CITY OF CANNON BEACH FOREDUNE MANAGEMENT PLAN
Preface

This document is an updated foredune management plan for the City of Cannon Beach, Oregon. This plan was written based on a consideration of the factors affecting the stability of the shoreline and includes sand management directions within each portion of the City’s foredune area. This document was prepared for incorporation into the Sand Dune Construction section of the City of Cannon Beach Comprehensive Plan and Chapter 17.42 of the City of Cannon Beach Municipal Code. These documents provide an update and replacement to the 1997 Rosenfeld plan to manage foredunes near Ecola Creek and the 2001 Marra plan to manage foredunes within City limits.

Other documents that have been prepared to address the requirements in Statewide Planning Goal 18: Beaches and Dunes (Implementation Requirement 7) and City of Cannon Beach Municipal Code (Chapter 17.42). These other documents include a Background Report and an Implementing Ordinance which formally outlines the procedures for carrying out prescribed management practices. Together, these materials constitute an overall plan for management of the foredune area fronting Cannon Beach.

Review and comment on a draft of this document will be requested from representatives of the Oregon Department of Land Conservation and Development and the Oregon Parks and Recreation Department. The technical background report which informed this plan was prepared by Jonathan Allan, Laura Gabel, and Fletcher O’Brien of the Oregon Department of Geology and Mineral Industries (DOGAMI) in 2018.

This document is a framework for foredune management in Cannon Beach consistent with Statewide Planning Goal 18. It is not a specific site plan for grading projects or grading individual management unit subareas. This plan and its implementation do not constitute a guarantee or assurance that erosion, flooding, tsunamis, and sand inundation will not impact property owners or the City. Damages related to ocean wave erosion, flooding, tsunamis, and sand accumulation is borne by the property owners and is an inherent risk of having property located in a changing environment adjacent to the Pacific Ocean.
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INTRODUCTION
This is an updated version of the City of Cannon Beach’s Foredune Management Plan.

Over the past few decades sand has accumulated north of Haystack Rock causing substantial accretion of the dunes west of Midtown and the north end of town. Wind-blown sand and view degradation have impacted residents as a result.

Although the shoreline fronting these portions of Cannon Beach has experienced sand accretion over the past decades, other portions of the management area have been shown to be susceptible to episodic wave-induced erosion and flooding. Specifically, Tolovana North and South have experienced minor erosion. As a generalization, within city limits, areas north of Haystack Rock have experienced sand accretion, and areas south of Haystack Rock have experienced erosion between 1997 and 2016.

The policies presented in this plan would be implemented by changes to the Comprehensive Plan and city zoning ordinance.

Overall Objective
The overall objective is to maintain and stabilize the existing foredunes and encourage sand deposition on the seaward portion of the foredunes with the goal to at least maintain existing foredune widths. Moving sand seaward of the foredunes makes sand available for along-shore transport to promote better sand distribution.

Goals
The overall goals to be balanced by the foredune management plan are:

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species;

4. To maintain the integrity and natural beauty of the dunes; and

5. To maintain dunes at a particular height via dune scraping in order to retain or restore views of the ocean and to minimize sand blowing inland among properties where it is not wanted.
View and Preventative Grading
Despite a lack of recent events demonstrating so, Cannon Beach’s beach is susceptible to erosion. Erosion events like those documented in the background report will likely occur from time to time, in between more regular periods of accretion. The grading directions in this plan will not increase the risk of erosion, or of flooding resulting from erosion.

In between major erosion events, which in most parts of town may occur every several decades, large volumes of sand accumulate in Cannon Beach’s foredunes. Windblown sand reaches through the foredune and inundates private properties and public streets.

Within Cannon Beach sand has accumulated such that some views are obscured. Although future iterations of the Foredune Management Plan may be focused on building up eroded foredunes, this plan is focused on measures to temporarily reduce view impacts without sacrificing the erosion and flood hazard mitigation benefits provided by the foredunes.

STRATEGY
This plan includes limited foredune grading in areas where growth in the height of the foredune area has continued on a regular basis. In eroded foredune areas, provisions are made for nourishment through bypassing or backpassing.

The planning area is divided into four management units based on the management unit boundaries specified in the 1997 plan. These boundaries separate areas with distinct foredune, development, and recreation conditions. Unique plans are proposed within each management unit to achieve the flood and erosion prevention, view, and recreational objectives in each area; specifically, grading is proposed in two management units (Presidential Streets and Breakers Point), while vegetative stabilization is promoted in all units. The policies in this plan would be implemented through amendments to the Comprehensive Plan and City Zoning Ordinance.

FEMA Flood Insurance Rate Maps (FIRM) for Cannon Beach were updated in 2010 and again in 2018. In 2018 Oregon DOGAMI published “Beach and Shoreline Dynamics in the Cannon Beach Littoral Cell; Implications for Dune Management”. Base Flood Elevations (BFEs) along with the DOGAMI report provided the basis for this plan. The most up to date BFE should be used in implementing the policies from this plan.

FOREDUNE CONFIGURATION
Foredunes lowered by grading must maintain a minimum elevation of the FEMA BFE+4 feet to comply with Statewide Planning Goal 18. Foredune width is measured seaward from the Statutory Vegetation Line. Foredune width must not decrease with grading activity.

The City of Cannon Beach wants to add an additional height requirement to protect community from the effects of climate change. The National Ocean and Atmospheric Administration (NOAA) has created sea level rise (SLR) scenarios beginning in the year 2000 and projecting as far out as 2100. For communities in Clatsop County estimates are based on data gathered from the tide gate in Astoria. The table below summarizes the estimated rise in sea level starting in the year 2000 according to the Extreme scenario which predicts for the highest level of sea level rise. Based on these projections, the City elected to add a one-foot safety factor to the state defined foresdune height of the current BFE + 4 feet.

<table>
<thead>
<tr>
<th>Year</th>
<th>Projected Rise in Sea Level in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>0.39</td>
</tr>
<tr>
<td>2040</td>
<td>1.41</td>
</tr>
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<td>2060</td>
<td>3.28</td>
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<tr>
<td>2080</td>
<td>5.84</td>
</tr>
<tr>
<td>2100</td>
<td>9.19</td>
</tr>
</tbody>
</table>

Table 1: Projected sea level rise for Cannon Beach under an "Extreme" scenario from NOAA.  

The City of Cannon Beach will ensure that grading does not negatively impact wildlife, including razor clams. Evidence suggests that razor clams can have a survival rate of 100% for burial up to 12 cm (4.7 in) and a 70% survival rate when the burial depth on the beach is doubled to 24 cm (9.5 in). Any proposal for a grading project with a burial depth on the beach of more than 12 cm will not be approved by the City. The City encourages sand to stay within the foresdune.

Sand that is graded from the foresdune crest to the foreslope must be placed at a gradient not exceeding 25-33%. Alternatively, sand may be graded back toward the statutory vegetation line to fill areas of interdunal trough. This grading should minimize impacts to vegetation by minimizing transport distances and fill relatively small areas higher, rather than filling large areas lower.

Grading is not proposed in the Haystack Rock and Downtown management areas. These areas are more vulnerable to wave overtopping and erosion than other management areas in the City.

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METHODS OF SAND REMOVAL
There is one method of sand removal proposed in Cannon Beach. This method is commonly used in Oregon and other coastal areas. It involves using a bulldozer to move dune sand seaward and placing the sand along the seaward face of the dune. Once the sand is placed in this location the wind moves the sand within the littoral cell. This activity may occur in April through June.

TIMING OF SAND REMOVAL
The 2018 Background report suggests that the best time for grading to occur is late spring/mid-summer and that there are challenges associated with the activity regardless of which time of year it occurs. The City of Cannon Beach collected public comment and the Planning Commission considered when is the best time of year to carry out this activity. After considering multiple factors, such as wind and wave patterns with the tourist season, the City determined grading may occur in April through June.

VEGETATION PLANTING AFTER GRADING
Areas disturbed by grading or other sand removal shall be revegetated immediately after the activity. Appropriate signage should shall be placed to discourage beach users from entering and disturbing planted areas while the plants are getting established.

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A first planting in the area shall consist of beach grass. There are three species of these grasses.\(^7\) European beach grass (*Ammophillia arenaria*) currently dominates the dunes throughout Cannon Beach; the City is interested in exploring alternatives.

European beach grass traps sand and forms tall and narrow dunes, whereas, native American dune grass (*Elymus mollis*) creates shorter and wider dunes.\(^8\) These grasses could be used together to stabilize foredunes post-grading. It is important that European beach grass be planted closer to buildings. Applicants may propose planting plans that utilize American dune grass towards the front of the dunes. These plans should be prepared by a professional who will consider the importance of protecting existing infrastructure.

Secondary planting in the backslope to make the vegetation more fire resistant may include Salal, Evergreen Huckleberry, Purple Beach Pea, Seashore Lupine, and Tree Lupine. Secondary species should be planted directly in the beach grass. For additional information regarding vegetation maintenance refer to Carlson, et al., 1991.\(^9\) No state listed noxious weeds may be used to revegetate foredunes.

Fire-resistant species are the preferred stabilizing vegetation within twenty-five feet of existing dwellings or structures, but fire-resistant vegetation shall only be planted when the foreslope and crest of the dune are adequately stabilized to prevent significant accumulation of windblown sand.

Vegetation planting specifications are included at the end of this document and shall be followed.

**MAINTENANCE**

Maintenance will include:

- additional plantings or fertilizer application in areas where plantings performed poorly,
- grading or sand removal to maintain access routes where accretion has occurred,
- foreslope shaping, and
- maintenance grading on the foredune crest as needed.

Maintenance activities to be carried out during the first two years of the implementation of this plan will generally consist of regular repair planting and fertilization. Monitoring and maintenance of dune and vegetation management projects are the responsibility of and are required of the applicant as a condition of permit approval.

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\(^7\) There are three types of grass that are discussed in this plan. *Ammophillia arenaria* is European beach grass and is currently found in Cannon Beach. *Elymus mollis* is a dune grass that is native to Oregon. *Ammophila breviligulata* is a non-native American dune grass introduced from the Eastern U.S.


A detailed maintenance program can be found at the end of this document and shall be followed.

**MONITORING**

**Project Monitoring**
Monitoring is required for all dune grading or sand removal projects. Monitoring shall include inspections, photographic documentation, and profile surveys. At a minimum, profiles shall be measured prior to grading, after grading has occurred, and after the graded areas have been subjected to a winter season. Affected areas shall be inspected at least annually for a period of five years after grading or sand removal. A brief assessment of whether the intended outcomes of grading were accomplished and sustained shall be made after the winter season measurement and after the five-year inspection. These shall include a comparison of the foredune design profile described in this plan, the permitted foredune design profile, and the foredune profile after the winter season. An independent reviewer shall review monitoring reports that are submitted to the City.

**Plan Monitoring**
Robust enforcement of the policies from this plan is critical for correct implementation. As the permitting and regulatory authority, the City shall maintain and monitor the effectiveness of this plan. Two years after adopting this plan, the City shall complete a preliminary evaluation of the extent to which the plan objectives have been achieved (existing profile elevations/volumes versus design profile elevations/volumes, percent vegetation cover and degree of foredune stabilization, effect on plants and wildlife (including shellfish, razor clams, and rare species), extent of access to public facilities, extent of ocean views from residential areas, etc.). Ten years after adopting this plan, the City shall update the evaluation, complete a review and update of the background report, and revise the Foredune Management Plan as necessary.

**PROJECT PLANNING AND PERMITTING**
This plan provides the general guidelines and conceptual approach to foredune grading and management in Cannon Beach. It does not provide specific designs for specific areas within the planning area, nor does it consist of a permit for actual grading projects.

Designs for individual management subareas that include minimum contiguous beach lengths of 400 feet must be prepared for grading projects based on survey profiles measured specifically for the project. Designs shall consider the existing and proposed foredune configurations in nearby management units. Adjoining projects shall be designed to complement each other in terms of erosion and flood protection, public access, and ocean views.

Grading projects require permits from Oregon Parks and Recreation Department (OPRD) and a Conditional Use Permit (CUP) from the City of Cannon Beach approved by the City’s Planning Commission. Written permission from all property owners must be obtained by any permit applicant seeking to grade on private property. Dune management activities generally will not be funded by the City. This means that property owners must pay for a range of activities.
associated with dune grading, including: the creation of subarea plans, obtaining permits for individual grading projects, hiring consultants to design grading projects, monitoring grading projects, and maintaining grading projects. Property owners desiring to grade may consider a variety of options to collectively finance grading activities including development of a taxing district or local improvement district.

Organized parties may begin implementing this plan immediately after it is adopted, but it may take time for the landowners and others who want to carry out the grading project to organize themselves in a way that provides for collective decision-making and financing for applying for permits, paying for grading, and managing the grading contractors and consultants.

LIMITATIONS
This Foredune Management Plan is based on a consideration of past and present conditions. Should events occur which alter existing conditions, such as erosion, directions contained in this document may need to be modified. Further, as additional information on site conditions is developed, directions contained in this document may need to be modified.

MANAGEMENT UNIT STRATEGIES

Haystack Rock
This dynamic shoreline extends from the west end of Harrison Street south to Haystack Rock and has experienced both sand deposition and erosion. The management unit is zoned as Open Space (OS) and falls within the Oceanfront Overlay Zone. There is no development within these zones in the management area; however, development surrounds the management area to the east, and the beach is highly utilized. Current FEMA maps shall be consulted to determine appropriate elevations.

Prioritized Management Objectives
1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species; and

4. To maintain the integrity and natural beauty of the dunes.
Conceptual Alternatives
The objectives and directions reflect those found in the 1997 plan. New conceptual alternatives are not considered for this area. However, pursuing alternatives that call for more grading in other management units may reinforce flood and erosion protection functions of this unit by making more sand available seaward of the foredune for along-shore transport to this area.

Recommended Management Strategies
This management unit shall be actively managed for receiving and retaining sand. The range of management activities prescribed for this management unit is:

- **Removal**- No removal of any kind is allowed in this management unit.
- **Foredune Grading**- Grading, other than that associated with nourishment, is not allowed in this management unit.
- **Nourishment**- Unless it can be demonstrated that this area is losing sand to erosion, it shall not be a priority spot for sand nourishment.
- **Stabilization**- Selective vegetative stabilization within this management unit is to follow the Vegetation Planting Specifications found at the end of this document.

Desired Foredune Configuration
A desired foredune configuration is not proposed for this management unit, because grading and removal are not permitted here. This is not a priority area for beach nourishment.

Presidential Streets
See Figure 2 for a map of this management area. Recently this area has experienced sand accretion. This management unit is zoned as Open Space (OS) and falls within the Oceanfront Overlay Zone. There is no development within these zones; however, residential development surrounds the management unit to the east and the beach is highly utilized in this area. Current FEMA maps shall be consulted when dune designs are created.

This subunit is located between the Haystack Management Unit and the Downtown Management Unit. The scope and timing of the sand management measures outlined above are intended to minimize adverse impacts to these adjacent areas. Monitoring and maintenance will help to ensure that impacts to adjacent properties are minimal.

There are three subunits within this management unit, each subunit of which has its own management objectives and strategies.
Prioritized Management Objectives

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species;

4. To maintain the integrity and natural beauty of the dunes; and

5. To maintain dunes at a particular height via dune scraping in order to retain or restore views of the ocean and to minimize sand blowing inland among properties where it is not wanted.

Figure 2: Presidential Streets Sand Management Area
Conceptual Alternatives
These objectives and directions reflect those of the Marra Report\(^{10}\). With the exception of changes to the boundaries of subunits one and two, new conceptual alternatives are not considered for this area.\(^{11}\) However, pursuing alternatives that call for more grading in other management units may reinforce flood and erosion protection functions in this unit, by making more sand available seaward of the foredune for along-shore transport to this area.

Recommended Management Strategies
This management unit shall be actively managed for receiving and retaining sand. The range of management activities prescribed within this foredune management unit is described below.

**Area I**
The priority management objectives in this subunit are:

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species; and

4. To maintain the integrity and natural beauty of the dunes.

Other than maintenance or enhancement of existing vegetation cover, little modification is permitted in this subunit. Grading, other than that associated with nourishment, is not allowed in this area. Until proven otherwise, this is not a priority area for nourishment. Any vegetative stabilization shall follow the Vegetation Specifications at the end of this document.

**Area II**
The priority management objectives in this subunit are:

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

\(^{10}\) Ordinance 01-02, 13. *Presidential Streets Sand Management Strategy*.

\(^{11}\) Details of this boundary change can be found in Ordinances 13-01 and 13-13.
2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species;

4. To maintain the integrity and natural beauty of the dunes; and

5. To maintain dunes at a particular height via dune scraping in order to retain or restore views of the ocean and to minimize sand blowing inland among properties where it is not wanted.

Grading the foredune is permitted down to BFE+4 feet, plus a one-foot safety factor to account for predicted seal level rise. The lower foreslope will extend approximately 250 feet out seaward from the secondary foredune crest and down to an elevation of approximately 9 feet NAVD88. Grading shall be carried out according to the strategies outlined within this document.

Due to high sand accumulation, regrading may be warranted in this area on a regular basis. Regrading shall follow the guidelines outlined at the beginning of this document.

After grading, vegetative stabilization shall be performed according to the guidelines outlined at the end of this document. Except for a 35-foot-wide unvegetated buffer strip located directly west of the ‘fence line’, planting of sand-stilling grasses shall be carried out across the entire graded foredune area. Planting shall take place immediately following grading.

**Area III**

The priority management objectives in this subunit are:

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species;

4. To maintain the integrity and natural beauty of the dunes; and

5. To maintain dunes at a particular height via dune scraping in order to retain or restore views of the ocean and to minimize sand blowing inland among properties where it is not wanted.
Grading the foredune is permitted down to BFE+4 feet, plus a one-foot safety factor to account for predicted seal level rise. The lower foreslope will extend approximately 250 feet out seaward from the secondary foredune crest and down to an elevation of about 8 feet NAVD88. Grading shall be carried out according to the strategies outlined at the beginning of this document.

Due to high sand accumulation, regrading may be warranted in this area on a regular basis. Regrading shall follow the guidelines outlined at the beginning of this document.

After grading occurs, vegetative stabilization shall be performed according to the guidelines outlined at the end of this document. Except for a 35-foot-wide unvegetated buffer strip located directly west of the ‘fence line’, planting of sand-stilling grasses shall be carried out across the entire graded foredune area. Planting shall take place immediately following grading.

**Downtown**

This dynamic shoreline has experienced sand deposition and erosion. The management unit is zoned as Open Space (OS) and falls within the Oceanfront Overlay Zone. There is no development within these zones in the management area; however, residential and commercial development surrounds the management to the east and the beach is highly utilized. Current FEMA maps shall be consulted to determine appropriate elevations.

**Prioritized Management Objectives**

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species; and

4. To maintain the integrity and natural beauty of the dunes.

**Conceptual Alternatives**

The objectives and directions reflect those found in the 1997 plan. New conceptual alternatives are not considered for this area. However, pursuing alternatives that call for more grading in other management units may reinforce flood and erosion protection functions of this unit by making more sand available seaward of the foredune for along-shore transport to this area.

**Recommended Management Strategies**

This management unit shall be actively managed for receiving and retaining sand. The range of management activities prescribed for this management unit are described below.
• Removal- No removal of any kind is allowed in this management unit.
• Grading- Grading, other than that associated with nourishment, is not allowed in this management unit.
• Nourishment- Unless it can be demonstrated that this area is losing sand to erosion, it shall not be a priority spot for sand nourishment.
• Stabilization- Selective vegetative stabilization within this management unit is to follow the Vegetation Planting Specifications found at the end of this document.

Desired Foredune Configuration
A desired foredune configuration is not proposed for this management unit, because grading and removal are not permitted here. This is not a priority area for dune nourishment.

Breakers Point
This section of shoreline has experienced the highest amount of sand accretion within Cannon Beach. This management unit is zoned as Open Space (OS) and falls within the Oceanfront Overlay Zone. Current FEMA maps shall be consulted when dune grading projects are designed.
Prioritized Management Objectives

1. To ensure the dunes sustain an adequate sand volume in order to withstand the erosional effects of extreme weather and to minimize any potential for wave overtopping and inundation (flooding) of backshore;

2. To strengthen weak points in the dune system by repairing areas subject to localized blowouts from wind or waves in order to prevent the dune buffer from weakening and potentially being breached during a storm;

3. To maintain valuable habitat for a wide range of plants and animals, such as shellfish, including razor clams, and in some cases rare species;

4. To maintain the integrity and natural beauty of the dunes; and

5. To maintain dunes at a particular height via dune scraping in order to retain or restore views of the ocean and to minimize sand blowing inland among properties where it is not wanted.

Conceptual Alternatives
The objectives and directions reflect those found in the Rosenfeld Report. New conceptual alternatives aren’t considered for this area.
**Recommended Management Strategies**
Grading down to the BFE+4 feet, plus a one-foot safety factor to account for predicted seal level rise, is permitted. The lower foreslope will extend approximately 250 feet out seaward from the secondary foredune crest and down to an elevation of approximately 9 feet NAVD88. Grading shall be carried out according to the strategies outlined at the beginning of this document. The removal of sand from the foredune area is prohibited.

After grading, vegetative stabilization shall be performed according to the guidelines outlined at the end of this document. Planting shall take place immediately following grading.

This unit is the most northern management unit. If current trends continue, this area will continue to accumulate sand. The scope and timing of the sand management measures outlined above are intended to minimize adverse impacts. Monitoring and maintenance will help to ensure that impacts to adjacent properties are minimal.

**MAINTENANCE PROGRAM**
This Maintenance Program identifies actions that can be or are required to be carried out to maintain the outcomes of dune grading and vegetation management processes. Regular maintenance will generally involve repair planting and fertilization and planting of secondary species in some areas. Maintenance may also involve foreslope shaping. Mowing is not permitted in the foredune area. Provisions for access management are also included as part of general maintenance measures.

**Maintenance Planting After Grading**
Planted areas shall be appropriately supplemented with fertilizer or other soil amendments, such as compost or biochar, to promote a sufficient survival rate. A qualified professional shall ensure that the planting plan is sufficient.

After the initial planting, any areas on the foreslope, crest of the foredunes, and other exposed areas with less than 50% vegetative cover shall be replanted with beach grass/dune grass at high densities to the specifications found at the end of this document. The backslope of foredunes, and other less exposed areas with less than 60% vegetative cover shall be replanted to the specifications found at the end of this document.

Secondary plantings may be established in backslope/interdune areas. This shall not be done until initial stabilizing vegetation is well established, generally after two years. Plants appropriate for secondary stabilization include salal, evergreen huckleberry, shore pine, purple beach pea, seashore lupine, and tree lupine. After secondary planting, further succession should occur naturally since beach grass tends to thin out and die where it is cut off from sand accretion.

**Maintenance Foreslope Shaping**
Grading, limited principally to redistribution of sand presently in the foreslope area, is an appropriate maintenance measure when:
1. The crest and foreslope are so dissected and irregular that they significantly impede proper growth of the foredune. In this instance, shaping will involve evening of crest height as well as evening of the foreslope to an angle not to exceed 25 to 33%\(^\text{12}\).
2. The foreslope is scarped in response to wave undercutting. In this instance, shaping will involve grading a portion of the crest just large enough to fill in the foreslope to an angle not to exceed 25 to 33%.
3. The foreslope is being nourished with sand from outside the management unit. In this instance, shaping will involve filling in the foreslope to an angle not to exceed 25 to 33%.

In all instances, foreslope shaping shall be carried out so as to minimize disturbance (i.e. moving no more sand than necessary and tapering shaped areas into unshaped areas). Vegetated areas that are not seriously damaged or buried in more than three feet of sand shall be immediately fertilized. Areas graded more than three feet in height or buried in more than three feet of sand shall be immediately replanted and fertilized.

**Remedial Grading**

“Remedial grading” refers to the clearing of sand necessary to maintain the function of a structure. Removal of sand that has built up against exterior walls, doors, or windows and that blocks access to a residential or commercial structure or may cause damage to these structures qualifies as remedial grading. In this regard, directions for remedial grading around residential or commercial structures are as follows:

1. Rear yard sand may be removed to the level of the top sill of the foundation within 20 feet of the structure. From the 10-foot line, the graded area shall slope upward to the elevation of the fronting foredune. This slope shall not exceed 50%.
2. Side yard sand that is landward of the structure may be removed to the top of the sill of the foundations, provided grading in this area does not create a slope in excess of 50% with adjacent properties.
3. Where the front yard is seaward of the structure, sand may be removed to the level of the top sill of the foundation within 20 feet of the structure. From the 10-foot line, the graded area shall slope upward of the elevation of the fronting foredune. This slope shall not exceed 50%.
4. Grading shall not lower the front yard below the level of adjacent streets or roads, except to clear sidewalks or driveways.\(^\text{13}\)

Areas graded more than three feet in height shall be immediately replanted and fertilized. All graded sand must remain within the management area. Graded sand should be used to fill low dune areas within individual management units. Graded sand may also be used to nourish identified areas as needed. The height of the foredune shall not be lowered.


Fire-resistant species are the preferred stabilizing vegetation within twenty-five feet of existing dwellings or structures. Fire-resistant vegetation shall only be planted when the foreslope and crest of the dune are adequately stabilized to prevent significant accumulation of windblown sand.

**Access Management**
Plants used for stabilization are vulnerable to trampling. It may be difficult to completely restrict pedestrian traffic in planted areas. Access management shall emphasize resident and visitor education and encourage voluntary avoidance of planted areas. Informational signs should identify sensitive foredune areas and direct recreational users away from these areas. Smaller signs encouraging pedestrians to stay out of planted areas should be placed around the boundary of planted areas.

**MONITORING PROGRAM**
Robust monitoring and evaluation policies are critical to the successful implementation of this plan. This monitoring program is intended to evaluate the achievement of the overall objectives of this plan, referred to here as “Plan Monitoring”. It also includes the basic monitoring requirements for those conducting grading projects, referred to here as “Project Monitoring”. Plan Monitoring will be based on the information provided by the Project Monitoring and is meant to supplement the project.

**Plan Monitoring**
The City shall complete Plan Monitoring Reporting after the second and fifth year following adoption and approval of the Management Plan. The Plan Monitoring report shall include the following:

1. References to or contents of the project designs, permits, and project monitoring data and reports for any grading projects that occurred during the time period;
2. Listing of any Management Unit Project Monitoring Reports that were supposed to be submitted by permit holders, but were not submitted, and what action was taken by the City;
3. A brief evaluation for each management unit on how the Overall Management Objectives and management unit objectives were achieved; and
4. Insights into how Foredune Management Plans are written and how their implementation should be improved in the future.

**Management Unit Project Monitoring**
Permit holders are responsible for Management Unit Project Monitoring. Measurements, photography, and inspections are to be completed shortly after grading, and then annually in the spring. Monitoring shall be completed by a qualified professional with experience working on Pacific Northwest beaches. Monitoring shall last for a period of five years and the following information shall be submitted to the City:

1. Annual profile and dune crest elevation measurements;
2. Annual photographic documentation and an overall inspection of the managed subarea; and
3. Annual summary report accompanied by monitoring observations and data, submitted to the City of Cannon Beach Planning Department.

Failure to submit the required monitoring reports will result in a penalty and will prevent future grading permits to be issued for the area for a period of five years beginning after the monitoring reports are brought up to date.

VEGETATION PLANTING SPECIFICATIONS

European beach grass\textsuperscript{14} currently dominates the dunes in Cannon Beach. This grass has been shown to build tall and narrow dunes.\textsuperscript{15} The City desires an alternative dune shape. A lower and wider dune provides storm protection, while maintaining ocean views to a greater degree. Research demonstrates that the two types of American beach grass/dune grass create shorter and wider dunes than European beach grass. These grasses also have a lower rate of sand capture than European beach grass.

The American dune grass that is native to Oregon (\textit{Elymus mollis}) has demonstrated a lower transplant survival rate than European beach grass and dies back in the winter. Therefore, because projects aim for a survival rate of approximately 98\%.\textsuperscript{16} European beach grass and American dune grass should be co-planted, with European beach grass closer to existing infrastructure and structures.

As planting methods are proven to be successful at meeting the objectives and goals of this plan the successful methods will be incorporated into the permitting process.

Revegetation shall cover the entire area subject to grading. In the event that sand fences are installed, a 35-foot-wide unvegetated buffer located directly west of the fence is permitted to allow the area to fill with sand. Stabilizing vegetation shall be planted once the area has filled in.

**Planting Stock**

For initial dune stabilization, \textit{Elymus mollis} and \textit{Ammophillia arenaria} shall be the bulk of the grass used for the replanting. The applicant will be required to ensure the quality of the planting stock. The location of each species shall be detailed on a planting plan that is submitted to the City.

**Preparation and Storage**

The plants shall be thoroughly cleaned by shaking sand and silt from the roots. Dead stalk and trash shall be removed from the culms by stripping. The underground stems shall be broken

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\textsuperscript{14} There are three types of grass that are discussed in this plan. \textit{Ammophillia arenaria} is European beach grass and is currently found in Cannon Beach. \textit{Elymus mollis} is a dune grass that is native to Oregon. \textit{Ammophila breviligulata} is a non-native American dune grass introduced from the Eastern U.S.


back so that one or two nodes remain. The grass culms shall be sorted and tied into bundles that weigh approximately ten pounds; tops shall be cut back so that the overall length of the planting stalk measures approximately 20 inches.

The planting stock shall be planted within eight hours of removal from the nursery or heeling-in beds. The heeling-in beds shall be a well-drained damp trench with roots (nodes) covered to a depth of at least eight inches. Stock shall be held in the heeling-in beds for a period not to exceed 14 days. The supply of stock at the planting site must be kept in a cool shady place or otherwise protected against damage from excessive drying. Cold storage at 34°F-38°F for periods of up to two months is also acceptable.

The planting stock shall be handled and transported by any method that does not damage the planting stock or area.

**Planting**

1. The grass shall be planted in hills with an average of 3 live culms (stems) per hill. 3 live culms shall be present on at least 90% of the hills. This means there will be approximately 3,004 plants per 1,000 square feet and 130,680 plants per acre.
2. The spacing between hills shall average 12 inches x 12 inches.
3. The grass shall be planted to a depth of 12 inches, with sand compacted to exclude air from the roots (nodes). The top of the plant shall be upright and extend approximately eight inches above the ground.
4. No planting shall be done on any area until the moisture is within 3 inches of the ground surface. Nor shall any planting be done when the temperature exceeds 60°F or when freezing conditions prevail.
5. Plants shall be kept in water immediately prior to planting to maintain root moisture and proper temperature. Plants shall be watered after planting and fertilizing.
6. All areas planted shall be fertilized with coarse particle ammonium sulfate commercial fertilizer (21-0-0), applied at a rate of 200 lbs./acre (one pound of available nitrogen per 1,000 ft²). Fertilizer shall be applied when the wind is calm and the rain is steady; irrigation may be substituted for rain. Application of fertilizer depends on timing of planting, the above factors, and how long it has been since the grass was planted. Compost and biochar are available alternatives.
7. Any area with pre-existing beach grass graded more than 3 feet deep or any area with less than 50% cover shall also be replanted.

**Maintenance**

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 the appropriate grass and then spread brush on the steep edges. Refertilizing any weak areas can bring back sufficient cover if the plant root systems have not been uncovered. Based on performance during the first two years, planted areas shall be given

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an annual application of 200 lbs/acre of 21-0-0 fertilizer or be supplemented with compost and/or biochar.

**Transplanting Beach Grass as Clumps**
Transplanted clumps of healthy beach grass salvaged from foredune areas that are lowered for view grading may be used instead of the planting stalks listed above. This process involves removing large clumps of beach grass from areas that are to be graded. The clumps are “heeled-in” on site in moist, protected areas while the grading occurs. When the graded area is ready to plant, the large clumps are divided into 6”-8” clumps and transplanted to a depth of approximately a foot. Planted clumps shall be spaced 12 inches apart. No published specifications regarding this process were found. Prior to implementing this method, a qualified landscaper shall be retained to refine the process, prepare more detailed specifications, and supervise its implementation.

**Secondary Stabilization**
The areas where this plan allows for dune grading are backed by lawns or Ocean Avenue. These areas do not require vegetation for secondary stabilization of the dunes. However, if this configuration were to ever change, then the types of vegetation listed below would be appropriate choices.

Plantings of secondary stabilizing vegetation which is more fire resistant is appropriate in well vegetated areas between the foredune crest and homes but not on the foredune crest or foreslope. Detailed guidelines for planting secondary vegetation can be found in the Soil Conservation Service’s publication Stabilizing Coastal Sand Dunes in the Pacific Northwest. Plants capable of growing taller than six feet shall be avoided so that they do not impact views. Below is a sample of possible species:

- Salal (*Gaultheria shallon*)
- Evergreen Huckleberry (*Vaccinium ovatum*)
- Purple Beach Pea (*Lathyrus japonicas*)
- Seashore Lupine (*Lupinus littoralis*)
- Tree Lupine (*Lupinus arboreas*)

Other species may be considered. Preference is given to native vegetation.

**Conditions**

1. Secondary stabilization shall only be done when initial stabilizing vegetation is well established.
2. Secondary plantings shall be conducted directly in existing stands of beach grass. Beach grass shall not be destroyed or removed prior, during, or after planting, so that it can continue to stabilize the area as secondary plants are establishing themselves. Succession should occur without destruction since beach grass tends to thin out and die where it is cut off from sand accretion.
REFERENCES


FEMA. (2010). Flood Insurance Study 41007CV001A.


APPENDIX:
OREGON STATEWIDE PLANNING GOAL 18: BEACHES AND DUNES

Oregon’s Statewide Planning Goals & Guidelines

GOAL 18: BEACHES AND DUNES
OAR 660-015-0010(3)

To conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of coastal beach and dune areas; and

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

Coastal comprehensive plans and implementing actions shall provide for diverse and appropriate use of beach and dune areas 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.

INVENTORY REQUIREMENTS

Inventories shall be conducted to provide information necessary for identifying and designating beach and dune uses and policies. Inventories shall describe the stability, movement, groundwater resource, hazards and values of the beach and dune areas in sufficient detail to establish a sound basis for planning and management. For beach and dune areas adjacent to coastal waters, inventories shall also address the inventory requirements of the Coastal Shorelands Goal.

COMPREHENSIVE PLAN REQUIREMENTS

Based upon the inventory, comprehensive plans for coastal areas shall:

1. Identify beach and dune areas; and
2. Establish policies and uses for these areas consistent with the provisions of this goal.

IDENTIFICATION OF BEACHES AND DUNES

Coastal areas subject to this goal shall include beaches, active dune forms, recently stabilized dune forms, older stabilized dune forms and interdune forms.

USES

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 as identified through application of Goals 5 and 17.

IMPLEMENTATION REQUIREMENTS

1. Local governments and state and federal agencies shall base decisions on plans, ordinances and land use actions in beach and dune areas, other than older stabilized dunes, on specific findings that shall include at least:

   (a) The type of use proposed and the adverse effects it might have on the site and adjacent areas;
   (b) Temporary and permanent stabilization programs and the planned...
maintenance of new and existing vegetation;

(c) Methods for protecting the surrounding area from any adverse effects of the development; and

(d) Hazards to life, public and private property, and the natural environment which may be caused by the proposed use.

2. Local governments and state and federal agencies shall prohibit residential developments and commercial and industrial buildings on beaches, active foredunes, on other foredunes which are conditionally stable and that are subject to ocean undercutting or wave overtopping, and on interdune areas (deflation plains) that are subject to ocean flooding. Other development in these areas shall be permitted only if the findings required in (1) above are presented and it is demonstrated that the proposed development:

(a) is adequately protected from any geologic hazards, wind erosion, undercutting, ocean flooding and storm waves; or is of minimal value; and

(b) is designed to minimize adverse environmental effects.

3. Local governments and state and federal agencies shall regulate actions in beach and dune areas to minimize the resulting erosion. Such actions include, but are not limited to, the destruction of desirable vegetation (including inadvertent destruction by moisture loss or root damage), the exposure of stable and conditionally stable areas to erosion, and construction of shore structures which modify current or wave patterns leading to beach erosion.

4. Local, state and federal plans, implementing actions and permit reviews shall protect the groundwater from drawdown which would lead to loss of stabilizing vegetation, loss of water quality, or intrusion of salt water into water supplies. Building permits for single family dwellings are exempt from this requirement if appropriate findings are provided in the comprehensive plan or at the time of subdivision approval.

5. Permits for beachfront protective structures shall be issued only where development existed on January 1, 1977. Local comprehensive plans shall identify areas where development existed on January 1, 1977. For the purposes of this requirement and implementation Requirement 7 "development" means houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through construction of streets and provision of utilities to the lot and includes areas where an exception to (2) above has been approved. The criteria for review of all shore and beachfront protective structures 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.

6. Foredunes shall be breached only to replenish sand supply in interdune areas, or on a temporary basis in an emergency (e.g., fire control, cleaning up oil spills, draining farm lands, and alleviating flood hazards), and only if the breaching and restoration after breaching is consistent with sound principles of conservation.

7. Grading or sand movement necessary to maintain views or to prevent sand inundation may be allowed for structures in foredune areas only if
the area is committed to development or is within an acknowledged urban growth boundary and only as part of an overall plan for managing foredune grading. A foredune grading plan shall include the following elements based on consideration of factors affecting the stability of the shoreline to be managed including sources of sand, ocean flooding, and patterns of accretion and erosion (including wind erosion), and effects of beachfront protective structures and jetties. The plan shall:

(a) Cover an entire beach and foredune area subject to an accretion problem, including adjacent areas potentially affected by changes in flooding, erosion, or accretion as a result of dune grading;

(b) Specify minimum dune height and width requirements to be maintained for protection from flooding and erosion. The minimum height for flood protection is 4 feet above the 100 year flood elevation;

(c) Identify and set priorities for low and narrow dune areas which need to be built up;

(d) Prescribe standards for redistribution of sand and temporary and permanent stabilization measures including the timing of these activities; and

(e) Prohibit removal of sand from the beach-foredune system.

The Commission shall, by January 1, 1987, evaluate plans and actions which implement this requirement and determine whether or not they have interfered with maintaining the integrity of beach and dune areas and minimize flooding and erosion problems. If the Commission determines that these measures have interfered it shall initiate Goal amendment proceedings to revise or repeal these requirements.

GUIDELINES FOR GOAL 18

The requirements of the Beaches and Dunes Goal should be addressed with the same consideration applied to previously adopted goals and guidelines. The planning process described in the Land Use Planning Goal (Goal 2), including the exceptions provisions described in Goal 2, applies to beaches and dune areas and implementation of the Beaches and Dunes Goal.

Beaches and dunes, especially interdune areas (deflation plains) provide many unique or exceptional resources which should be addressed in the inventories and planning requirements of other goals, especially the Goals for Open Space, Scenic and Historic Areas and Natural Resources; and Recreational Needs. Habitat provided by these areas for coastal and migratory species is of special importance.

A. INVENTORIES

Local government should begin the beach and dune inventory with a review of Beaches and Dunes of the Oregon Coast, USDA Soil Conservation Service and OCCDC, March 1975, and determine what additional information is necessary to identify and describe:

1. The geologic nature and stability of the beach and dune landforms;
2. Patterns of erosion, accretion, and migration;
3. Storm and ocean flood hazards;
4. Existing and projected use, development and economic activity on the beach and dune landforms; and
5. Areas of significant biological importance.

B. EXAMPLES OF MINIMAL DEVELOPMENT

Examples of development activity which are of minimal value and suitable for development of conditionally stable dunes and deflation plains include beach and dune boardwalks, fences which do not affect sand erosion or migration, and temporary open-sided shelters.

C. EVALUATING BEACH AND DUNE PLANS AND ACTIONS

Local government should adopt strict controls for carrying out the Implementation Requirements of this goal. The controls could include:
1. Requirement of a site investigation report financed by the developer;
2. Posting of performance bonds to assure that adverse effects can be corrected; and
3. Requirement of re-establishing vegetation within a specific time.

D. SAND BY-PASS

In developing structures that might excessively reduce the sand supply or interrupt the longshore transport or littoral drift, the developer should investigate, and where possible, provide methods of sand by-pass.

E. PUBLIC ACCESS

Where appropriate, local government should require new developments to dedicate easements for public access to public beaches, dunes and associated waters. Access into or through dune areas, particularly conditionally stable dunes and dune complexes, should be controlled or designed to maintain the stability of the area, protect scenic values and avoid fire hazards.

F. DUNE STABILIZATION

Dune stabilization programs should be allowed only when in conformance with the comprehensive plan, and only after assessment of their potential impact.

G. OFF-ROAD VEHICLES

Appropriate levels of government should designate specific areas for the recreational use of off-road vehicles (ORVs). This use should be restricted to limit damage to natural resources and avoid conflict with other activities, including other recreational use.

H. FOREDUNE GRADING PLANS

Plans which allow foredune grading should be based on clear consideration of the fragility and ever-changing nature of the foredune and its importance for protection from flooding and erosion. Foredune grading needs to be planned for on an area-wide basis because the geologic processes of flooding, erosion, sand movement, wind patterns, and littoral drift affect entire stretches of shoreline. Dune grading cannot be carried out effectively on a lot-by-lot basis because of these areawide processes and the off-site effects of changes to the dunes.

Plans should also address in detail the findings specified in Implementation Requirement (1) of this Goal with special emphasis placed on the following:
- Identification of appropriate measures for stabilization of graded areas and areas of deposition, including use of fire-resistant vegetation;
- Avoiding or minimizing grading or deposition which could adversely affect surrounding properties by changing wind, ocean erosion, or flooding patterns;
- Identifying appropriate sites for public and emergency access to the beach.