development Commission.

"Controlling Coastal Sand Dunes in the Pacific Northwest", 1942, by Willard T. McLaughlin and Robert L. Brown, Nursery Division of the USDA Soil Conservation Service

and, Plants of the Oregon Coastal Dunes, 1974, by Alfred Wiedemann, LaRea Dennis, and Frank Smith, Department of Botany, Oregon State University.

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McLaughlin, Willard T., and Robert L. Brown. 1942. "Controlling Coastal Sand Dunes in the Pacific Northwest." Circular No. 660. U.S. Department of Agriculture, Washington, D.C. 46 pp.

U.S. Army Corps of Engineers, Portland District. 1974. Coastal Reconnaissance Study: Oregon and Washington. Battelle Pacific Northwest Laboratories, Richland, Washington. 478 pp.

U.S. Department of Agriculture, Soil Conservation Service and Oregon Coastal Conservation and Development Commission. 1975. Beaches and Dunes of the Oregon Coast. U.S. Department of Agriculture, Soil Conservation Service, Portland, Oregon. 161 pp.

Weideman, Alfred M., Dennis J. LaRea, and Frank H. Smith. 1974. Plants of the Oregon Coastal Dunes. Oregon State University Book Stores, Inc., Corvallis, Oregon. 117 pp.

Beach & Dune Implementation Techniques:



Oregon Coastal Zone Management Association, Inc.

This report was prepared as part of a larger document addressing various beach and dune planning and management considerations and techniques. Other segments of the document and additional materials are:

I. BACKGROUND ON BEACH AND DUNE PLANNING:

Background of the Study

An Introduction to Beach and Dune Physical and Biological Processes

Beach and Dune Planning and Management on the Oregon Coast: A Summary of the State-of-the-Arts

II. BEACH AND DUNE IDENTIFICATION:

A System of Classifying and Identifying Oregon's Coastal Beaches and Dunes

III. PHYSICAL AND BIOLOGICAL CONSIDERATIONS:

Physical Processes and Geologic Hazards on the Oregon Coast

Critical Species and Habitats of Oregon's Coastal Beaches and Dunes

IV. MANAGEMENT CONSIDERATIONS:

Dune Groundwater Planning and Management Considerations for the Oregon Coast

Off-road Vehicle Planning and Management on the Oregon Coast

Sand Removal Planning and Management Considerations for the Oregon Coast

Oregon's Coastal Beaches and Dunes: Uses, Impacts and Management Considerations

Dune Stabilization and Restoration: Methods and Criteria

V. IMPLEMENTATION TECHNIQUES:

Beach and Dune Implementation Techniques: Findings-of-Fact

Beach and Dune Implementation Techniques: Site Investigation Reports

*Beach and Dune Implementation Techniques: Model Ordinances**

VI. ANNOTATED BIBLIOGRAPHY:

Beach and Dune Planning and Management: An Annotated Bibliography

VII. EDUCATIONAL MATERIALS:

Slide show: *Managing Oregon's Beaches and Dunes*

Brochure: *Planning and Managing Oregon's Coastal Beaches and Dunes*

*Prepared under separate contract between Oregon Department of Land Conservation and Development and the Bureau of Governmental Research, Eugene,

Cover illustration by Arlys Bernard, Newport, Oregon.

BEACH AND DUNE IMPLEMENTATION TECHNIQUES:

SITE INVESTIGATION REPORTS

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PREFACE

The following report presents the results of an in-depth analysis of site investigation reports as a tool for use by local jurisdictions in evaluating proposals for beach and dune areas. This report was prepared under the auspices of the Oregon Coastal Zone Management Association and constitutes one element of an overall analysis of planning for, and managing, coastal beaches and dunes as required by Oregon's Beaches and Dunes Goal.

This report was prepared by Wilbur E. Ternyik, Wave Beachgrass Nursery, Florence, Oregon, with assistance from OCZMA's Beaches and Dunes Study Team composed of Carl Lindberg, Project Director, Christianna Crook, Research Associate, Arlys Bernard, Project Secretary, and Kathy Fitzpatrick, Project Administrator.

In addition, valuable review and comments were made on portions of this product by the Beaches and Dunes Steering Committee composed of:

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Peter Bond and John Phillips, Oregon Department of Transportation, Parks and Recreation Division
Bob Cortright, Oregon Department of Land Conservation and Development
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I. THE SITE INVESTIGATION

Suggested within the Guidelines of the Beaches and Dunes Goal as one possible method that local governments might use to direct beach and dune development is the "site investigation report" (LCDC, 1977):

> *"Local governments should adopt strict controls for carrying out the Implementation Requirements of [the Beaches and Dunes Goal...including] requirement of a site investigation report financed by the developer."*

For the purpose of this report, the site investigation report is intended to provide a systematic process for developer and jurisdiction review of the following types of information:

(1) the identification of possible negative impacts caused by geologic hazard accentuated by or impacting the proposed development, adjoining property, and overall dune sheet;

(2) to suggest solutions or remedies to identified problems to overcome geological hazard or to accommodate other environmental considerations; and

(3) to identify consistency or conflict with local, state and federal regulations, including the Oregon Beaches and Dunes Goal and other statewide planning goals, and the local comprehensive plan.

In this regard, the site investigation report would serve to provide planning staffs and decision-makers with all the pertinent information necessary in any deliberation concerning beach and dune areas to arrive at a decision based on findings-of-fact.

The purpose of the site investigation report in beach and dune areas is to provide information on geologic hazards and environmental constraints which may affect or be affected by the proposed development, in addition to identifying pertinent regulations affecting the development proposals. Because Oregon's Beaches and Dunes Goal suggests that local governments require SIRs to assist in "evaluating beach and dune plans and actions," additional information pertaining to impacts of the proposed development, over and above potential geologic constraints, is noted within the following material. However, the primary objective of the Beaches and Dunes Goal and the SIR is to ensure development that is compatible with the beach and dune landforms. In this regard, benefits to be derived from a project, whether social, economic, environmental, recreational, or otherwise, should not solely be used to determine the appropriateness of a proposal that is clearly inconsistent with identified hazards. However, cities and counties may find such information to be useful in evaluating other aspects of the proposed development once it is determined to be compatible with the landform. For this reason, and to ensure compliance with existing regulations, the material presented herein has been developed in a fashion that comprehensively evaluates development proposals in an effort to assist both the developer and the local decision-maker. In short, the SIR is intended to provide a systematic analysis of proposed uses in beach and dune areas that are "consistent with their ecological, recreational, aesthetic, water resource,

and economic values, and consistent with the natural limitations of beaches, dunes and dune vegetation for development" (LCDC, 1977).

In order to maintain sound management of Oregon's coastal beach, dune and cliff areas and still provide for acceptable development, data must be collected to allow for wise decision-making. Even more important is the accuracy of the data due to possible later legal challenges to decisions made. Great care should be taken to ensure that the evidence developed and used for "findings-of-fact" will stand up in court and reflect a true method of implementing the Oregon Land Conservation and Development Commission's statewide planning goals and local land use regulations affecting uses in coastal beach, dune and cliff areas. Because of the report's use in developing findings-of-fact that may be tested in court, the jurisdiction should give clear direction on all necessary information needed.

It is recommended that the Site Investigation Report (SIR) contain two phases. The first would be a simple "yes" or "no" development proposal handout checklist available from local planning offices. If significant hazards are identified as a result of the Phase 1 SIR, or if there are possible compliance problems with state or local land use regulations, then a Phase 2 SIR would be required.

Although the use of the short form Phase 1 SIR should quickly eliminate a large share of proposals from full site investigations, careful review of the Phase 1 SIR would be required of the local planning staff in order to determine if a Phase 2 investigation should be required. Official planning commission action should determine if the full site investigation report is required (or such authority could be delegated to the planning staff).

Once the determination is made that there is sufficient reason to require a Phase 2 SIR, the development proposal will be subjected to intense scrutiny. The applicant should be notified by certified mail of the need to conduct a Phase 2 SIR and what his/her responsibilities will be. Additionally, it is important that the applicant be informed of the various roles and responsibilities of the agencies involved.

For the purpose of the site investigation report, major and minor impacts are not distinguished by size, but rather by their cumulative impacts on coastal landforms and/or hazard potential. The smallest project can have a major impact, whereas a large project can have a minor impact depending on location and associated design modifications.

Finally, due to the dynamic nature of Oregon's coastal beach and dune systems, the interdependencies of the system, and the intent of the Beaches and Dunes Goal, it is necessary that public agency (federal, state and local) development proposals within the beach and dune area be required to follow the site investigation report procedure with local units of government as identified herein. If this is not done, management of Oregon's coastal beaches and dunes will be uncoordinated and haphazard, without regard for the integrity of the dune system or the regulations which mandate balanced management of these unique systems.

While the format and emphasis of any particular site investigation report will vary with location and situation, it is recommended that the site investigation report generally include the following types of information:

I. Purpose of the Site Investigation Report
II. Scope of the Investigation including methods and commissioning party
III. Site Data and Identification including project description and location
IV. Site Investigation Report
    A. State and Local Zoning Regulations
    B. Identified Set-back Lines
    C. Identified Hazardous Conditions
    D. Existing Site Vegetation
    E. Fish and Wildlife Habitat
    F. Floodplain Elevation
    G. Historical and Archaeological Sites
    H. Condition of Adjacent Areas
    I. Development Impacts
    J. Proposed Design
    K. LCDC Coastal Goal Requirements
V. Graphic Portrayal of Data
VI. Conclusions
VII. Recommendations
VIII. Other information including literature referenced, copies of approved permits, etc.

While not specific to beaches and dunes, the City of San Jose, California has developed guidelines for geologic and engineering geology reports that provide an example of the format and contents of a site investigation report (Nelson, 1976).

II. BEACHES AND DUNES SITE INVESTIGATION - PHASE I

INITIAL PROPOSED DEVELOPMENT APPLICATION CHECKLIST[1]

LOCATION:

YES	NO		
		1.	LOCAL ZONING REGULATIONS
___	___		Does the proposed development site plan conform to City, or County Zoning Regulations regarding setback lines and other code provisions? (Contact the City or County Engineer for details.)
YES	NO	2.	COMPREHENSIVE PLAN SETBACK LINE OR DESIGNATION
___	___		a. Has a Coastal Construction Setback Line (CCSBL) been adopted for this County or City? (Inquire from the County or City Engineer.)
___	___		b. If a CCSBL has been adopted for this County or City is the proposed site seaward of the CCSBL?
___	___		c. If the proposed site is seaward of the adopted CCSBL, has application for a variance or exception been made to the Planning Commission having jurisdiction?

[1] If answer to any of the above is Yes then full details of location, extent, type, and possible remedies will be required.

YES NO 3. IDENTIFIED HAZARDOUS CONDITIONS

___ ___ a. Has any portion of the property been identified as being affected by any potential or existing geological hazard? (Contact County or City Planning Departments for information published by the State Department of Geology and Mineral Industries, U.S. Department of Agriculture-Soil Conservation Service, U.S. Geological Survey, U.S. Army Corps of Engineers and other government agencies).

b. Are any of the following identified hazards present?

___ ___ 1. Active foredune

___ ___ 2. Water erosion

___ ___ 3. Flooding

___ ___ 4. Wind erosion

___ ___ 5. Landslide or sluff activity

___ ___ c. Are there records of these hazards ever being present on the site?

YES NO 4. EXISTING SITE VEGETATION

___ ___ a. Does the vegetation on the site, afford adequate protection against soil erosion from wind and surface water runoff?

___ ___ b. Does the condition of vegetation present constitute a possible fire hazard or contributing factor to slide potential?

(If answer is Yes, full details and possible remedies will be be required.)

YES NO 5. FISH AND WILDLIFE HABITAT

___ ___ a. Does the site contain any identified rare or endangered species or unique habitat (feeding, nesting or resting)?

___ ___ b. Will any significant habitat be adversely affected by the development? (Contact State Fish and Wildlife, County and City Planning Staffs for inventory data.)

YES NO 6. HISTORICAL AND ARCHAEOLOGICAL SITES

___ ___ Are there any identified historical or archaeological sites within the area proposed for development? (Contact local planning office.)

YES NO 7. FLOOD PLAIN ELEVATION

___ ___ a. If the elevation of the 100 year flood plain or storm tide has been determined, does it exceed the existing ground elevation at the proposed building site? (Contact the Federal Insurance Administration, City or County Planning Departments for information on 100 year flood plain information. Existing site elevations can be identified by local registered surveyor.)

YES NO

___ ___ b. If elevation of the proposed development is subject to flooding during the 100 year flood or storm tide, will the lowest habitable floor be raised above the top of the highest predicted storm-wave cresting on the 100 year flood or storm tide?

YES NO 8. CONDITION OF ADJOINING AND NEARBY AREAS

Are any of the following natural hazards present on adjoining or nearby properties that would pose a threat to this site?

___ ___ a. Open dunes

___ ___ b. Active foredunes

___ ___ c. Storm runoff erosion

___ ___ d. Wave undercutting or wave overtopping

___ ___ e. Slide areas

___ ___ f. Combustible vegetative cover

(Contact County and City Planning staffs for local hazard information.)

YES NO 9. DEVELOPMENT IMPACTS

___ ___ a. Will there be adverse off-site impacts as a result of this development?

b. Identify possible problem type

___ ___ 1. Increased wind exposure

___ ___ 2. Open sand movement

___ ___ 3. Vegetative destruction

___ ___ 4. Increased water erosion (storm runoff, driftwood removal, reduction of foredune, etc.)

___ ___ 5. Increased slide potential

___ ___ 6. Affect on aquifer

___ ___ c. Has landform capability (density, slope failure, groundwater, vegetation, etc.) been a consideration in preparing the development proposal?

___ ___ d. Will there be social and economic benefits from the proposed development?

e. Identified benefits

___ ___ 1. New jobs

___ ___ 2. Increased tax base

___ ___ 3. Improved fish and wildlife habitat

YES NO

___ ___ 4. Public access

___ ___ 5. Housing needs

___ ___ 6. Recreation potential

___ ___ 7. Dune stabilization (protection of other features)

___ ___ 8. Other _____

YES NO 10. PROPOSED DESIGN

___ ___ a. Has a site map been submitted showing in detail exact location of proposed structures?

___ ___ b. Have detailed plans showing structure foundations been submitted?

___ ___ c. Have detailed plans and specifications for the placement of protective structures been submitted if need is indicated?

___ ___ d. Has a plan for interim stabilization, permanent revegetation and continuing vegetative maintenance been submitted?

e. Is the area currently being used by the following?

___ ___ 1. off-road vehicles

___ ___ 2. motorcycles

___ ___ 3. horses

___ ___ f. Has a plan been developed to control or prohibit the uses of off-road vehicles, motorcycles, and horses?

YES NO 11. LCDC COASTAL GOAL REQUIREMENTS

___ ___ a. Have you read the LCDC Goals affecting the site? (Contact LCDC, City or County office for copies of Goals.)

___ ___ b. Have you identified any possible conflicts between the proposed development and the Goals or acknowledged comprehensive plan? (If so, list them and contact local planning staff for possible resolution.)

___ ___ c. Have all federal and state agency consistency requirements been met? (Contact local planning office.)

___ ___ d. Has applicant or investigator determined that the development proposal is compatible with the LCDC Beaches and Dunes Goal and other appropriate statewide land use planning laws?

III. BEACHES AND DUNES SITE INVESTIGATION - PHASE 2
DEVELOPMENT APPLICATION CHECKLIST

The following are suggested inclusions of a full site investigation report, with an explanation of the importance of the material requested noted in italics.

A. State and Local Zoning Regulations

1. Submit letter from city or county planning staff and/or engineer certifying that the proposed development site plan conforms with applicable city or county zoning regulations or plan designations.
2. Same letter must indicate approval of conformance with any special code provisions.
3. If an exception to a statewide planning goal or a variance has been previously approved for the particular locale, substantiate accordingly.

B. Identified Set Back Line or Designations

1. Identify on plot plan the 100-year floodplain line.
2. Identify on plot plan all established set back lines.

C. Identified Hazardous Conditions

1. Map to approximate scale all identified areas of wind erosion, water erosion, and slide activity.
2. Provide written details on extent of hazard as follows:
   a. Wind Erosion
      (1) Size and slope of active sand area.
      Size and slope of open sand areas indicate required stabilization methods, development location, and probable length of time elapse between intitial stabilization and development construction.
      (2) Delineate areas of sand loss or accretion.
      Areas of sand loss or accretion indicate probable continued erosion. Their size and location indicate probable rate of erosion. Location and wind exposure will dictate appropriate stabilization methods required.

(3) Identify off-site source of sand and probable movement patterns and rate of movement.
Off and on site wind data is used to determine continued sand movement problems and their extent.

(4) Indicate wind exposure and estimated fetch length.
Wind exposure is all importnat in determining possible problems with existing wind erosion or possible new erosion potential caused by development activities. Road and path location are in some cases determined by wind exposure at the site. Temporary stabilization of open areas must be immediate if they are located in northwest wind exposures in the summer or southwest wind exposures in the fall and winter. The fetch length is all importnat in weighing probable wind erosion relative to average wind velocity. Normally the shorter the fetch length, the less problem with wind erosion.

(5) Indicate height of water table in relation to ground surface.
Water table height is important to plant species selection and stabilization method selection.

(6) Identify plant species present and general location.
Plant identification is used to evaluate status of dune movement and indicate seasonal water table influence.

b. Water Erosion

(1) Size and slope of areas affected.
Size and degree of slope are indicators of rate of erosion and wave energy present. (The steeper cut banks indicate severe erosion needing corrective action. If height of cut bank is twenty feet or more in sand, then special setbacks should be considered if corrective measures cannot be taken.

(2) Delineate areas of material loss or deposit.
Areas of loss or deposit indicate possible future problems from water erosion. Careful study of those areas will also indicate possible rate and extent of future erosion. This information will then dictate proper corrective measures to be taken.

(3) Identify off site conditions contributing to past or continuing water erosion problems.
Off site conditions causing continuing water erosion might be related to drainage, adjoining structures, jetties, groins, riprap, construction activities, vegetation removal, driftwood deposit or removal, etc. Assessment must be made to determine if on site corrective measures will be sufficient to protect the site.

(4) Submit photographic or other evidence of type of erosion (i.e., wave, current, storm runoff, etc.)
Clearly identified photos of areas of water erosion should allow for a determination of type and severity of water erosion on the site. All photos should be dated. To ensure current conditions, up to date photos taken within the past thirty days should be submitted along with any historic photo record.

(5) Indicate width and slope of beach from mean low water to beach line.
The width and slope of a beach influences the wave energy delivered to the beachfront site. This information is essential for proper design specifications in placement of riprap.

(6) Identify all water present causing erosion (i.e., ocean, rivers, lakes, seasonal flooding, etc.)
Photos of wave run-in during severe storms would be valuable, especially if taken at high tide. All potential significant water areas need to be identified so that water management plans can be developed to minimize problems.

(7) Produce evidence, if possible, of past erosion rates and give investigator's prediction of future erosion rates.
All areas that are currently "conditionally stable" foredunes have past histories of active water erosion. Historical aerial photographs with scale and date will provide evidence of past erosion rates and cycles.

(8) Indicate areas of vegetative cover on front of foredune area.
Vegetative cover limited to the upper slopes of foredune areas often indicates previous erosion that has been restored at the base of the slope by windblown sand. Caution must be taken in such cases as active foredune or unstable open dune areas might be present. Also, look for sloughing, including leaning vegetation, usually associated with slides.

(9) Provide complete location mapping and actual work specifications for all corrective measures proposed to alleviate future water erosion problems. Furnish detailed cost estimates and post performance bonds in that amount with the local jurisdiction.
Location, time schedule, and work specifications allow for determination of probable success and provide legal documentation for ensuring compliance. Specifications should be compared with U.S. Corps of Engineers suggestions for similar work. Cost estimates should be compared with similar type work performed within the last years to ensure that funds are adequate to complete the job. The performance bond should be adequate to allow the local unit of government to perform all work not completed by the developer. Failure to do this might lead to damage lawsuits against the local jurisdiction filed by on or off site tenants or owners.

c. Slide Areas

(1) Identify areas affected by slide or sloughing on site plan and furnish dated photographs and/or other evidence showing all such activity.
Identification of slide activity areas can be used to identify areas safe for development. Photographs can be used to help identify slide type and level of threat.

(2) Identify type of slide: rotation block, rockfall or soil creep and nature of the instability.
Type of slide indicates degree of hazard and course of corrective action needed.

(3) Identify area of occurrence such as foredune, sea cliff or interior dunes.
Location of slide activity in dune sheet helps to identify causes and assists in selection of course of corrective action.

(4) Describe width, height, and degree of slope. Include types of soil and underlying bedrock.
Width, height and slope of slide help in establishing on-site construction setback line. Type of soil and underlying bedrock helps to determine projected future movement rates.

(5) Describe location and measurements of cracks, drainage patterns, driftwood deposits, bedrock outcrops, wave undercutting, or other major features.
Descriptions of visible cracks, drainage patterns, driftwood deposits, etc. are all indicators used in determining historical movement and predicting future movement.

(6) Describe probable cause and investigator's prediction of future slide activity.
Description of cause of slide activity allows for quick decision on possible corrective action.

D. Existing Site Vegetation

1. Map all major areas of vegetation and provide lists of dominant species in each area.

   Dominant species indicate stage of plant succession and indicate wet or dry conditions.

2. Provide investigator's assessment of age, condition, and stability of all vegetated areas.

   Information on age and condition of species will indicate probability of continued survival. In some cases, vegetation may indicate that the area is returning to an open dune area unless carefully managed.

3. Identify on site plan any removal or modification of vegetative cover.

   Identification of areas of vegetative removal or modification is necessary to determine probable success of stabilization or restoration efforts.

4. Give brief description of vegetative cover on adjoining lands.

   It is necessary to determine the possible impacts of development on adjoining lands. Cutting of pine forest on adjoining lands might increase wind erosion and storm run-off damage. Unmanaged beach grass or gorse stands on adjoining lands can pose serious threats to development. Vegetation fire break plans using fire retardant species is one possible solution.

5. Identify and describe areas where vegetative cover poses a fire hazard. List species and condition. Propose solution to fire hazard problem. Furnish dated photographs of such areas.

   Lee slopes of foredunes or high dunes with older stands of European beachgrass (Ammophila arenaria) pose extreme fire hazards throughout Oregon coastal dunes. the south coast has heavy stands of gorse (Ulex europaeus) that is a significant fire hazard.

E. Fish and Wildlife Habitat

1. Describe and identify any rare or endangered species or unique habitats present on the site.

   Rare and endangered species and unique habitat protection is a priority requirement of Oregon's Coastal Management Program. Federal and state permits depend on resolving problems encountered by development in such areas.

2. Describe any adverse impacts on significant habitat to be caused by the proposed development.

   Other habitat, if it is mapped as significant in Oregon by the Oregon Department of Fish and Wildlife, should be addressed and may cause similar permit approval problems if not addressed.

3. If adverse impacts are anticipated, describe plans for minimizing such impacts.

   It is important to anticipate all potential problems and suggest solutions.

4. Describe possible benefits to adjoining habitats to be realized as a result of the project.

   Negative impacts, such as loss of open sand, might be offset by stabilization of open dunes that are inundating wetlands, lakes, woodlands, estuarine habitats, etc.

F. Floodplain Elevation

1. Identify on site plan 100 year floodplain or storm tide line. Give elevation of same.

   Information will assist in determining if applicant must meet HUD Floodplain Insurance Program requirements.

2. Identify on site plan the State of Oregon Beach Zone line.

   Any work west or seaward of the established Oregon Beach Zone Line must receive prior approval from the State of Oregon. Protective structures such as riprap or seawalls that are identified as being located seaward of the Oregon Beach Zone Line must have proof of written approval.

3. Give evidence that elevation of the lowest habitable floor will be raised above the top of the highest predicted storm wave or 100 year floodplain. Registered surveyor or engineer signed report will suffice.

   This information is needed to ensure HUD building requirements are met (the object being to minimize unnecessary risk to life and property).

G. Historical and Archaeological Sites

1. Describe and locate on site plan any identified historical or archaeological sites.

2. Describe any protection measures that may be needed to protect the site(s).

   The requirement to protect historic areas for future generations is a requirement of the LCDC "Open Spaces, Scenic and Historic Areas, and Natural Resources" Goal (LCDC, 1977). Unless an exception is taken or the local comprehensive plan designates otherwise, historical and archaeological areas should be protected.

H. Condition of Adjoining Areas

a. Open Dunes

(1) Give location of open dunes in relationship to the development site.
Open dunes located adjacent to the site may pose insurmountable problems to the proposed development project.

(2) Indicate approximate size (acres), maximum elevation, direction of movement, and predicted rate of movement of adjoining open dune areas.
The location and size will indicate the probable time a problem might occur. In some cases the adjoining dune might bury the development (from one to twenty years). The estimated rate of movement allows for determination of needed stabilization and when it should occur.

(3) Indicate ownership of adjoining dunes and proposed future management, if known.
Ownership and proposed future management of adjoining dune areas is necessary to verify that corrective action, if needed, will indeed take place. Without this assurance, a development permit should not be allowed.

(4) Indicate investigator's assessment of probable threat to development site. Furnish aerial photographs if possible.
Some person, in this case the investigator, must make a value judgement based on the information gathered as to the potential long or short term threat posed by adjoining areas. Aerial photos assist the reviewer in his judgement of the investigators conclusions.

b. Active Foredunes

(1) Describe size (height and width) of active foredunes on adjoining areas.
Height and width of active foredunes on adjoining areas indicates possible continuing accretion or erosion. This allows for predicted impact on the development area. Stabilizing areas within the development site may not alone alleviate the threat posed by adjoining property.

(2) Describe any threat they pose to development site.
Will the identified water or wind erosion on adjoining foredunes spread to the development site? Could wave overtopping on adjoining foredunes pose flood threat to structures on adjoining site? Will wind blown sand move from adjoining active foredune areas and bury the development?

(3) Describe any plans for cooperative measures to alleviate problems.
Corrective actions must be coordinated in order to avoid adverse impacts. Riprap on adjoining active foredunes might cause increased erosion and slope failure on development site, or vice versa. Corective measures must be consistant if desired protection is to be achieved.

c. Storm Run-off Erosion

(1) Describe any known storm run-off or flood velocity hazards on adjoining property that might adversely affect the site. Examples might be stream, river, denuded watershed, etc.
These identified problems could lead to wash outs, gullies, slope failures, structure undermining, etc.

(2) Describe any plans for cooperative measures to alleviate problems.
Proof of cooperative efforts to alleviate serious problems identified above should be required.

d. Wave Undercutting or Wave Overtopping

(1) Describe extent of recent or historic undercutting, length of area and height of cut.
Length and height of current or historic wave undercutting will indicate measures that must be taken to correct the problem before development is allowed. Height of cut is useful in determining proper setback recommendation.

(2) Describe area of wave overtopping and furnish photographs or other evidence.
Look for water flattened vegetation, new driftwood deposit and erosion channels on back side of foredune. Be careful of using old driftwood deposits as a gauge. Remember driftwood deposits were present on all Oregon Beaches and deflation plain areas before the recent formation of most foredunes by European beachgrass. Wave overtopping evidence is distinctly different to the trained eye. It is recommended that great care be taken in evaluating this potential danger!

(3) Describe historic stability of beaches in the general area. *Look for any slow or sudden changes in beach erosion and identify causes if possible. It is possible that a man-made action caused a short term severe erosion problem. It is also possible that historic erosion cycles are evident and the proposed development will have predictable problems.*

(4) Furnish investigator's assessment of possible threat to the site. *The investigator's opinion is all important in determining if the level of hazard can be overcome.*

I. Development Impacts

1. Report should include the investigator's assessment of the site's overall capability and suggest maximum use level that will not cause weight slope failure, vegetation problems from too high a density of human population, damage to aquifer, etc.

   This is a judgement of extreme importance because the cumulative effect of minor impacts could result in a total dune project failure.

2. Describe any projected off site adverse impacts on adjoining or nearby properties as a result of the development.

   Anticipated off site adverse impacts should be identified before construction in order to avoid hard feelings and possible law suits. For example, say that Area A is stabilized and developed, thus cutting off the sand supply to Area B. This results in sand loss and what was a buildable elevation is now deflation plain. Another example might be that stabilization efforts in Area A were not timed properly, so Area B received fifteen feet of sand deposit in one southwest storm and all windows were sandblasted and paint was removed.

3. Identify and list all benefits of the project:

   (a) new jobs created (temporary construction and permanent);
   (b) increased tax base or assessed valuation of completed project;
   (c) Describe any newly created or restored habitat resulting from development; and
   (d) Describe any improvement to public access provided by the project.

(Information needed to evaluate social economic gains as required by the Oregon Economy of the State Goal (#9) and coordination with possible area recreation plan.)

4. Evaluate the impact of the proposed development on seasonal surface water and drainage flow patterns and the potential impact of flooding problems resulting from the development. If the development proposes to lower the groundwater in the deflation plain, plans must accommodate problems associated with changes in the landform. The SIR should address groundwater considerations including high water table, ponding, saltwater intrusion, drawdown on sand spits, and pollution potential.

   Failure to address various groundwater considerations could result in hazard to the development and/or adjoining area. It is important to plan appropriately for projected changes to the groundwater condition proposed by the project. For example, drainage of the deflation plain necessitates that the plan accommodate upland situations resulting from a change in the vegetation community (marsh to upland habitat).

J. Proposed Design

1. Furnish a site plan map using scale required by local planning office. Show in detail exact location and size of all proposed structures. Scale drawing of front, back and side views are required as well.

   Scale of required plans should be consistent for ease of review. Man-made structures, roads, paths, buildings, utilities, and drainage systems should be included on site plan. Artists conception of back, front and side views are useful in making determination of development's impact on aesthetic values.

2. Submit detailed plans and specifications for structure foundation and identify materials to be used.

   Due to extreme variability in dune and cliff foundation strength, foundations must be adequate to support the structure.

3. Furnish detailed plans and specifications for the placement of all protective structures proposed.

   Protective structures are in many cases the very foundation of the continued existence of the landform on which the development takes place.

4. Provide complete location mapping and actual work specifications for all initial, temporary, or maintenance stabilization plans proposed.

   Location, time schedule, and work specifications allow for determination of probable success and provide legal documentation for ensuring compliance.

5. Furnish detailed cost estimates and post performance bond in that amount with local jurisdiction to accomplish stabilization or restoration proposed.

   Cost estimates should be checked against comparable type work performed within the last year. Performance bond should be adequate to allow local unit of government to perform all needed stabilization or restoration in case of developer default.

6. Identify legal responsibilities for long range vegetation maintenance programs.

   Dune vegetation at best is a fragile cover requiring substantial maintenance. Who will have responsibility to maintain vegetation once it is established (e.g., developer or purchaser)? Will local government be obligated if both the developer and purchaser fail to maintain vegetation? This point needs to be clarified within the application for development, and should be legal and binding.

7. Describe any benefits realized from dune stabilization or restoration measures proposed.

   Dune stabilization may improve wildlife habitat, or afford protection to other features such as lakes, rivers, harbors, wetlands, or highways. The Oregon coast experiences extreme seasonal wind and wave energy. Work performed must follow specifications approved or disasters will follow.

8. Furnish copies of necessary shorefront protection permits or completed permit applications.

   Pilings, fills, removals, and/or riprap usually require permits from the Oregon Division of State Lands, the U.S. Army Corps of Engineers and/or other agencies.

9. Furnish detailed plans and specifications for interim stabilization, permanent re-vegetation, and vegetative maintenance as proposed.

   While stabilization work is fairly simple, the complex nature of Oregon's beaches and dunes demands precise methods for many different situations. Only proven specifications should be used. The developer should name in advance the firm proposed to do the work and furnish his record of experience. Careful field checking of major proposals will be necessary in order to determine if special problems exist.

10. Furnish detailed plan for off-road vehicle and pedestrian management.

    Off-road vehicles, motorcycles, and horses constitute the largest threat to vegetative cover. Plans should detail access road or path location and type of material used in construction. Motorcycles should be prohibited in all areas except older stabilized dunes. Horses should not be allowed in deflation plains or conditionally stable dunes. Off-road vehicles should be assigned to carefully selected open sand areas.

11. Furnish detailed plan for required reclamation of areas disturbed for sand removal, road construction, logging, etc.

    Due to the sensitive nature of dune areas some consideration should be given to reclamation. In some instances, this is required by state law.

K. LCDC Coastal Goal Requirements

1. Identify potential conflicts with Coastal Goals or LCDC-acknowledged comprehensive plan, and Oregon's Coastal Management Program.

2. Identify efforts made in development design to resolve or minimize identified conflicts.

   Each applicant should be familiar with the Coastal Goals and other statewide planning goals, and be encouraged to read the goals before initiation of the site investigation report. First hand knowledge of the content of the goals should help alleviate many problems for all concerned. The applicant's written record of efforts made to resolve identified conflicts will speed up the review process and will afford the decision-making body insight into the method used in preparing the SIR.

IV. A PROCEDURE FOR IMPLEMENTING BEACH AND DUNE PLANNING REQUIREMENTS

The following procedures should be observed in applying for, reviewing and approving or disapproving a proposal for an activity within an identified beach or dune area (see Figure 1).

1. Applicant prepares and submits a Phase 1 site investigation report to the local planning agency.

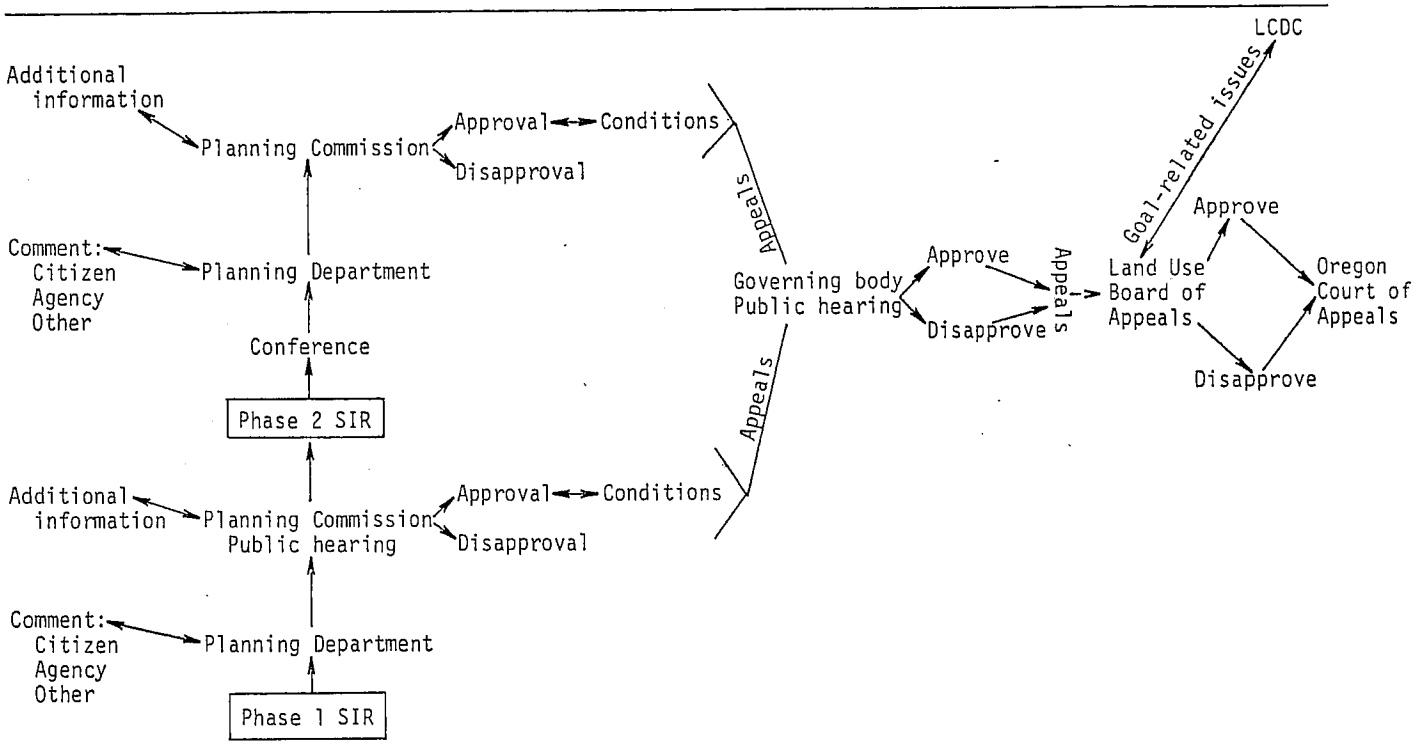


Figure 1. Procedural flowchart.

2. Planning staff distributes copies of the SIR to affected governmental units and agencies, citizen involvement committees, and other interested parties, giving them a specific length of time (at least three weeks) to review and respond to the development proposal.

3. Following the staff's review of the proposal and related comments, the proposal is submitted to the Planning Commission for consideration and public hearing. Staff recommends that SIR is adequate and decision should be based on SIR as submitted, or staff recommends that SIR appears inadequate and that further information is appropriate or that a Phase 2 SIR should be undertaken.

4. The Planning Commission reviews the application at a public hearing and develops findings-of-fact based on at least the following requirements of the Beaches and Dunes Goal, weighing Beach and Dune Goal requirements with other planning goals or comprehensive plan requirements:

   (1) the type of use proposed and the adverse impacts it might have on the site and adjacent areas;
   (2) temporary and permanent stabilization programs and the planned maintenance of new and existing vegetation;
   (3) methods for protecting the surrounding area from any adverse effects of the development; and,
   (4) hazards to life, public and private property, and the natural environments which may be caused by the proposed use.

5. The Planning Commission either approves the proposal based on the Phase 1 SIR, requires the applicant to provide further information within the Phase 1 SIR, or requires the applicant to prepare a Phase 2 SIR.

6. If the applicant is asked to prepare a Phase 2 SIR, at the applicant's request, an informational conference between the applicant and planning staff should be arranged. The purpose of such an informational conference is to make the applicant aware of available inventory material and other information relative to the site, to explain the purposes and requirements of the Phase 2 SIR, and to discuss the critical issues involved with the proposed activity in relation to the local plan or statewide planning goals.

7. The process would be repeated for the Phase 2 SIR, as with the Phase 1 SIR, (e.g., SIR sent out for review, staff recommendation formulated, Planning Commission conducts public hearing and arrives at a decision based on findings-of-fact).

8. If the proposal is approved, the Planning Commission may attach conditions consistent with local zoning ordinances if it finds that such conditions are necessary to carry out the purposes and policies of the Beaches and Dunes Goal or local comprehensive plan relating to beach and dune areas.

9. All permits issued pertaining to an approved proposal should be issued only in accordance with the approved final proposal. Major changes to the approved final proposal should be considered as a new application. Minor changes in the approved final proposal may be approved by the staff provided that such changes do not in any way raise a question as to whether the project is still compatible with the Beaches and Dunes Goal, other statewide planning goals, or the local comprehensive plan.

10. The decision made by the Planning Commission for the Phase 1 SIR or Phase 2 SIR is appealable to the City Council or County Board of Commissioners.

11. The decision of the governing body (county or city) can be appealed to the Land Use Board of Appeals and thence to the Oregon Court of Appeals.

V. ROLES AND RESPONSIBILITIES IN THE PREPARATION AND REVIEW OF SITE INVESTIGATION REPORTS

There are four basic avenues by which the site investigation report may be prepared. One alternative is that used in the State of Minnesota whereby local governments file an environmental assessment worksheet (EAW) with the Minnesota Environmental Quality Council which is subject to agency and interested party review. The other alternatives are similar to those utilized within the State of California pursuant to the California Environmental Quality Act of 1970. They are: (1) the jurisdiction's staff conduct and evaluate an environmental impact report; (2) the developer pays for the EIR, but the EIR is prepared under contract with the local jurisdiction; and (3) the developer contracts and pays for the EIR. Within California, EIRs must be prepared for all projects having a "significant" environmental impact. The California Resources Agency has prepared guidelines addressing the contents of the EIR, but the method used to produce an EIR is left up to local discretion. According to Norman Hill, Assistant Secretary for Resources, all three of the alternatives are widely used throughout the state.

While the environmental impact report approach utilized in California is for environmental impact of development proposals within the entire State of California, the approaches suggested in obtaining needed information for findings-of-fact are applicable to the approaches Oregon coastal jurisdictions may wish to pursue in obtaining information pertinent to the Beaches and Dunes Goal. Table 1 lists the pros and cons of the various approaches based on the applicability of the approach to Oregon's Coastal Management Program within the context of the Beaches and Dunes Goal.

Table 1. Pros and cons of various approaches in the preparation and review of site investigation/environmental impact reports

Approach	Pros	Cons
1. central office of State conducts assessment	--control over investigation --consistency in evaluations	--not consistent with Oregon's Coastal Management Program of planning and implementing plans at the local level --sporadic review of proposals; not a comprehensive approach
2. jurisdiction's staff prepares assessment and conducts evaluation; jurisdiction may charge developer to recoup cost	--gives jurisdiction control over document, time and effort expended --allows for the compilation of data useable for other assessments; --cost is generally lower than hiring private consultant	--appears as a larger budget item on local budgets (despite collection of fees to offset cost) --necessitates larger staff --requires constant work load and thus is generally unsuitable for smaller jurisdictions
3. developer pays cost of assessment; jurisdiction oversees investigation and evaluation	--allows for non-constant work load, thus is suitable for smaller jurisdictions --does not require expansion of staff --allows jurisdiction's interjection of local views	--contract administration selection process --extra administrative steps --jurisdiction may experience problems with quality of the product --in many instances, developer hires own consultant anyway
4. developer responsible for preparation of assessment; jurisdiction responsible for evaluation	--easiest method for local government to administer --no added cost to jurisdiction	--difficult to control quality of product --product may be slanted to project developer's perspective

Within the State of Oregon, the fourth alternative is the approach that is presently accepted and used, and for this reason, the following is a breakdown of the various responsibilities of affected parties utilizing this approach.

A. Applicants Responsibility

1. Preparation of Site Investigation Report.

2. Selection of any investigators with demonstrated field experience needed to complete report outline requirements.

3. Determine if investigator(s) are properly qualified.

4. Furnish all maps, photographs, soil tests and development specifications required to meet Goal or plan requirements

5. Appear on request at Planning Commission meeting to answer questions about content of Site Investigation Report.

6. All costs of the evaluation. (depending on local established policy)

7. Prepare modifications the Planning Commission deems necessary to make the proposed development compatible with the LCDC Beaches and Dunes Goal, other statewide planning goals and local requirements.

8. File any appeal if applicant disagrees with the decision of the Planning Commission. (Appeals may be filed with appropriate city council or county commission.)

9. File further appeal to the Land Use Board of Appeals or through the judicial system.

B. Planning Staff and Commission Responsibility

1. Furnish detailed outline of all information that will be needed in the site investigation report before a decision can be considered.

2. Identify number of days that staff will need for evaluation.

3. Immediate notification of possible delay and reasons why.

4. All costs of evaluation. (Depending on local established policy.)

5. Provide applicant with list, if known, of qualified investigators. Meet with applicant for informational conference as appropriate.

6. Verification of purported factual data contained in report.

7. Render objective decision approving or denying the development proposal based on findings-of-fact developed from the SIR.

8. Verify compliance with the Beaches and Dunes Goal element of the local comprehensive plan, or the Beaches and Dunes Goal if the local plan is not yet acknowledged.

9. Provide opportunity for citizen comment consistent with local program for citizen's involvement.

C. Citizen's Input

1. Review and comment on SIRs as circulated for review.

2. Submit oral or written testimony to planning commission, governing body, the Land Use Appeals Board or judicial body as appropriate.

As called for in the LCDC Citizen's Involvement Goal (#1), opportunities for citizen review and input before the decision to grant the development permit is essential. Published notice of all meetings where major or controversial projects will be discussed should contain project name. All information pertinent to the project should be available at the planning office for citizen review. Comments, written or verbal, should be made a part of the record of the project review.

D. Local City Council or County Commission Responsibility

1. Review all material used by the plannning commission in arriving at findings-of-fact on which they based their decision if appeal is made.

2. Generate other findings-of-fact that would justify modifying or overturning the planning commission decision.

3. Provide opportunity for citizen comment consistent with local program for citizen's involvement.

4. Ultimate legal responsibility for implementing the intent of the LCDC Goals and local comprehensive plan.

E. Land Use Appeals Board

1. Review on appeal any purported violation of the Beaches and Dunes Goal or other Goals in the local comprehensive plan or the Goal itself if plan is not in compliance.

2. Seek comment and recommendation from the Oregon Land Conservation and Development Commission on any Goal policy issue.

3. Render a decision based on their own findings-of-fact.

VI. EVALUATION OF SITE INVESTIGATION REPORTS

It is not reasonable to assume that coastal planning staffs will have the time or expertise to fairly evaluate the Phase II site investigation reports. In such cases, outside consultation may be mandatory. In view of this, it might be appropriate to have such evaluations performed by an inter-disciplinary team of experts available to all coastal jurisdictions. Conversely, a pre-approved list of such experts could be made available to coastal jurisdictions, with the jurisdiction hiring a reviewer on an on-call basis. Finally, a permanent coastal implementation team could assist coastal jurisdictions. Such an approach has been suggested through the pooling of any implementation funds received from the federal Office of Coastal Zone Management (Bartl, 1978; Vian, 1979). Whatever the approach, it should be clearly spelled out in contractual agreements that any reviewer may be called upon to appear in court to substantiate conclusions.

Likewise, it is not reasonable to assume that coastal jurisdictions can afford the financial burden of reviewing the Phase II SIRs. An interdisciplinary team of experts could be made available to jurisdictions with assistance from the State of Oregon; a permanent coastal implementation team would likely qualify for federal Coastal Zone Management assistance. If jurisdictions are faced with reviewing Phase II SIRs, they may elect to

consult with outside experts with the financial burden placed on the applicant. If the cost of such an evaluation is to be paid by the applicant, he should be notified in advance.

The following evaluation criteria and process are presented to assist the local jurisdiction in evaluating site investigation reports:

Evaluation Criteria

Before a building or use is established within an area identified as under the provisions of the LCDC Coastal Beaches and Dunes Goals, the petitioner must demonstrate that the development will meet the following criteria:

1. The operating characteristics and intensity of land use shall be compatible with and shall not adversely affect the site or adjacent land uses.

2. The site planning and design shall be as attractive as the nature of the use and setting will allow.

3. The development shall not adversely affect access to or land partitioning of abutting properties.

4. The development shall include temporary and permanent stabilization programs, and the planned maintenance of new and existing vegetation.

5. The development shall not subject hazards to life, public or private property or the remaining natural environment.

6. The development shall be consistent with the Management Objectives of the particular dune type.

7. The development shall be compatible with the general purpose and intent of the governing comprehensive plan.

Determination of Appropriate Use or Uses

It is suggested that the governing body consider the following format when arriving at a decision of appropriate use.

1. Staff report on project:
   a. General proposal statement.
   b. Site investigation report on determination of dune type.
   c. Recommendation on how the project relates to each of the Evaluation Criteria.

2. The governing body shall make a finding-of-fact and approve or deny the proposal by:
   a. Evaluating the recommendations of staff and accepting or rejecting the staff appraisals (rejected appraisals should be replaced by appraisals acceptable to the governing body).
   b. Evaluating the proposal statement by the applicant.
   c. Consideration of public testimony.

3. Motion shall be made to approve or deny the proposal requested by stating the findings of the governing body after consideration of 2 a., b., and c.

VII. QUALIFICATIONS FOR CONSULTANTS OR INVESTIGATORS

Information in the site investigation report provided by the consultant will probably be the evidence used by the local planning commission to arrive at findings-of-fact. In the event of a legal challenge to these findings-of-fact, the consultant may be called upon as an expert witness in court proceedings.

There is no cut-and-dry method of determining expertise. The following are factors that indicate degree of expertise which the developer and jurisdiction may find useful:

1. college degree(s)
2. publications on the subject
3. membership in related national or international professional dune management groups
4. proof of consultation or information exchange with other recognized experts
5. proof of past actual in-field dune management or evaluation work. This should include a complete list of projects worked on, the part the consultant played, and the nature of the project.

Due to the complex nature of coastal landforms and dune management problems, several fields of expertise may be needed and may include any of the following:

1. geologist
2. oceanographer
3. hydrologist
4. botanist/agronomist
5. biologist
6. engineer
7. lawyer
8. stabilization specialist

It is doubtful that any one person will be knowledgeable in all fields of dune management. Bear in mind that in a court situation, the opposing attorney has the right to challenge the qualifications of any expert witness. If the judge sustains his objection, the witness cannot testify.

The applicant has a legal right to hire a consultant of his choice; it is the applicant's responsibility to assess the qualifications of the consultant. In some instances, local government might assist the developer by providing a suggested list of names of firms or individuals. However, local government cannot legally force the hiring of a particular firm or individual.

VIII. PERFORMANCE STANDARDS

The Beaches and Dunes Goal suggests that "local government should adopt strict controls for carrying out the Implementation Requirement of this (Beaches and Dunes) goal. The controls could include... posting of performance bonds to assure that adverse effects can be corrected;" (LCDC, 1977).

Assuming that the site investigation report has been found complete and satisfactory, there is one other tool needed to ensure implementation. All major and minor development projects should require the posting of a performance bond before the development permit is issued. The dollar amount of the bond should equal the amount estimated to carry out the intended restoration or protective measures noted within the SIR.

All phases of actual construction should be closely monitored by the local jurisdiction. Any departure from the proposed development plan should be approved in writing and signed by both parties with opportunity availed for review and comment by the appropriate agencies, jurisdictions and citizens.

In the case of vegetation restoration or stabilization, the performance bond should not be relaeased until one growing season following the planting activities to provide an opportunity to assess the effectiveness of the stabilization effort.

IX. THE DISCLOSURE STATEMENT

Once the local comprehensive land use plans are acknowledged by LCDC, they are considered to embody the requirements of the various statewide planning goals, including the provisions of the Beaches and Dunes Goal where appropriate. The Beaches and Dunes Goal very clearly sets forth criteria whereby local jurisdictions will "conserve... the resources and benefits of coastal beach and dune areas (while) reducing the hazard to human life and property from natural or man-induced actions associated with these areas" (LCDC, 1977).

In this context, the local land use plan plays a determining role in the reduction of hazardous situations and ensuring safe living conditions. Because of this, local jurisdictions may find themselves in the position of being legally responsible for catastrophes which occur in areas of known hazard if it was the local governing body's decision which allowed or provided for habitation of the area.

In areas of known geologic hazard where development is allowed to take place or continue (vested rights, design modification minimizes threat, etc.), it is strongly recommended that local jurisdictions require signing of a disclosure statement in view of possible future legal dilemmas. It is further recommended that such a disclosure statement become an official portion of the deed for a particular parcel of land.

Following preparation and review of the Phase 1 or Phase 2 SIR, the local jurisdiction should maintain the authority (within zoning ordinances) to require that all property sold within the area of discussion be accompanied by a signed disclosure statement at the time of sale. The disclosure statement would note that the buyer recognizes that the potential for hazard exists at the site, and that although protective measures may be taken (pursuant to the approved project design) there is still some degree of risk involved. Such a disclosure statement would be required of developers or real estate personnel when acquiring or selling property, and of purchasers.

In areas where development has taken place prior to acknowledgement of local comprehensive plans, it is suggested that local jurisdictions enact zoning ordinances giving them authority to require similar disclosure statements prior to issuance of a building permit. Such statements should note that the building permit is issued because of vested rights in the property, and in no way implies that the jurisdiction has evaluated or considered the potential of the area to accommodate the proposed activity in light of hazardous conditions. Alternatively, a jurisdiction may require submission of a registered professional engineer's, registered professional geologist's or specially certified engineering geologist's certification as to the safety of the project, as is the case in Lincoln County, which forms the basis for decision-making (Granger, 1979).

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Beach & Dune Planning & Management: An Annotated Bibliography

Oregon Coastal Zone Management Association, Inc.

This report was prepared as part of a larger document addressing various beach and dune planning and management considerations and techniques. Other segments of the document and additional materials are:

I. BACKGROUND ON BEACH AND DUNE PLANNING:

Background of the Study

An Introduction to Beach and Dune Physical and Biological Processes

Beach and Dune Planning and Management on the Oregon Coast: A Summary of the State-of-the-Arts

II. BEACH AND DUNE IDENTIFICATION:

A System of Classifying and Identifying Oregon's Coastal Beaches and Dunes

III. PHYSICAL AND BIOLOGICAL CONSIDERATIONS:

Physical Processes and Geologic Hazards on the Oregon Coast

Critical Species and Habitats of Oregon's Coastal Beaches and Dunes

IV. MANAGEMENT CONSIDERATIONS:

Dune Groundwater Planning and Management Considerations for the Oregon Coast

Off-road Vehicle Planning and Management on the Oregon Coast

Sand Removal Planning and Management Considerations for the Oregon Coast

Oregon's Coastal Beaches and Dunes: Uses, Impacts and Management Considerations

Dune Stabilization and Restoration: Methods and Criteria

V. IMPLEMENTATION TECHNIQUES:

Beach and Dune Implementation Techniques: Findings-of-Fact

Beach and Dune Implementation Techniques: Site Investigation Reports

*Beach and Dune Implementation Techniques: Model Ordinances**

VI. ANNOTATED BIBLIOGRAPHY:

Beach and Dune Planning and Management: An Annotated Bibliography

VII. EDUCATIONAL MATERIALS:

Slide show: *Managing Oregon's Beaches and Dunes*

Brochure: *Planning and Managing Oregon's Coastal Beaches and Dunes*

*Prepared under separate contract between Oregon Department of Land Conservation and Development and the Bureau of Governmental Research, Eugene.

BEACH AND DUNE PLANNING AND MANAGEMENT:

AN ANNOTATED BIBLIOGRAPHY

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PREFACE

The following annotated bibliography presents the results of selected references pertaining to planning for and managing beaches and dunes on the Oregon Coast conducted by the Oregon Coastal Zone Management Association, Inc. This report constitutes one element of an overall analysis of planning for and managing coastal beaches and dunes as required by Oregon's Beaches and Dunes Goal.

This report was prepared by Timms Fowler, WICHE Intern and Arlys Bernard, OCZMA Beaches and Dunes Study Team Project Secretary, with assistance from Carl Lindberg, Project Director, Christianna Crook, Research Associate, and Kathy Fitzpatrick, Project Administrator.

This product represents the finalization of a preliminary bibliography submitted to the Oregon Department of Land Conservation and Development in December of 1978. In this regard, OCZMA acknowledges and extends appreciation to Bob Cortright, Coastal Specialist for the Oregon Department of Land Conservation and Development for his review.

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I. BEACH AND DUNE PLANNING AND MANAGEMENT IN OREGON

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This paper summarizes the major findings of an evaluation of existing policies and programs for providing public access and protection to beaches and other coastal areas. The paper includes a section on "Areas Not Covered and Suggested Improvements."

Fitzpatrick, Kathy, Ed. 1979. Beaches and Dunes Handbook for the Oregon Coast. Oregon Coastal Zone Management Association, Inc., Newport, Oregon. 679 pp.
The document is a compendium of the following reports: Introduction to Beach and Dune Physical and Biological Processes: A Summary of the State-Of-The-Arts; A System of Classifying and Identifying Oregon's Beaches and Dunes; Physical Processes and Geologic Hazards on the Oregon Coast; Critical Species and Habitats of Oregon's Coastal Beaches and Dunes; Dune Groundwater Planning and Management Considerations; Off-road Vehicle Planning and Management on the Oregon Coast; Sand Removal Planning and Management Considerations for the Oregon Coast; Oregon's Coastal Beaches and Dunes: Uses, Impacts, and Management Considerations; Stabilization; Beach and Dune Implementation Techniques: Findings-of-Fact and Site Investigation Reports.

Oregon Coastal Conservation and Development Commission. 1973. "Policies and Standards for Fragile Sand Areas." Florence, Oregon. 10 pp.
This is a report to aid development of policies and standards for management of fragile sand areas. It contains general policy statements expressed by participants at OCCDC public involvement workshops and suggested policies developed by the staff of SCS.

Oregon Coastal Conservation and Development Commission. 1975. Progress Report. Florence, Oregon. 209 pp.
A report presented to the Governor's Office to provide an accounting of the progress and scope of the OCCDC overall work program. Pages 43 to 62 cover the beaches and dunes resources and comprise the basic data from which Goal #18 Beaches and Dunes was derived.

Oregon Land Conservation and Development Commission. 1976. "Draft No. 3, Coastal Planning Goals and Guidelines." Salem, Oregon. 20 pp.
The third and final draft of the coastal goals before their adoption on December 18, 1976; included the Beaches and Dunes Goal.

Oregon Land Conservation and Development Commission. 1977. "Statewide Planning Goals and Guidelines." Salem, Oregon. 24 pp.
This publication presents nineteen statewide planning goals for Oregon. A list of definitions is also included.

Oregon Land Conservation and Development Commission. 1977. "Coastal Goals: Response to Concerns." Salem, Oregon. 4 pp.
An explanation of why the Commission changed certain wording within the four coastal goals prior to adoption. The two changes to the Beaches and Dunes Goal explain the change of the site investigation from a goal requirement to a guideline - replaced by mandated findings-of-fact and secondly the rewording to clearly prohibit residential, commercial or industrial development on active or wave overtopped foredunes.

Oregon State Highway Department, State Parks and Recreation. 1966. Public Use Study: Oregon's Coastal Beaches. Salem, Oregon. 78 pp.
Provides information concerning recreational interests, significance and physical characteristics on thirty-nine sections of beach. Noted as a preliminary and limited study it provides basic data and aerial photos on beach use in 1966.

Stembridge, James E., Jr. 1975. "Shoreline Changes and Physiographic Hazards on the Oregon Coast." PhD dissertation. Department of Geography, University of Oregon, Eugene, Oregon. 202 pp.
This study analyzes, classifies, and inventories the shoreline changes on the Oregon coast.

U.S. Army Corps of Engineers. 1971. National Shoreline Study: Inventory Report Columbia-North Pacific Region Washington and Oregon. Portland, Oregon. 101 pp.
An inventory of the physical characteristics, historical changes, ownership, and shoreline uses are provided for the Washington and Oregon coast generally and by county. Many useful illustrated maps are included.

U.S. Army Corps of Engineers, Portland District. 1974. Coastal Reconnaissance Study: Oregon and Washington. Battelle Pacific Northwest Laboratories, Richland, Washington. 478 pp.

This is a reconnaissance level survey of fifteen Oregon and Washington coastal projects to determine their potential recreation and conservation use. Characterisitcs of each site presented related to recreation, wildlife, land use, open space, and historical and archaeological values.

U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. 1977. Final Environmental Impact Statement, Oregon Dunes National Recreation Area Management Plan. Washington, D.C. 80 pp. + appendices.

The statement is a review of the Oregon Dunes National Recreation Area within Coos, Douglas and Lane Counties. The results were that none of the lands in the Oregon Dunes National Recreation Area met the requirement for designation as wilderness.

U.S. Department of Agriculture, Soil Conservation Service and Oregon Coastal Conservation and Development Commission. 1975. Beaches and Dunes of the Oregon Coast. U.S. Department of Agriculture, Soil Conservation Service, Portland, Oregon. 161 pp.

This study was produced for and with OCCDC to provide resource data for land use decision making and for educational information concerning the beach and dune environment. Beach and dune landforms are explained and identified on aerial photos of the Oregon coast. Proposed management policies are presented.

Warrenton Dune Soil and Water Conservation District Clatsop County, Oregon. 1966. "Thirty-one Years of Progress, 1935-1966." Astoria, Oregon. 17 pp.

This is an illustrated history of the Warrenton Dune Soil and Water Conservation District dune management program with some very good before and after photographs.

Wilsey and Ham. 1978. Lane County: Coastal Resource Inventory. Portland, Oregon. 180 pp.

This book includes a forty-two page section on beaches and dunes covering topics such as topography, nature and stability of the dunes area, hydrologic conditions, land use, public access and recreation, economic significance and past and future development.

II. GENERAL INFORMATION ON BEACH AND DUNE SYSTEMS

Barnes, R. K. S., Ed. 1977. The Coastline. John Wiley and Sons, New York, New York. 356 pp.
A highly useful systematic examination of the ecology and physiography of coastal aquatic and terrestrial environments. Land use and management problems are highlighted.

Bascom, W. 1964. Waves and Beaches. Doubleday, Garden City, New York. 267 pp.
A basic introduction to the wave and beach processes from a west coast study that included Oregon.

Bird, E. C. F. 1969. Coasts. The MIT Press, Cambridge, Massachusetts. 246 pp.
The fourth and last volume of a series on landforms treating landforms as parts of systems in which the interacting processes are almost completely produced and altered by solar energy. Thus the coastal situation is viewed in terms of waves, currents and wind as agents in fashioning the coastal forms. Chapter V-Beaches, Spits, and Barriers and Chapter VI-Coastal Dunes give a general introduction to the morphology of these landforms.

Buckler, William R. 1978. Dune Type Inventory and Barrier Dune Classification Study of the Lake Michigan Shore. Preliminary Draft submitted to the Michigan Department of Natural Resources. Lansing, Michigan. 74 pp.
A dune morphology classification is developed for the Great Lakes and dune assemblages are mapped. The classification is based on the dune form, relief, orientation, and relationship to the underlying formation.

Bush, George. 1976. "Soils Management Services Report, Sand Lake Recreation Area." United States Department of Agriculture, Forest Service. Siuslaw National Forest, Hebo Ranger District, Corvallis, Oregon. 16 pp.
Describes geo-environmental changes which have occurred at Sandlake in historic times. Management recommendations designed to enhance and protect the dunes and associated recreational facilities are offered.

Carefoot, Thomas. 1977. Pacific Seashores: A Guide to Intertidal Ecology. University of Washington Press, Seattle, Washington. 208 pp.
This work is a broad, well-illustrated guide to intertidal ecology. There is one generally useful section on sand dunes.

Cooper, W. S. 1958. Coastal Sand Dunes of Oregon and Washington. Geological Society of America Memoir 72, New York, New York. 169 pp.
Classic geomorphic description and interpretation of sand dune morphology evolution, and historic development in coastal Oregon and Washington; also, subdivides the Oregon coast into four geomorphically dissimilar sand dune regions.

Inman, Douglas L. and Birchard M. Bush. 1973. "The Coastal Challenge." Science. Washington, D.C. 181:20-32. 13 pp.
This article considers the coastal processes of currents, etc. and man's interference with the natural processes. Highlighted are shoreline stabilization, sand budget and transport.

Katz, Barbara A. and Stephen R. Gabriel. 1977. "Oregon's Ever-Changing Coastline." Extension Marine Advisory Program. 5G 35. Oregon State University, Corvallis, Oregon. 7 pp.
This work provides a good non-technical introduction to the ocean shore processes.

Komar, Paul. 1976. Beach Processes and Sedimentation. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 429 pp.
A recent text that describes the physical processes of beaches and the resulting sedimentary deposits on the Pacific Coast.

Lund, Ernest H. 1971. "Coastal Land Forms Between Florence and Yachats, Oregon." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 33(2)21-44. 24 pp.
The article provides an overview of the headland basalt structures and the differential erosion. Sand dunes are briefly mentioned.

Lund, Ernest H. 1973. "Oregon Coastal Dunes Between Coos Bay and Sea Lion Point." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 35(5)73-92. 24 pp.
The article offers a good, short overview of the sand dune types including useful photographs.

Lund, Ernest H. 1974. "Rock Units and Coastal Landforms Between Newport and Lincoln City, Oregon." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 36(5)69-92. 24 pp.
The article offers a useful, short background on the land forms and basic geology including good photographs.

Pinto, Carlos, Eugene Silovsky, Fred Henley, Larry Rich, Jack Parcell and Don Boyer. 1972. The Oregon Dunes NRA Resource Inventory - Siuslaw National Forest. U.S. Department of Agriculture, Forest Service, Portland, Oregon. 294 pp.
This report provides excellent descriptions, environmental baseline data and carrying capacity guidelines for sand landforms represented in the Oregon Dunes National Recreation Area. Maps, text and matrices are included.

Ranwell, D. S. 1975. Ecology of Salt Marshes and Sand Dunes. Halsted Press, New York, New York. 258 pp.
This work is a detailed ecological study and considers management of both salt marshes and sand dunes. Sand dune management includes water extraction, species introduction, and other factors.

Ruef, Michael H. 1975. Coastal Sand Dunes Study: Pacific and Grays Harbor Counties, Washington. State Department of Ecology, Olympia, Washington. 31 pp.

A detailed study of Washington's coastal dunes that relates vegetation to the sand landforms; provides analysis on ocean-dune relationship, impacts of man, natural areas, and suggests some management considerations.

Starr, Richard M., Richard A. Marston, and Madeline J. Hall. 1975. Environmental Sensitivity of Oregon's Coastal Sand Areas. Department of Geography Resource Paper 7. Oregon State University, Corvallis, Oregon. 48 pp.

Coastal sand area types are placed in sensitivity classes. These classes are given performance standards to guide development. The specific study area is north of Florence and is mapped by sensitivity class.

Weideman, Alfred M., Dennis J. LaRea, and Frank H. Smith. 1974. Plants of the Oregon Coastal Dunes. Oregon State University Book Stores, Inc., Corvallis, Oregon. 117 pp.

A very useful work which includes a brief but highly informative introduction to the physical geography of Oregon's coastal dunes. The primary emphasis is on the description of sand dune plants with taxonomic key included.

Zenkovick, V. P. 1962. Processes of Coastal Development. J. A. Steers, Ed. Translated by D. G. Frey. Oliver and Boyd, London. 738 pp.

The most thorough discussion of shore processes found in any one single publication. The author adopts a wide regional approach to the subject. Chapter 12, "Aeolian Processes on Sea Coasts" is concise and covers the literature as well as the worldwide variants of sand beaches and dunes.

III. BEACH AND DUNE PLANNING AND MANAGEMENT CONSIDERATIONS

A. Sand Removal

Bernewitz, M. W. von. 1930. "Treatment and Sale of Black Sands." Information Circular 7000. U.S. Department of Interior, Washington, D. C. 21 pp.

The author provides background information on the nature of black sands and experiences in mining and processing it from several case studies.

Carter, George, Hal J. Kelly and E. W. Parsons. 1962. "Industrial Silica Deposits of the Pacific Northwest." Information Circular No. 8112. U.S. Department of the Interior, Bureau of Mines, Washington, D.C. 57 pp.

An evaluation report of data derived from field and laboratory examinations of 82 silica deposits. The Coos Bay dune sands was one of five samples taken in Oregon. These sands were found to be not of high quality but could be used as a source for the manufacture of ceramic ware and amber container glass.

Carter, G. J., H. M. Harris and K. G. Strandbert. 1964. "Beneficiation Studies of the Oregon Coastal Dune Sands for Use as Glass Sand." RI 6484. U.S. Department of the Interior, Bureau of Mines, Washington, D.C. 21 pp.

This study found the sand deposits in the Coos-Umpqua dunes area to be suited for foundry, sand blasting, filler, ceramic use, and for certain types of glass if properly treated.

Dasher, John, Foster Fraes and Alton Gabriel. 1942. "Mineral Dressing of Oregon Beach Sands, 1. Concentration of Chromite, Zircon, Garnet and Ilmenite." Report of Investigation 3668. U.S. Department of the Interior, Washington, D.C. 19 pp.

On the coast of southwestern Oregon, particularly in Coos and Curry Counties, are numerous pockets of heavy sand that have been deposited on the back of old beaches. The investigation found certain levels of materials that could be extracted depending on the market demands.

Department of Civil Engineering, Oregon State University. 1978. "Notes From Brainstorming Meeting on Coastal Aggregates." Oregon State University, Corvallis, Oregon. 21 pp.
A series of notes outlining the goals of a three year research project to study coastal aggregates. The goals as presented were: a. identify promising marginal aggregates, b. evaluate benefication methods, c. develop specifications, and d. establish economic limits for the use of these aggregates.

Erickson, Robert, Roger Iwasaki, Russ Kellogg, Brian Mostue, and Lawrence Walker. 1974. Visual Resource Analysis of the Oregon Coastal Zone: Experimental Qualities of Oregon Coastal Environments. The Oregon Coastal Conservation and Development Commission, Florence, Oregon. 135 pp.
This report is one of ten for use in developing a resource management plan for the Oregon Coastal Zone. The purpose of this report is to identify the significant visual values on the coast and their management problems.

Inman, Douglas L. 1978. "The Impact of Coastal Structures on Shorelines." Proceedings of Coastal Zone 78. American Society of Civil Engineers, New York, New York. pp. 2265-2272. 8 pp.
This article discusses the present crisis situation of man's impingement upon the shoreline and his need to rapidly develop new technology and understanding of the problems.

Magoon, Orville T., John C. Haugen, and Robert L. Sloan. 1972. "Coastal Sand Mining in Northern California, U.S.A." Proceedings of the 13th Coastal Engineering Conference. American Society of Civil Engineers, New York, New York. pp. 1571-1597. 26 pp.
This paper describes the history and character of sand mining in California. Noting that sand removal is significant at specific locations, the authors point out that the beaches represent a major recreational asset.

Stephenson, E. L. 1945. "Magnetometer Surveys on Black Sands of the Oregon Coast." RI 3814. U.S. Department of the Interior, Washington, D.C. 18 pp.
This investigation located deposits of black sands in Coos and Curry Counties, Oregon.

Sterrett, Chester K. 1958. "Industrial Silica for Pacific Northwest Industries." Resource Report No. 1. Raw Materials Survey, Inc., Portland, Oregon. 14 pp.
In a section of "Oregon Beach Sands" the report notes that no specific studies on beach sands as a source of industrial silica have been conducted. It was noted, however, that no extensive deposits of pure white sands exist with a low quartz content (forty percent with partial iron staining).

U.S. Department of the Interior, Bureau of Mines. 1978. "Minerals in the Economy of Oregon." SMP-21. Washington, D.C. 14 pp.
This is a report on the mineral resources of Oregon. It includes tables on the quantity and value of mineral production in 1976 and 1977 as well as Oregon's role in the U.S. mineral supply in 1977.

B. Stabilization and Restoration Methods

Brown, Robert L., and A. L. Hafenrichter. 1962. "Stabilizing Sand Dunes on the Pacific Coast With Woody Plants." Misc. Publication No. 892. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C. 18 pp.
This describes the uses of woody plants as stabilizers, the planning required, and the species used for stabilization.

Davis, John H., Jr. 1975. Stabilization of Beaches and Dunes by Vegetation in Florida. Sea Grant Program Report No. 7. University of Florida, Gainesville, Florida. 52 pp.
The report discusses the role and methods of vegetation in stabilizing beaches and dunes, with guidelines for property owners and managers.

Georgia Department of Natural Resources. 1974. Methods for Beach and Sand Dune Protection. Conference Report. Georgia Department of Natural Resources, Atlanta, Georgia. 48 pp.
This is a collection of papers delivered during the conference that relate to three basic topics: The Natural Functioning of the Beach and Sand Dune System, Methods for Beach and Sand Dune Protection, and Workshop Discussions and Recommendations. Emphasis on East Coast experiences.

Green, Diantha L. 1965. "Developmental History of European Beachgrass (Ammophila arenaria) Plantings on the Oregon Coastal Sand Dunes." MS Thesis, Oregon State University, Corvallis, Oregon. 64 pp.
The development from initial planting to takeover of natural species is discussed. Data on the plots studied south of Florence included various measurements of Ammophila, Pinus, and Cytisus and the frequency of native species present.

Hafenrichter, A. L. 1967. "Lassoing the West's Rampaging Dunes." Outdoors USA. U.S. Department of Agriculture Yearbook, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C. pp. 317-321. 5 pp.
A good introduction to the USDA Soil Conservation Service's dune stabilization program on the Pacific Coast that includes the Warrenton Soil Conservation District project.

Hafenrichter, A. L., John L. Schwendinan, Harold L. Harris, Robert S. MacLauchlan, and Harold W. Miller. 1968. Grasses and Legumes for Soil Conservation in the Pacific Northwest and Great Basin States. Agriculture Handbook 339. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C. 69 pp.
They explored various grasses and legumes for stabilization projects including beaches and dunes.

Illinois Department of Conservation. 1977. Illinois Beach State Park Duneland Vegetation Rehabilitation and Restoration Feasibility Study. Springfield, Illinois. 57 pp.
A study of existing duneland degradation and destruction with alternative policies to solve identified problems. Many problems identified are common to the Oregon coastal dunes and proposed solutions may be of interest.

Knutson, Paul L. 1978. "Planting Guidelines for Dune Creation and Stabilization." Proceedings of Coastal Zone '78. Volume II. American Society of Civil Engineers, New York, New York. pp. 762-779. 18 pp.
Several West Coast examples are given including the Clatsop Plains.

McLaughlin, Willard T., and Robert L. Brown. 1942. "Controlling Coastal Sand Dunes in the Pacific Northwest." Circular No. 660. U.S. Department of Agriculture, Washington, D.C. 46 pp.
This describes the various techniques and the background of the stabilization of the Pacific Northwest started in 1935.

Oertel, George F., and James L. Harding. 1977. Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island; Wassaw Island Erosion Study Part III. Technical Report Series Number 77-3. Georgia Marine Science Center, University System of Georgia, Skidaway Island, Georgia. 46 pp.
This is a study of Wassaw Island, Georgia and the testing of three synthetic methods (snow fences, sand bags, and patches of beach straw) to modify the sediment budget of an historically eroding shore area.

Swingle, Charles F. 1939. Seed Propogation of Trees, Shrubs and Forbs For Conservation Planting. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C. 198 pp.
A compilation of information on number of seeds per pound, germination percentages, recommended handling, and yield of plants.

Woodhouse, W. W., Jr. 1978. Dune Building and Stabilization With Vegetation. Special Report No. 3. U.S. Army, Corps of Engineers, Coastal Engineering Research Center. Fort Belvoir, Virginia. 112 pp.
The report discusses dune stabilization including the use of fences, vegetation and matting based on twenty years experimentation in coastal areas.

Woodhouse, W. W., Jr., and R. E. Hanes. 1967. Dune Stabilization With Vegetation On the Outer Banks of North Carolina. Technical Memorandum No. 22. U.S. Army, Corps of Engineers, U.S. Coastal Engineering Research Center, Fort Belvoir, Virginia. 45 pp.
This memorandum provides results on experiments to develop a more effective revegetation program. Plant species and methods for planting are provided.

Woodhouse, W. W., Jr., E. D. Seneca, and S. W. Broome. 1976. Ten Years of Development of Man-initiated Coastal Barrier Dunes in North Carolina. Bulletin 453, North Carolina Sea Grant Program Publication No. 77-01. North Carolina University Agricultural Experiment Station, Raleigh, North Carolina. 55 pp.
Development of dunes by planting various vegetation is described along with the results of such experiments. Dune grasses, American beachgrass and sea oats were used.

C. Groundwater

Brown, G. S. and R. C. Newcomb. 1963. Ground-Water Resources of the Coastal Sand-Dune Area North of Coos Bay, Oregon. U.S. Department of the Interior, Geological Survey Water Supply Paper 1619-D. U.S. Government Printing Office, Washington, D.C. 32 pp.
This report provides information on the hydrology of the sand dune aquifer north of Coos Bay, Oregon including water quality and water supply.

California Pollution Control Board. 1954. Investigation of Travel of Pollution. Publication 11. Sacramento, California. 218 pp.
The capabilities of some soils and subsurface materials as filtering agents of various pollutants are investigated.

Dugan, Patrick, Y. R. Nayudu, Daniel Bottom, and Kathy Fitzpatrick. 1976. A Study of Shoreland Management Alternatives - Inventory of Five Shoreland Areas. Oregon Coastal Conservation and Development Association, North Bend, Oregon. 280 pp.
This study provides basic environmental baseline data on five shoreland areas representative of Oregon coastal environments. The following areas are examined: The Nehalem River, Woahink and Siltcoos Lakes, the shoreline of Curry County, Yaquina Bay and the Siletz River.

Frank, F. J. 1970. Ground Water Resources of the Clatsop Plains, Sand Dune Area, Clatsop County, Oregon. U.S. Department of the Interior, Geological Survey Water Supply Paper 1899-A. U.S. Government Printing Office, Washington, D.C. 41 pp.

This study provides a good picture of characteristics of the Clatsop aquifer; includes geohydrology, water quality and development problems.

Hampton, E. R. 1961. "Ground Water From Coastal Dune and Beach Sands." Geological Survey Research. U.S. Department of the Interior, Geological Survey Professional Paper 424B. U.S. Government Printing Office, Washington, D.C. pp. B204-B206. 3 pp.

A brief but informative introduction to Oregon coastal dune groundwater characteristics is presented in this article.

Hampton, E. R. 1963. Ground Water in the Coastal Dune Area Near Florence, Oregon. U.S. Department of the Interior, Geological Survey Water Supply Paper 1539-K. U.S. Government Printing Office, Washington, D.C. 36 pp.

The occurrence, quantity and general quality of dunal groundwater near Florence are investigated in this report. Duneland aquifer characteristics are described and practical withdrawal methods and considerations are discussed.

Larson, Douglas W. 1974. A Water Quality Survey of Selected Coastal Lakes in the Sand Dune Region of Western Lane and Douglas Counties, 1972-1973. Final Report, Western Quality Studies. Oregon Department of Environmental Quality, Portland, Oregon. 152 pp.

A technical study of thirteen coastal lakes to document existing limnological characteristics to establish a baseline for future planning and management.

Larson, Douglas William. 1970. "On Reconciling Lake Classification With the Evolution of Four Oligotrophic Lakes in Oregon." PhD Dissertation, Oregon State University, Corvallis, Oregon. 135 pp.

This study considers the responses of four Oregon lakes, including Woahink Lake in coastal Lane County, to the ambient physical environment and cultural use interactions; assesses factors which encourage or inhibit eutrophication in each lake and; proposes an alternative, diagnostic lake classification system.

Robison, J. H. 1973. Hydrology of the Dunes Area North of Coos Bay, Oregon. U.S. Department of the Interior, Geological Survey, Portland, Oregon. 62 pp.

A detailed study of the hydrology of a twenty square mile area of dunes along the central Oregon coast. Within the study an analog model was used to analyze current and projected water levels.

Smith, David L. 1962. Lake and Stream Formation on Sand Dunes in the Florence District, Oregon. University of Oregon, Eugene, Oregon. 90 pp.
This study deals with the description and interpretation of lake and stream forms near Florence, Oregon.

Sweet, Randy H. 1977. Carrying Capacity of the Clatsop Plains Sand-Dune Aquifer. A report for the Clatsop County Commission and Oregon Environmental Quality Commission, Clatsop County, Oregon. 73 pp.
This study assesses the physical hydrogeological characteristics of this area and proposes management recommendations.

D. Off-road Vehicles

Baldwin, Malcolm R., and Dan H. Stoddard, Jr. 1973. The Off-Road Vehicle and Environmental Quality. 2nd Edition. The Conservation Foundation, Washington, D.C. 61 pp.
Environmental concerns as well as other ORV problems are discussed and good recommendations are offered.

Bennett, Shaun. 1973. A Trail Rider's Guide to the Environment. American Motorcyclists Association, Westerville, Ohio. 60 pp.
The booklet is geared for the "biker" and is humorously illustrated pointing out responsible use is a must to ensure off-road opportunities. Environmental considerations are mentioned regarding soil and other elements.

Bess, Fred H. 1973. "The Effectiveness of Helmets for EAR Protection." Proceedings of the 1973 Snowmobile and Off the Road Vehicle Research Symposium. Donald F. Holecek, Ed. Department of Parks and Recreation Resources Technical Report No. 9 (147-149). Michigan State University, East Lansing, Michigan. 3 pp.
The potential hazards of ORV noise were mentioned and various helmet brands were tested. None were particularly effective.

Blodget, Bradford G. 1978. The Effect of Off-Road Vehicles on Least Terns and Other Shorebirds. National Park Service Cooperative Research Unit Report No. 26. University of Massachusetts. 79 pp.
A carefully conducted study specifically on Least Terns, and other shorebirds. The study took place in an area of extremely high ORV management.

Bury, Richard L., Robert C. Wendling, and Stephen McCool. 1976. Off-Road Recreation Vehicle - A Research Summary, 1969-1975. MP-1277. Texas Agriculture Experiment Station, Texas A & M University, College Station, Texas. 84 pp.
This review is very useful to rapidly become oriented in ORV literature and problems. It covers all major areas.

California Department of Parks and Recreation. 1975. Pismo State Beach and Pismo Dunes State Vehicular Recreation Area -- General Development Plan and Resource Management Plan. Sacramento, California. 83 pp.
This plan is a good example of management of high use areas. Many ORV problems are considered.

California Department of Parks and Recreation. 1978. Off-Highway Vehicle Recreation in California. Sacramento, California. 96 pp.
A complete overview of the California system is provided. It serves as a good example of an off-road vehicle system.

Carter, James E. 1977. "Use of Off-Road Vehicles on Public Lands." U.S. Presidential Executive Order 11989. Government Printing Office, Washington, D.C. 1 p.
This order allows federal land managers to close an area to certain ORVs if there are real or potential adverse environmental effects.

Godfrey, Paul J., Stephen P. Leatherman, and P. A. Buckley. 1978. "Impact of Off-Road Vehicles on Coastal Ecosystems." Coastal Zone '78 Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone Management. Volume II. American Society of Civil Engineers, New York, New York. pp. 581-600. 20 pp.
This summarizes the ORV effects on several coastal ecosystems and appears to be the most comprehensive research effort in that regard. It is very informative and serves to launch one into the specific studies it summarizes.

Harrison, Rob. 1973. "ORV Noise Effects and Measurements." Proceedings of the 1973 Snowmobile and Off the Road Vehicle Research Symposium. Donald F. Holecek, Ed. Technical Report No. 9. Michigan State University, East Lansing, Michigan. pp. 135-145. 11 pp.
ORV noise measurement techniques are discussed as are effects. ORV noise detectability is considered.

Lodico, Norma Jean. 1973. Environmental Effects of Off-Road Vehicles: A Review of the Literature. Bibliography Series No. 29. Office of Library Services, U.S. Department of the Interior, Washington, D.C. 112 pp.
This work is useful and shows areas of environmental concern. At the time it was published, the number of authoritative studies on ORV impacts was limited.

McCool. S. F., and J. W. Roggenbuck. 1974. Off-Road Vehicles and Public Lands: A Problem Analysis. Department of Forestry and Outdoor Recreation and Institute for the Study of Outdoor Recreation and Tourism, Utah State University, Logan, Utah. 109 pp.
This work comprehensively organizes the questions about ORVs to identify the areas most needing research. It provides a quick background on the multitude of ORV related problems.

McEwen, Douglas N. 1978. Turkey Bay Off-Road Vehicle Area at Land Between the Lakes: An Example of New Opportunities for Managers and Riders. Research Report Number 1. Department of Recreation, Southern Illinois University, Carbondale, Illinois. 28 pp.
The work shows many examples of how to successfully plan and manage an ORV area.

Motorcycle Industry Council. 1978. 1978 Motorcycle Statistical Annual. Newport Beach, California. 46 pp.
Statistics on the motorcycle market, manufacturers, use, and ownership are presented. Off-road use is considered.

Muntz, E. P., T. L. Deglow, and D. H. Campbell. 1972. "Public Lands and Off-Road Motorized Recreation." Environmental Engineering Programs Bulletin 100. School of Engineering, University of Southern California, Los Angeles, California. 18 pp.
The area of disturbance for a trail biker and a hiker is quantified, compared, and related to the finite resource base.

Neidoroda, A. 1975. Geomorphological Effects on ORVs on Coastal Systems of Cape Cod, Massachusetts. National Park Service Cooperative Research Unit Report No. 17. University of Massachusetts. 100 pp.
The study considers the causes and results of ORV downslope sand transport. It suggests ways to limit such transport and ORV related erosion.

Nixon, Richard M. 1972. "Use of Off-Road Vehicles on the Public Lands." U.S. Presidential Order 11644. U.S. Government Printing Office, Washington, D.C. 2 pp.
The order required federal agencies to develop management plans for ORVs on their lands and consider several factors in doing so.

Oregon Department of Environmental Quality. 1978. DEQ Handbook for Environmental Quality Elements of Oregon Local Comprehensive Land Use Plans. Portland, Oregon. 28 pp.
This loose-leaf work provides background on noise restrictions that apply to ORVs.

Oregon Department of Transportation, Parks and Recreation Branch. 1977. Oregon Outdoor Recreation Needs Bulletin 1977. Technical Document III of the State Wide Comprehensive Outdoor Recreation Plan. Salem, Oregon. 183 pp.

This document considers the recreational statewide needs and includes ORV use. The figures on availability of trails are questionable, however, it does recognize ORV use.

Peine, John D. 1973. "Off-Road Vehicle Use in Tucson, Arizona." Proceedings of the 1973 Snowmobile and Off the Road Vehicle Research Symposium. Donald F. Holecek, Ed. Technical Report No. 9. Department of Parks and Recreational Resources, Michigan State University, East Lansing, Michigan. 202 pp.

The paper is based on Peine's unpublished thesis. It describes the ORV activity and develops a model for ORV preference.

Rasor, Robert. 1978. Five State's Approaches to Trailbike Recreation Facilities and Their Management. American Motorcycle Association, Westerville, Ohio. 64 pp.

Different systems for trail bike areas are discussed and useful examples of management are provided. It shows trail bikes can be a manageable form of recreation. The Appendixes are very useful including the ORV legislation from the States of Washington and California.

Stupay, Arthur M. 1971. "Growth of Powerized Vehicles in the 1970's." Proceedings of the 1971 Snowmobile and Off the Road Vehicle Research Symposium. Michael Chubb, Ed. Technical Report No. 8. Michigan State University, East Lansing, Michigan. 196 pp.

It provides a background on the growth of ORVs.

U.S. Department of Agriculture, Forest Service. 1976. "Travel Plan Off-Road Vehicle Use -- Siuslaw National Forest." Corvallis, Oregon. 4 pp. + maps.

It describes the various vehicle designations and operating conditions for each open area; the basis for these policies is mentioned.

U.S. Department of the Interior, Bureau of Land Management. 1970. Operation ORVAC: Recommendations and Guidelines for the Management of Off-Road Vehicles on Public Domain Lands in California. Sacramento, California. 40 pp.

General guidelines are provided that are useful as is the approach to the ORV problem through an advisory council.

Visco, Christopher. 1977. "The Geomorphic Effects of Off-Road Vehicles on the Beach, Fire Island, New York." MA Thesis. State University of New York, Binghamton, New York. 74 pp.
Describes how different factors relating to ORV travel on beaches, such as speed, affect the net amount of sediment moved down slope by vehicle tracks.

Washington Department of Natural Resources. 1976. "Operating All-Terrain Vehicles in the State of Washington." Olympia, Washington. 14 pp.
This is an informational booklet on the all-terrain program in Washington.

E. Sand Movement--Erosion and Accretion

Aguilar-Tunon, N. A., and P. D. Komar. 1978. "The Annual Cycle of Profile Changes of Two Oregon Beaches." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 40(2)25-39. 14 pp.
This study compares two beaches, Gleneden Beach and Devil's Punchbowl Beach. The purposes of the study were to examine annual changes and relate these changes to wave conditions.

Beaulieu, John D. 1974. Geologic Hazards Inventory of the Oregon Coastal Zone. Misc. Paper 17. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 94 pp.
This publication provides an excellent introduction to the geologic hazard potentials along the Oregon coast. It is aimed at the planner and planning official and includes test, maps and matrices.

Beaulieu, John D. 1978. "Surfical Geologic Hazard Concept for Oregon." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 40(3):41-56. 16 pp.
This article deals with hazards such as mass movement, slope erosion, flooding, and stream erosion. It is a general introduction to such hazards.

Beaulieu, John D. and Paul W. Hughes. 1975. Environmental Geology of Western Coos and Douglas Counties, Oregon. Bulletin 87. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 148 pp + maps.
The purpose of this report is to provide a data base concerning land capabilities and limitations of coastal Coos and Douglas Counties to allow for safe and responsible development.

Byrne, John V. 1963. "Coastal Erosion, Northern Oregon." Essays in Marine Geology in Honor of K. O. Emery. University of Southern California Press, Los Angeles, California. pp. 11-33. 24 pp.
The article discusses erosion on the Oregon coast including the climatic, oceanographic and geologic features which control erosion.

Byrne, John V. 1964. "An Erosional Classification for the Northern Oregon Coast." Association of American Geographers Annals. Association of American Geographers, Chicago, Illinois. 54:329-335. 7 pp.
The article proposes a classification procedure which subdivides the northern coast of Oregon according to the geologic factors which control erosion.

Collier, Courtland A., Kamran Eshaghi, George Cooper, and Richard S. Wolfe. 1977. Guidelines for Beachfront Construction with Special Reference to the Coastal Construction Setback Line. Report No. 20. Department of Civil Engineering, University of Florida, Gainesville, Florida. 72 pp.
The report discusses and illustrates problems encountered in beachfront construction and criteria for evaluating variances that will uphold the purpose and philosophy of the Florida Coastal Construction Setback Line Law whenever construction seaward of that line is justified.

Cooper, William S. 1967. Coastal Dunes of California. Memoir No. 104. Geological Society of America, Boulder, Colorado. 131 pp.
This work completed a geomorphic investigation of the coastal dunes of California which was originally published in 1958; includes areas of northern Baja California.

Davis, J. L. 1977. Geographical Variation in Coastal Development. Longman Group Ltd., London, England. 204 pp.
This publication includes generalized patterns of coastal morphology and introduces the idea of climatic controls on regional coastal geomorphology.

Davis, Richard A., Jr., Ed. 1978. Coastal Sedimentary Environments. Springer-Verlag, New York, New York. 420 pp.
This publication is a thorough academic treatment of offshore, beach, dune and riverine coastal sedimentary environments, with geomorphological emphasis.

Dicken, S. N. 1961. Some Recent Physical Changes of the Oregon Coast. Office of Naval Research Contract Nonr-2771(04). Department of Geography, University of Oregon, Eugene, Oregon. 151 pp.
This report is concerned with the physical changes of the Oregon Coast since white settlement, with special emphasis on beaches, dunes, and tidal marshes in the estuaries.

Dickson, Samuel N., Carl L. Johannessen, and Bill Hanneson. 1961. Some Recent Physical Changes of the Oregon Coast. Department of Geography, University of Oregon, Eugene, Oregon. 151 pp.

The factors causing shoreline changes are discussed with the emphasis being on the historical changes of the beaches, nearby dunes, and estuaries since the time of white settlement. Vegetation changes are considered in this rather comprehensive work.

Flawn, Peter T. 1970. Environmental Geology: Conservation, Land-Use Planning, and Resource Management. Harper and Row, New York, New York. 313 pp.

A good introduction into planning rationales and the geologic system. The author specifically deals with beaches and man's impacts in various sections of the document.

Hamilton, Stanley F. 1973. "Oregon Estuaries." Oregon Division of State Lands, Salem, Oregon. 49 pp.

This publication presents maps and aerial photographs along with information on Oregon's estuaries.

Hanneson, Bill. 1961. "Vegetation Changes of the Oregon Coastal Dunes." Some Recent Physical Changes of the Oregon Coast. Office of Naval Research Contract Nonr-2771(04). Department of Geography, University of Oregon, Eugene, Oregon. pp. 77-99. 23 pp.

This article documents the alteration of the Oregon sand dunes by man and discusses the processes by which man makes these changes.

Komar, P. D. 1977. "Beach Profiles Obtained With an Amphibious DUKW on the Oregon and Washington Coasts." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 39(11):169-180. 12 pp.

During a Navy study in 1945 and 1946 beach profiles were collected at 15 Oregon and Washington locations using a DUKW. Included is information on the outer bars and troughs and extends across the entire nearshore zone.

Komar, P. D. 1978. "Wave Conditions On the Oregon Coast During the Winter of 1977-78 and the Resulting Erosion of Nestucca Spit." Shore and Beach. American Shore and Beach Preservation Association, Miami, Florida. 46(4):3-8. 6 pp.

This article describes the wave erosion of Nestucca Spit during unusually intense storm waves in the winter of 1977-78.

Komar, P. D., J. R. Lizarraga-Arciniega and T. A. Terich. 1976. "Oregon Coast Shoreline Changes Due to Jetties." Journal of Waterways, Harbors and Coastal Engineering Division. American Society of Civil Engineers, New York, New York. 102(WW1) Paper 11933:13-30. 18 pp.

This article discusses the role of jetties in erosion and deposition, primarily in an area of zero net littoral sand drift. The jetty systems of Nehalem River, Tillamook Bay, Yaquina Bay, Siuslaw River mouth, the Umpqua River, Coos Bay entrance, the Coquille River, Rogue River, and Chetco River mouth are included.

Lizarraga-Arciniega, J. R. and Paul D. Komar. 1975. Shoreline Changes Due to Jetty Construction on the Oregon Coast. Publication Number ORES4-T-75-004. Oregon State University Sea Grant College Program, Corvallis, Oregon. 85 pp.

All nine jetty systems on the coast are included except those on the Columbia River. The relationship between beach erosion, accretion and jetty construction is discussed. A computer model is provided to simulate shoreline changes resulting from the Siuslaw River jetties.

McKinney, B. A. 1977. "The Spring 1976 Erosion of Siletz Spit, Oregon, With an Analysis of the Causative Wave and Tide Conditions." MS Thesis, School of Oceanography, Oregon State University, Corvallis, Oregon. 66 pp.

This study documents the 1976 erosion of Siletz Spit and contrasts it with early occurrences. The role of tides was investigated and it was determined that storm surges did not contribute to the spit erosion.

North, W. B. 1964. "Coastal Landslides in Northern Oregon." MS Thesis, Oregon State University, Corvallis, Oregon. 85 pp.

This thesis explores the contributions of landslides to the erosion of the northern Oregon Coast.

Phipps, John B. and John M. Smith. 1978. "Pacific Ocean Beach Erosion and Accretion Report." Grays Harbor College, Aberdeen, Washington. 75 pp.

Historical shorelines of southwestern Washington are mapped, and the factors affecting erosion/accretion are considered in light of a sand budget. A projected shoreline map is provided and dune management is discussed.

Prestedge, G. K. 1977. "Stabilization of Landslides Along the Oregon Coast." Engineering Report, Department of Civil Engineering, Oregon State University, Corvallis, Oregon. 53 pp.

This paper studies the landslide problem on the Oregon coast in order to propose methods of stabilization for potential landslides. An analytical model of the landslide mechanism is presented.

Rea, Campbell C. 1974. "The Erosion of Siletz Spit, Oregon." MS Thesis, Oregon State University, Corvallis, Oregon. 105 pp.

A paper viewing the history of erosion and accretion with comments on changes of the shoreline and sand budget. Recommendations for controlling erosion are presented.

Rea, Campbell C. and Paul D. Komar. 1975. "The Erosion of Siletz Spit, Oregon." Reference 75-4. School of Oceanography, Oregon State University, Corvallis, Oregon. 105 pp.

This paper examines the history of erosion on Siletz Spit to determine whether the erosion is long term or cyclical and to suggest causes and remedies.

Schatz, C. 1965. "Source and Characteristics of the Tsunami Observed Along the Coast of the Pacific Northwest on 28 March 1964." MS Thesis, Department of Oceanography, Oregon State University, Corvallis, Oregon. 39 pp.

The thesis discusses the possibility that the 1964 tsunami was caused by uplift and subsidence of submarine crustal blocks. The degree and type of transformation of the waves as they reached estuaries was based on the underwater and coastal features at the estuary.

Schatz, Clifford E., Herbert Curl, Jr., and Wayne V. Burt. 1964. "Tsunamis on the Oregon Coast." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 26(12):231-232. 2 pp.

The article reviews the effects of the tsunami of 1964. It explains that the coast will probably be struck again and the estuaries are the areas most susceptable to damage.

Schlicker, Herbert G. and Robert J. Deacon. 1974. Environmental Geology of Coastal Lane County, Oregon. Bulletin 85. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 116 pp.

A geological background is provided along with geological hazards and a well-illustrated section on sand dunes within this work.

Schlicker, Herbert G., Robert J. Deacon, John D. Beaulieu and Gordon W. Olcott. 1972. Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon. Bulletin 74. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 164 pp.

A substantial geological background is provided along with geological hazards, mineral resources including sand and gravel, and engineering characteristics of the geological units.

Schlicker, Herbert G., Robert J. Deacon, Gordon W. Olcott, and John D. Beaulieu. 1973. Environmental Geology of Lincoln County, Oregon. Bulletin 81. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 171 pp.

A substantial geological background is provided along with groundwater, geological hazards, and mineral resources.

State Soil and Water Conservation Commission. 1978. Inventory: Oregon Coastal Shoreline Erosion. Volume I. Salem, Oregon. 109 pp.

A study of the shoreline erosion problem and related sources of information including an annotated bibliography. The processes and historic patterns are presented with a county by county approach.

Stembridge, James E. 1976. Recent Shoreline Changes of the Oregon Coast. Accession No. ADA048436. National Technical Information Service, Springfield, Virginia. 51 pp.
An analysis and classification of shoreline erosion along Oregon's pacific coastline based on earlier research for PhD dissertation at University of Oregon.

Terich, T. A. 1973. "Development and Erosion of Bayocean Spit, Tillamook." PhD Thesis, Department of Geography, Oregon State University, Corvallis, Oregon. 145 pp.
The thesis discusses the development of a resort on Bayocean sand spit on the northern Oregon coast and the reasons for its abandonment, primarily erosion of the spit due to construction of a jetty.

Terich, T. A., and P. D. Komar. 1974. "Bayocean Spit, Oregon: History of Development and Erosional Destruction." Shore and Beach. American Shore and Beach Preservation Association, Miami, Florida. 42(2):3-10. 8 pp.
The article describes the development of Bayocean Park on Bayocean Spit and its failure due to erosion of the Spit after construction of a jetty in 1914-17.

F. Biological Information

Amos, William H. 1959. "The Life of a Sand Dune." Scientific American. Scientific American, Inc, New York, New York. 201:91-99. 9 pp.
This article discusses the community of plants and animals which live on a sand dune.

Byrd, N. L. 1950. "Vegetation Zones of Coastal Dunes Near Waldport, Oregon." MS Thesis. Oregon State University, Corvallis, Oregon. 44 pp.
This thesis discusses the effects of physical factors on the zonation of vegetation on sand dunes in the area north of Alsea Bay near Waldport Oregon.

Dyrness, C. T., J. F. Franklin, C. Maser, S. A. Cook, J. D. Hall, and G. Faxon. 1975. Research Natural Area Needs in the Pacific Northwest. U.S. Forest Service General Technical Report, PNW-38 U.S. Department of Agriculture, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 231 pp.
The publication is a guide to describe a system of natural areas for Oregon and Washington and to help coordinate the preservation of natural areas and alert land planners to their value.

Eilers, Peter, III. 1974. "Plants, Plant Communities, Net Production and Tide Levels; Ecological Biogeography of the Nehalem Salt Marshes, Tillamook County, Oregon." PhD Thesis, Department of Geography, Oregon State University, Corvallis, Oregon. 368 pp.
This is a detailed study of the coastal salt marsh at Nehalem estuary in Oregon. The primary purpose is to understand and establish the importance of these types of areas.

Hitchcock, C. Leo and Arthur Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, Washington. 730 pp.
This is an illustrated, condensation of the five-volume work, Vascular Plants of the Pacific Northwest, (below).

Hitchcock, C. Leo, Arthur Cronquist, Marion Ownbey, and J. W. Thompson. 1955-1969. Vascular Plants of the Pacific Northwest. University of Washington Press, Seattle, Washington. 5 volumes.
This is a five-volume technical description and discussion of the vascular plant families of the Pacific Northwest including keys for their identification.

Kumler, M. L. 1969. "Plant Succession on the Sand Dunes of the Oregon Coast." Ecology. Duke University Press, Durham, North Carolina. 50:695-704. 10 pp.
Perhaps the most thorough and comprehensive recent study of coastal dune dynamics; especially appropriate for the central Oregon coast.

Macdonald, Keith B., and Michael G. Barbour. 1974. "Beach and Salt Marsh Vegetation of the North American Pacific Coast." Ecology of Halophytes. W. H. Queen and R. J. Reimold, Eds. Academic Press, New York. pp. 175-234. 60 pp.
The paper surveys beach and salt marsh vegetation between Point Barrow, Alaska and Cabo San Lucas at the southern tip of Baja California.

Oosting, H. J. and W. D. Billings. 1942. "Factors Affecting Vegetation Zonation on Coastal Dunes." Ecology. Duke University Press, Durham, North Carolina. 23:131-142. 12 pp.
This article discusses the development of blow-outs along areas of unconsolidated sands on the coast of North Carolina. Several types of beach plants were planted on the dunes with various treatments of the plants tried. The characteristics of the sand and atmosphere were also discussed.

Wiedemann, Alfred Max. 1966. "Contributions to the Plant Ecology of the Oregon Coastal Sand Dunes." PhD Thesis, Oregon State University, Corvallis, Oregon. 255 pp.
This thesis investigates the ecological and economic aspects of Oregon coastal dunes. A literature review is included on the botanical and ecological aspects of the dunes. The deflation plain is discussed in detail.

IV. BEACH AND DUNE MANAGEMENT TECHNIQUES

A. Hazard Management

Coastal Zone Management. 1976. Natural Hazard Management in Coastal Areas. U.S. Department of Commerce, NOAA. Washington D.C. 286 pp.
A handbook geared to provide guidance and information to coastal planners and decision-makers on major natural hazards. The handbook presents the material as: Major Coastal Hazards, Problems and Recommendations, Hazard Management in the Coastal States, Annotated Bibliography and a Directory of Selected Agencies.

Georgia Department of Natural Resources. 1975. Handbook: Building in the Coastal Environment. Atlanta, Georgia. 118 pp.
The handbook provides site specific guidelines including site analysis, planning/design, construction, and land exchange. The concepts are highly illustrated.

Kates, Robert W. 1978. Risk Assessment of Environmental Hazard. John Wiley and Sons, New York, New York. 112 pp.
A technical report that examines the present state of the art with respect to coping with environmental risks. Existing methods and modes of risk assessment along with the observed trends and attitudes in assessing environmental threat are presented.

State Soil and Water Conservation Commission. 1978. Oregon Coastal Management Program: Shoreline Erosion Management Policies and Procedures. Volume II. Salem, Oregon. 113 pp.
A description of the Oregon Coastal Zone Management program with a focus on management techniques for shoreline erosion is presented. An evaluation of the current program is given with suggestions for policy changes.

The Conservation Foundation. 1977. Physical Management of Coastal Floodplains: Guidelines for Hazards and Ecosystems Management. Council on Environmental Quality, Washington, D.C. 179 pp.
A technical report that offers development and conservation guidelines for the following coastal areas: coastal watersheds, shoreland water systems, coastal floodlands, saltwater wetlands, bluffs, dunes, beaches, basin floor, and coastal waters.

U.S. Army Corps of Engineers. 1966. Beach Erosion Control and Shore Protection Studies. Engineering Manual No. 1110-2-3300. Office of the Chief of Engineers, Washington, D.C. 19 pp. + appendices.
This manual discusses the types of information needed to conduct beach erosion studies, such as program development and data collection, to serve as a basis for planning remedial measures.

U.S. Army Corps of Engineers. 1975. Shore Protection Manual Volume I. Second edition. U.S. Army Coastal Engineering Research Center, Fort Belvoir, Virginia. 508 pp.
This is the first volume of a three volume manual. It describes the physical environment of the coastal zone and discusses coastal engineering, wave mechanics, wave and water predictions, and littoral processes.

U.S. Army Corps of Engineers. 1975. Shore Protection Manual Volume II. Second edition. U.S. Army Coastal Engineering Research Center, Fort Belvoir, Virginia. 505 pp.
This volume of a three volume manual deals with planning and structural design in relation to the physical factors of Volume I. An example is provided.

U.S. Army Corps of Engineers. 1975. Shore Protection Manual Volume III. Second Edition. U.S. Army Coastal Engineering Research Center, Fort Belvoir, Virginia. 141 pp.
This volume of the three volume manual contains the appendixes (glossary, list of symbols, tables and plates, and subject index) for the first two volumes.

U.S. Department of Housing and Urban Development. 1977. Elevated Structures/Reducing Flood Damage Through Building Design: A Guide Manual. HUD-FIA-184(2). Washington, D.C. 108 pp.
The manual provides background information on the National Flood Insurance Program and the hazards associated with building in the floodplain. It reviews the existing alternatives to house construction on raised foundations and offers performance criteria for such foundation systems.

B. Considerations and Impacts

Alen, Ray, David Brower, B. J. Copeland, D. Frankenberg, and Francis Parker. 1976. Ecological Determinants of Coastal Area Management. Volume II. North Carolina State University, Raleigh, North Carolina. 392 pp.
A comprehensive work that covers both the coastal ecological systems and tools and techniques for coastal area management. While having a bias for the North Carolina situation, this work does offer valuable insight into the application of many tools upon several coastal ecosystems.

Battelle Institute. 1971. Shoreland Management Guidelines to Grays Harbor Regional Planning Commission. Battelle Pacific Northwest Laboratories, Richland, Washington. 95 pp.
A detailed study of the shorelands of Grays Harbor County, Washington, that described the natural systems, land-use activities and presented management guidelines including a checklist for shoreland policy decisions.

Bella, David A. 1973. "Environmental Planning Methods." Coastal Zone Management Problems. Water Resources Institute, Oregon State University, Corvallis, Oregon. pp. 53-60. 8 pp.
An approach to coastal zone management planning that places a high value on environmental variety is presented. The key to this method is the preservation of future options enabling the management authority to adjust decisions in relationship to changing value systems and unanticipated environmental impacts.

Brahtz, J. F. Peel, Ed. 1972. Coastal Zone Management: Multiple Use With Conservation. John Wiley and Sons, Inc. New York, New York. 351 pp.
This book addresses a wide range of resource uses, conflicts and problems of coastal zone management, each from the particular viewpoint of a specialist in one of the classical problem areas.

Bright, Donald B. 1973. "Local Land Use: Management Concepts and Problems." Proceedings of Coastal Zone Management and the Western States Future. William B. Merselis, Ed. Marine Technology Society, Newport Beach, California. pp. 222-226. 5 pp.
The author presents three management concepts: ethical changes, land as a resource and a commodity, and a cross-matching scheme.

Brower, David, Dirk Frankenberg, and Francis Parker. 1976. Ecological Determinants of Coastal Area Management--An Overview. Volume 1. Sea Grant Publication UNC-SG-76-05. North Carolina State University Raleigh, North Carolina. 133 pp.
The work analyzes the ecological processes of the barrier island system and lagoon-estuary system. Various management tools are provided to preserve the components of the two main systems.

Canter, Larry. 1977. Environmental Impact Assessment. McGraw-Hill Book Company, New York, New York. 331 pp.
An introductory text that presents a systematic approach to the prediction and assessment of impacts on the physical, chemical, biological, cultural and socioeconomic factors in the environement.

Dickert, Thomas and Jens Sorensen. 1978. Collaborative Land-Use Planning for the Coastal Zone: A Process for Local Program Development. Volume I. IURD Monograph No. 27. Institute of Urban and Regional Development, University of California, Berkeley, California. 120 pp.
Collaborative planning in this work is presented as a midpoint compromise between centralized and decentralized approaches in which state and local units of government work jointly to prepare and implement local, regional and state land use plans.

Dilton, Robert B., John L. Seymour, and G. C. Swanson. 1977. Coastal Resources Management: Beyond Bureaucracy and the Market. Lexington Books, Lexington, Massachusetts. 196 pp.

An overview of the main issues involved in coastal zone management. The authors review current practices, future needs and describe several case histories. The main emphasis is on improved management for multiple use.

Harrison, Pete. 1977. "The Pressure for Shoreline Development: Spatial Concepts in Review." Coastal Zone Management Journal, New York, New York. 3(3):319-322. 4 pp.

The relationships between dispersed and concentrated shoreline development, environmental carrying capacity and public access are developed in a broad conceptual scheme.

Harvard University Graduate School of Design. 1967. Three Approaches to Environmental Resource Analysis. The Conservation Foundation, Washington, D.C. 102 pp.

An excellent view of three major approaches to environmental planning. Included are the works of G. Angus Hills, Philip H. Lewis, Jr. and Ian L. McHarg. Although the work is dated, it is still a basic source and contains an annotated bibliography.

Hendler, Bruce. 1977. Caring for the Land: Environmental Principles for Site Design and Review. Report No. 328. American Society of Planning Officials, Chicago, Illinois. 94 pp.

A generalized approach to planning is provided including environmental, site, and design considerations. It is a well-illustrated and useful overview to thoughtful development.

Hermon, Barbara A. 1975. "The Environmental Review Team." Planners Notebook. Volume 5. American Institute of Planners, Cambridge, Massachusetts. 5(5). 6 pp.

A report on the history and methodology of an interdisciplinary environmental review team that was established in Eastern Connecticut in 1968 to assist local governments and developers in assessing the environmental impacts of proposed large scale projects.

Jain, R. K., L. V. Urban, and G. S. Stacey. 1977. Environmental Impact Analysis: A New Dimension in Decision-Making. Von Nostrand Reinhold Company, New York, New York. 330 pp.

A technical look at environmental impact statements that gives insight into how to determine which of forty-nine bio-physical and socio-economic factors may be affected by a given project. The authors present methods on how to identify and measure in advance impacts on these forty-nine attributes.

Komar, P. D. and B. A. McKinney. 1977. "The Spring 1976 Erosion of Siletz Spit, Oregon, With an Analysis of the Causative Storm Conditions." Shore and Beach. American Shore and Beach Preservation Association, Miami, Florida. 45(3):23-30. 8 pp.
This study documents erosion on Siletz Spit, Oregon and contrasts it with earlier winter erosion periods. Tide levels and storm surges are analyzed.

Komar, P. D., W. Quinn, H. C. Creech, C. C. Rea, and J. R. Lizarraga-Arciniega. 1976. "Wave Conditions and Beach Erosion on the Oregon Coast." The Ore Bin. Oregon Department of Geology and Mineral Industries, Portland, Oregon. 38(7):103-112. 10 pp.
Data from November, 1971 through June, 1975 has been analyzed concerning the wave height at Newport, Oregon every six hours, measured by a recording device that detects microseisms.

Komar, P. D. and C. C. Rea. 1976. "Erosion of Siletz Spit, Oregon." Shore and Beach. American Shore and Beach Preservation Association, Miami, Florida. 44(1):9-15. 7 pp.
This article explains the erosion of Siletz Spit, Oregon due to rip currents eroding embayments on the beach.

Komar, Paul and Thomas A. Terich. 1976. "Changes Due to Jetties at Tillamook Bay, Oregon." Proceedings 15th Coastal Engineering Conference. American Society of Civil Engineering, New York, New York. Chapter 104:1791-1811. 21 pp.
This paper explains that physical changes on the Bayocean Spit are the results of local rearrangement of the beach, not from a change in the net littoral drift.

Kulm, L. D. and J. V. Byrne. 1966. "Sedimentary Response to Hydrography in an Oregon Estuary." Marine Geology. Elsevier Publishing Company, Amsterdam. 4:85-118. 34 pp.
This article discussed two major realms of deposition of Yaquina Bay, Oregon - marine and fluviatile and a third - marine-fluviatile transition realm. Sediment transport and deposition is discussed as it relates to climatic and hydrographic variations.

Louisiana Coastal Resources Program. 1976. A Process for Coastal Resources Management and Impact Assessment. Louisiana State Planning Office, Baton Rouge, Louisiana. 72 pp.
The report is presented as a management handbook for elected and appointed officials, citizens and private sector interests to provide suggested methods of approaching some of the unique planning problems of the Louisiana coastal zone.

Roberts, William H. 1978. "Environmental Developmental Trade-offs in the Coastal Zone." Proceedings of Coastal Zone '78. Volume IV. American Society of Civil Engineers, New York, New York. pp. 2773-2790. 18 pp.

The author presents environmental and developmental functions in the planning process as mutually exclusive or conflicting (where a potential for accommodation or trade-off exists) in an approach to make coastal zone management programs effective.

Schoenbaum, Thomas J. and Kenneth G. Silliman. 1976. Coastal Planning: The Designation and Management of Areas of Critical Environmental Concern. University of North Carolina Sea Grant Publication UNC-SG-76-09. Chapel Hill, North Carolina.

This study reviews general legal limitations and suggests a process to designate and manage areas of particular environmental concern. Oregon's approach is included as are all states involved with such legislation.

Schoenbaum, Thomas J. and Ronald H. Rosenberg. 1976. "The Legal Implementation of Coastal Zone Management: The North Carolina Model." Duke Law Journal. Durham, North Carolina. 1:1-37. 37 pp.

The authors review several policy areas that affect coastal management (planning, impact analysis, land use controls, permits, various tax programs, and government acquisition and ownership). Authors conclude that traditional land use legal tools are inadequate and that they should be enhanced by new techniques coupled with a strong intergovernmental cooperation strategy.

Sorensen, Jens C. 1971. "A Framework for Identification and Control of Resource Degradation and Conflict in the Multiple Use of the Coastal Zone." MA Thesis, University of California, Berkeley, California. 50 pp.

A useful introductory work that provides an approach to the development of coastal planning policy. The paper is divided into five parts: (1) resource conflict and degradation, (2) development of an impact system framework, (3) description of the parts (4) applications of the framework, and (5) future needs to improve the framework.

Stockhom, John. 1974. Performance Standards: A Technique for Controlling Land Use. Extension Service Special Report 424. Oregon State University, Corvallis, Oregon. 50 pp.

This paper examines performance standards as a land use control technique available to supplement or replace zoning for plan implementation.

Thurow, Charles, William Toner, and Duncan Erley. 1975. Performance Controls for Sensitive Lands: A Practical Guide for Local Administrators. ASPA Planning Advisory Service Report Nos. 307 and 308. American Society of Planning Officials, Chicago, Illinois. 156 pp.

This manual advocates the protection of environmentally sensitive areas (streams and creeks, aquifers, wetlands, woodlands, and hillsides) by using the police powers of local jurisdictions. Also provided is information on the importance of such areas, performance standards, examples of existing ordinances, and a list of technical assistance resources.

V. GENERAL INFORMATION (INCLUDING BEACHES AND DUNES)

A. Coastal Zone Management Issues

American Society of Civil Engineers. 1978. Coastal Zone '78, Proceedings of the Coastal Zone '78 Symposium. Volumes I - IV. New York, New York. 3091 pp.

This symposium proceedings contains 218 articles in twenty-six general subject areas (i.e., Coastal Ecosystems, Environmental Engineering, Impact Assessment Methodology, Coastal Hazards and Coast Processes, etc.).

Ketchum, Bostwick H., Ed. 1972. "The Water's Edge - Critical Problems of the Coastal Zone." Proceedings of the Coastal Zone Workshop. Woods Hole Oceanographic Institution, Massachusetts. 393 pp.

This work provides a good overall basic introduction to the many issues of coastal zone management including several sections on beaches and dunes.

B. Coastal Zone Management Bibliographies

Ditsworth, George R. 1966. Environmental Factors in Coastal and Estuarine Waters Bibliographic Series, Coast of Oregon. Volume 1. Pacific Northwest Water Laboratory, Federal Water Pollution Control Administration, Corvallis, Oregon. 62 pp.

A bibliography pertaining to the marine waters indexed under; Marine Biology, Climate, Fisheries, Geology, Hydrology, Chemical and Physical Oceanography, and Bibliographies. Useful but somewhat dated.