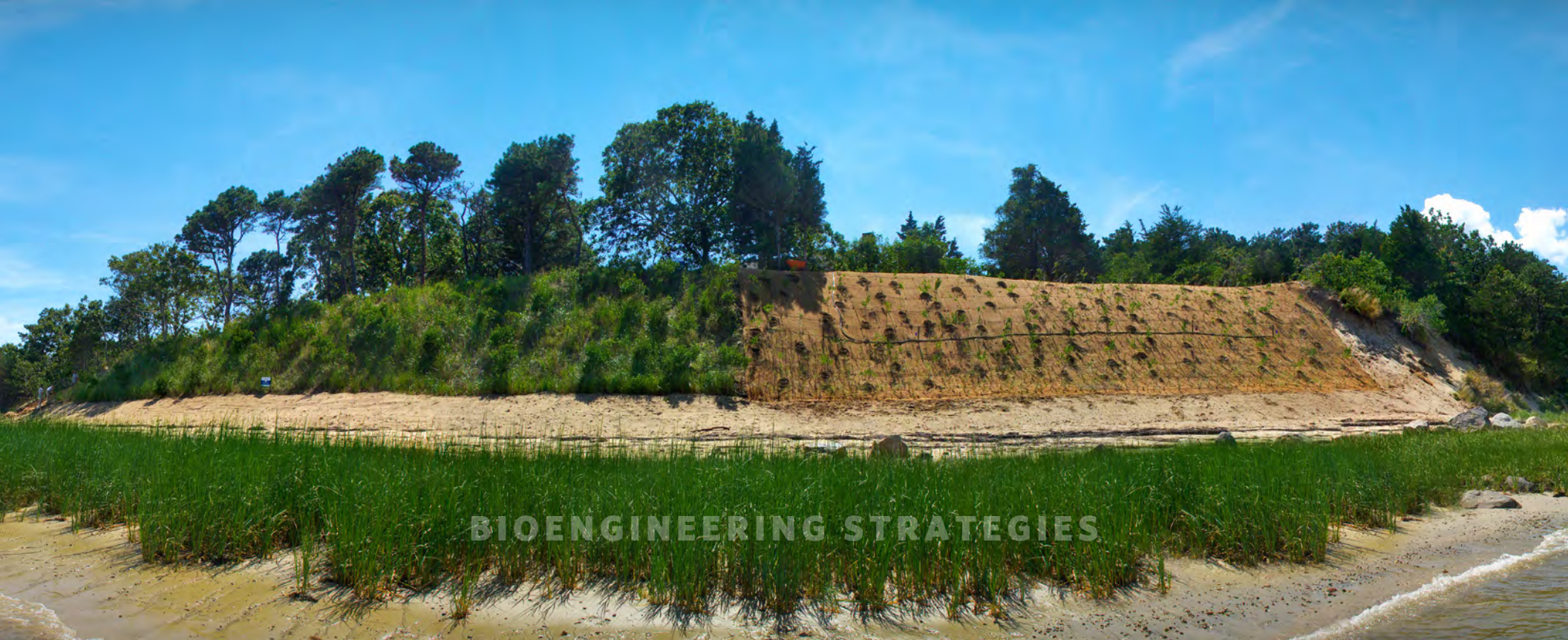




BIOENGINEERING STRATEGIES

Reducing Coastal Erosion and Coastal Storm Damage While Minimizing Impacts



BIOENGINEERING STRATEGIES

Reducing Coastal Erosion and Coastal Storm Damage While Minimizing Impacts

Based on **SITE SPECIFIC** Criteria



Based on **SITE SPECIFIC** Criteria



Understanding if a beach has a
BASE ELEVATION.



Based on **SITE SPECIFIC** Criteria



Understanding if a beach has a
BASE ELEVATION.



Understanding the function a
FRINGE MARSH plays.



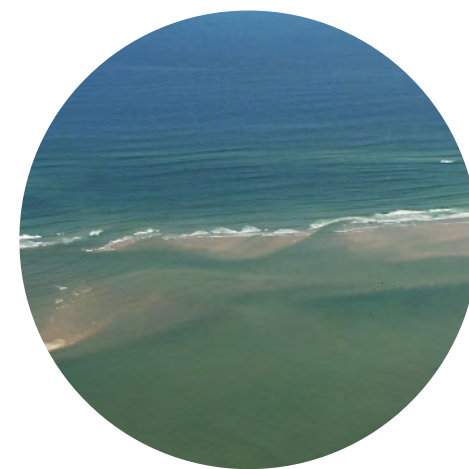
Based on **SITE SPECIFIC** Criteria



Understanding if a beach has a
BASE ELEVATION.



Understanding the function a
FRINGE MARSH plays.



Understanding near shore
characteristics such as **FETCH**, **WATER**
DEPTHS, **SAND BARS**, and location
within a given **LITTORAL CELL**.

BIOENGINEERING STRATEGIES
MATERIALS



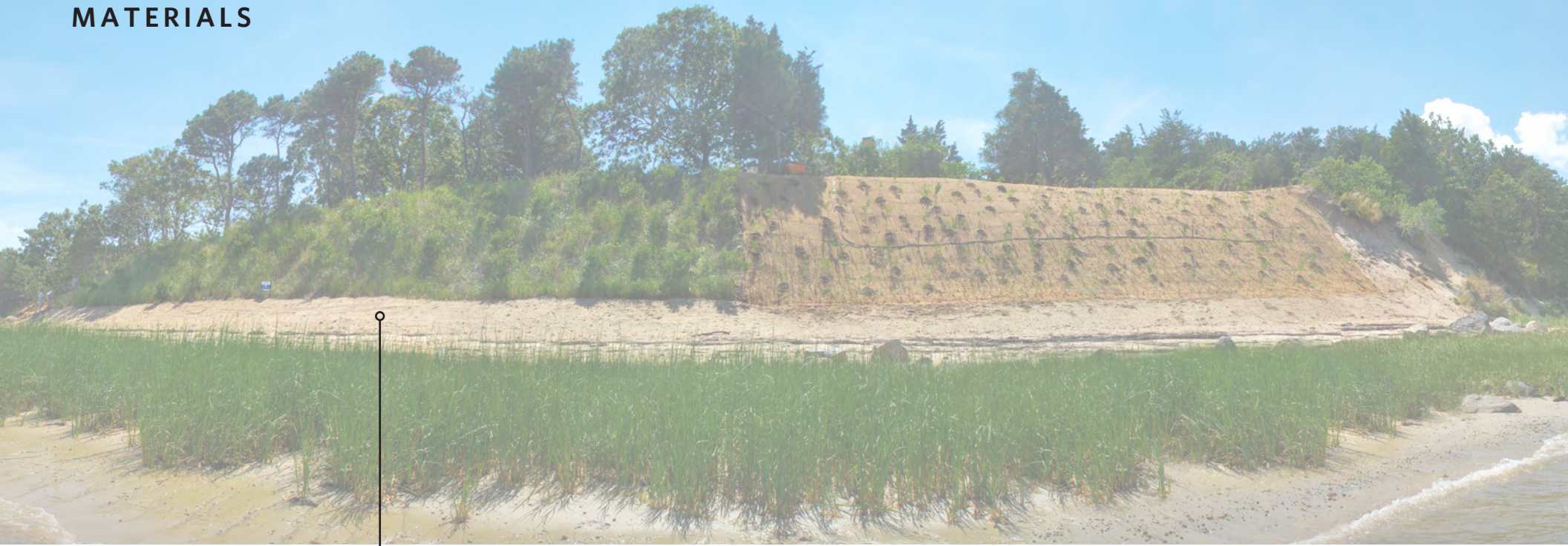
BIOENGINEERING STRATEGIES MATERIALS



COIR FIBER ROLLS

Adds stability and protection to the toe of a bank and provides a window of opportunity to establish vegetation.

BIOENGINEERING STRATEGIES MATERIALS



COIR FIBER ROLLS

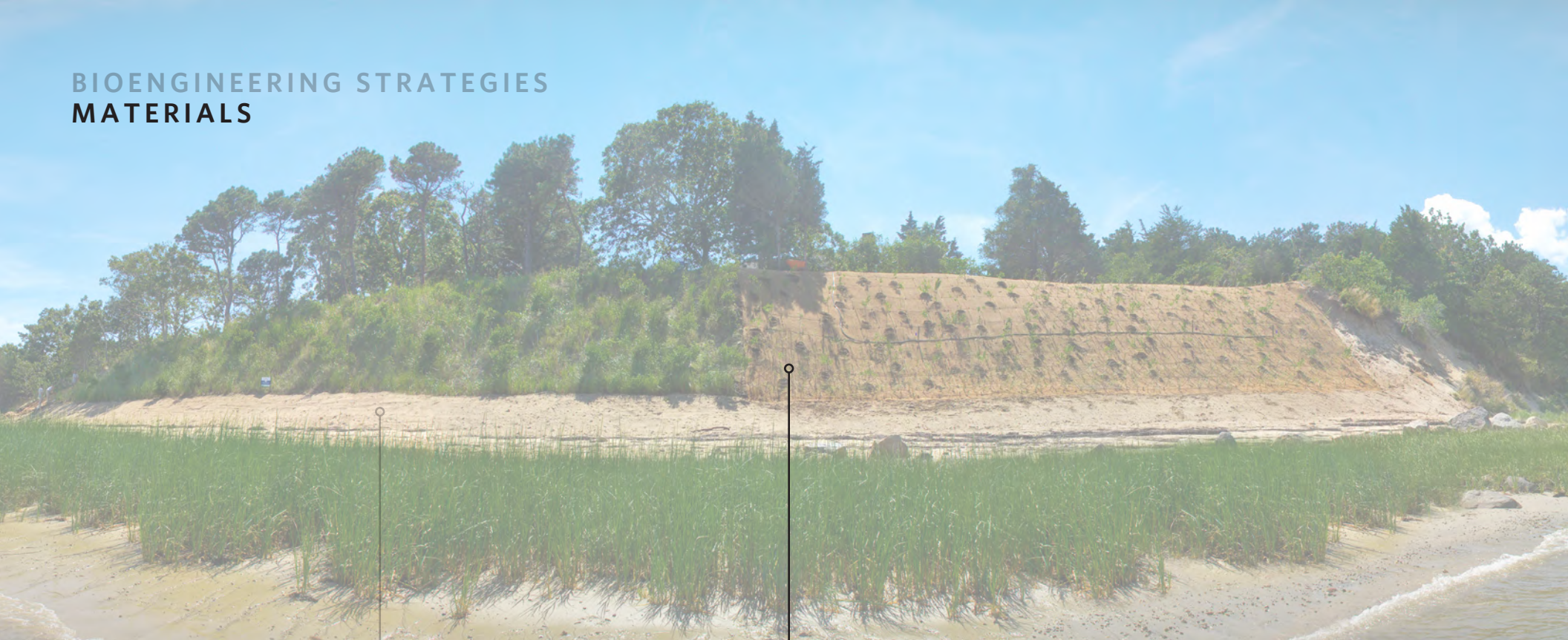
Adds stability and protection to the toe of a bank and provides a window of opportunity to establish vegetation.



ROBUST ANCHORING SYSTEM

BIOENGINEERING STRATEGIES

MATERIALS



COIR FIBER ROLLS

Adds stability and protection to the toe of a bank and provides a window of opportunity to establish vegetation.



ROBUST ANCHORING SYSTEM

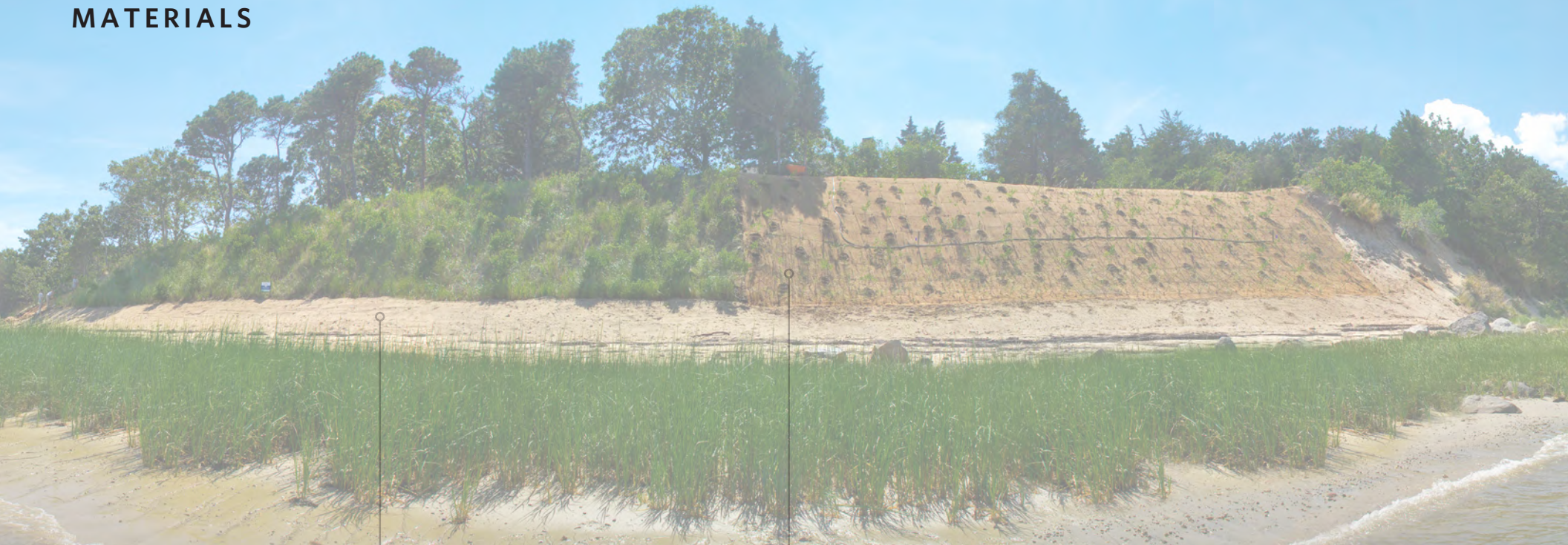


EROSION CONTROL BLANKETING

blanketing of natural fibers are used to stabilize soils allowing time for
NATIVE SALT TOLERATE
PLANTS BECOME ESTABLISHED.

BIOENGINEERING STRATEGIES

MATERIALS



COIR FIBER ROLLS

Adds stability and protection to the toe of a bank and provides a window of opportunity to establish vegetation.



ROBUST ANCHORING SYSTEM



EROSION CONTROL BLANKETING

blanketing of natural fibers are used to stabilize soils allowing time for
NATIVE SALT TOLERATE
PLANTS BECOME ESTABLISHED.

- Resists degradation from the marine environment.
- Absorbs some of the force of wave energy unlike many hard solutions that deflect the energy of wave action to surrounding areas.
- Materials life-expectancy to stabilize sediments matches the time required to **ESTABLISH NATIVE PLANTS.**

BIOENGINEERING STRATEGIES
MATERIALS



NATIVE SHRUBS



NATIVE GRASSES

BIOENGINEERING STRATEGIES
MATERIALS



PRE-VEGETATED
FIBER ROLLS



NATIVE SHRUBS



NATIVE GRASSES

BIOENGINEERING STRATEGIES
MATERIALS



SALT MARSH



PRE-VEGETATED
FIBER ROLLS



NATIVE SHRUBS



NATIVE GRASSES

BIOENGINEERING STRATEGIES
MATERIALS



**BIOENGINEERING STRATEGIES
INSTALLATION & CASE STUDIES**

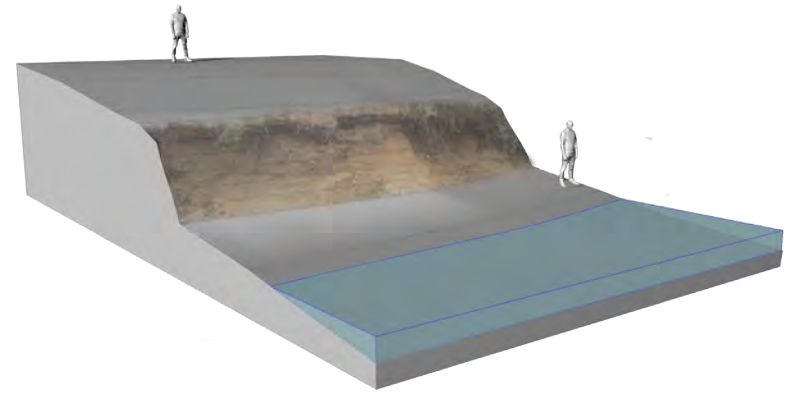


BIOENGINEERING STRATEGIES
RAIN GARDENS



INSTALLATION & CASE STUDIES

Typical Eroding Bank

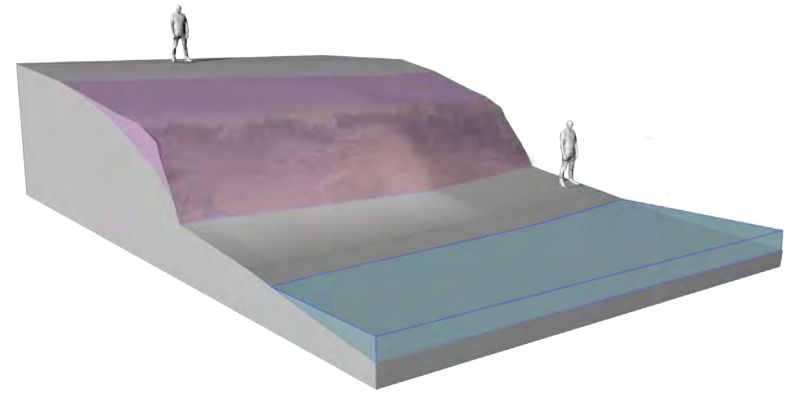


INSTALLATION & CASE STUDIES

Importance of Establishing a Stable Slope

- If the slope of the bottom of the bank is steeper than the upper bank, it is likely unstable and prone to slumping or collapses.

(Storm Smart Properties Fact Sheet 4)



1

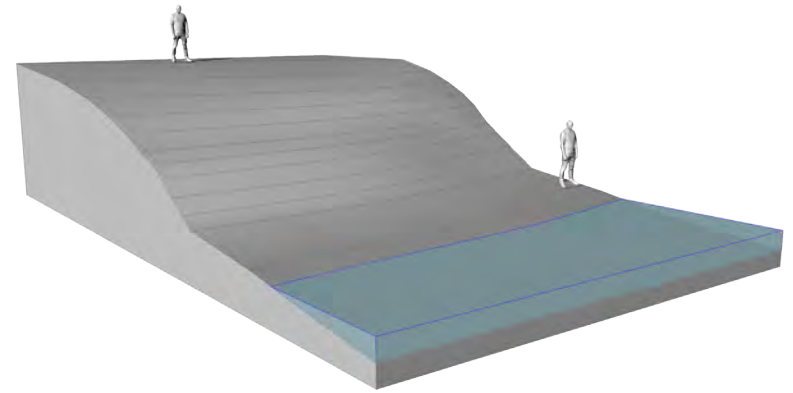


INSTALLATION & CASE STUDIES

Importance of Establishing a Stable Slope

- Utilizing a portion of the upper bank can create a more stable slope angle.
- Adds increased stability and storm damage prevention to the bank.
- Without this step, an investment in bioengineering can be lost due to bank collapses.

(Storm Smart Properties Fact Sheet 4)



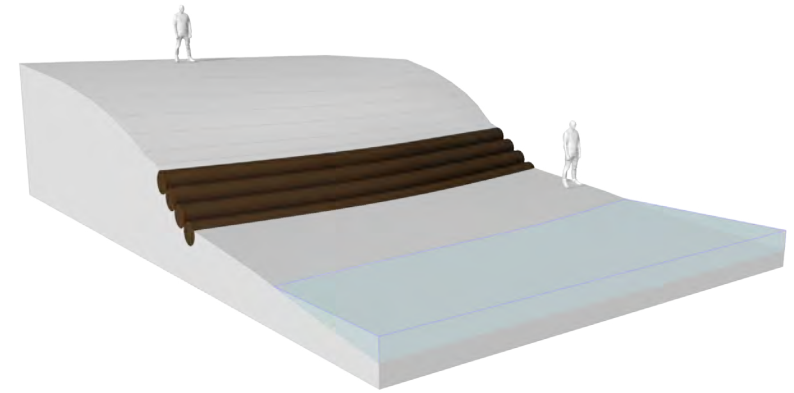
1 2



INSTALLATION & CASE STUDIES

Stabilizing toe of bank - Fiber rolls

- Installation begins at the base of the array and proceeds up bank.
- Proper anchoring strategy to hold toe protection in place.
- Synthetic filter fabrics DO NOT ENHANCE success of a bioengineering project.



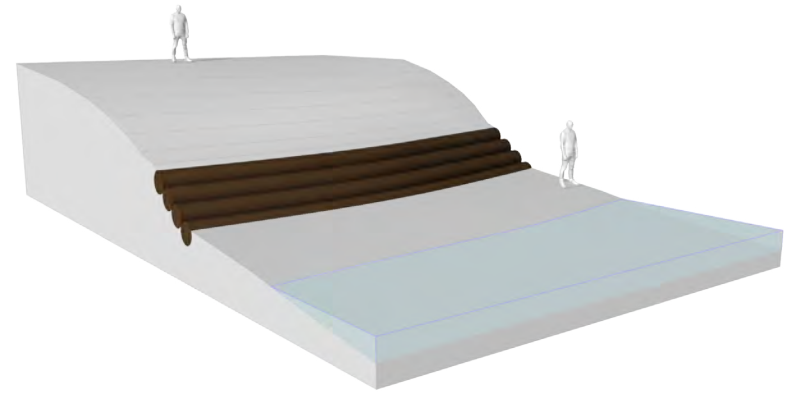
1 2 3



INSTALLATION & CASE STUDIES

Stabilizing toe of bank - Pre-vegetated fiber rolls

- Use of pre-vegetated fiber rolls along top of array.
- Added vegetation to the root matrix.
- Full season of plant growth prior to installation.



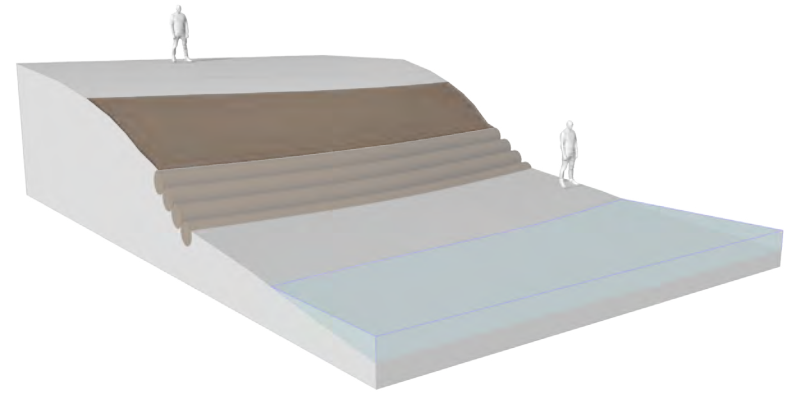
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INSTALLATION & CASE STUDIES

Stabilizing soils above toe protection

- Native salt tolerant grasses are seeded into the bank prior to installation of erosion control blankets.
- Protect soils from erosion and helps to retain moisture to promote seed germination.



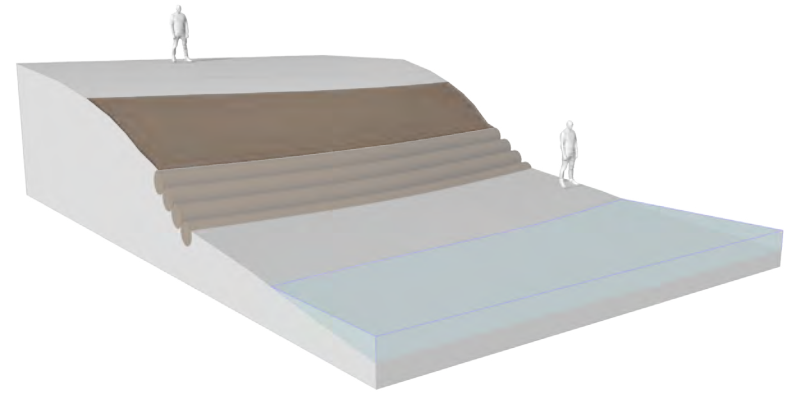
1 2 3 4



INSTALLATION & CASE STUDIES

Stabilizing soils above toe protection

- 6" deep lock-in trench at top and bottom of slope.
- Overlap blankets a minimum of 6".
- Use appropriate staking to match the sediment.
- Only run orientation of blankets perpendicular to the contours (up and down slope).



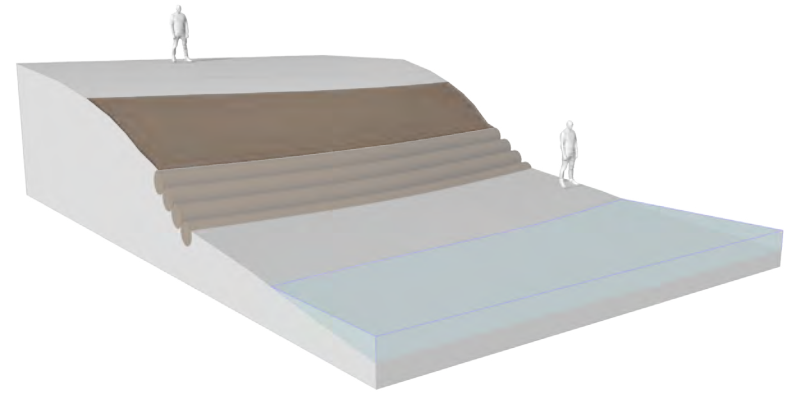
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INSTALLATION & CASE STUDIES

Native shrub species

- Native beach plum and bayberry planted through erosion control blanketing.
- Temporary above ground irrigation for plant establishment.

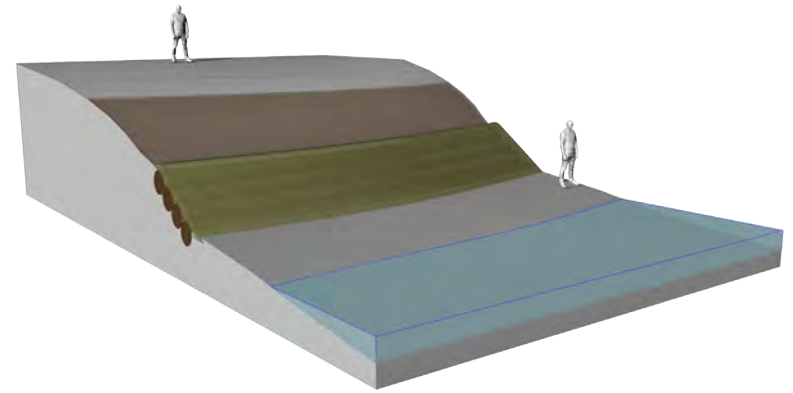


1 2 3 4 5



INSTALLATION & CASE STUDIES

- Establishment of native vegetation after two seasons of growth.

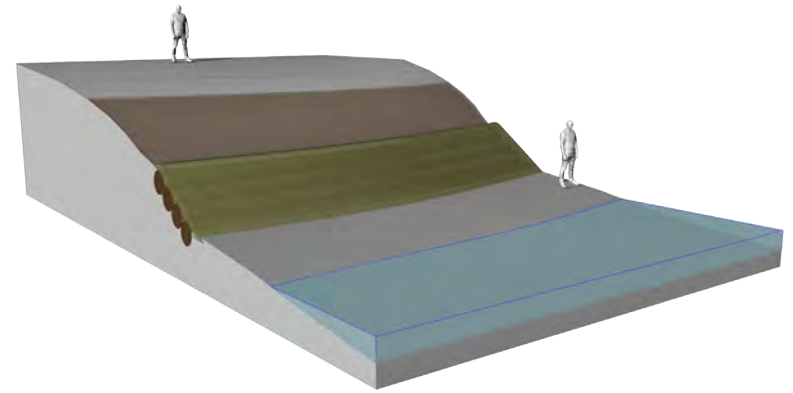


1 2 3 4 5 6



INSTALLATION & CASE STUDIES

Condition of fiber roll array following
Hurricane Sandy
11/2012



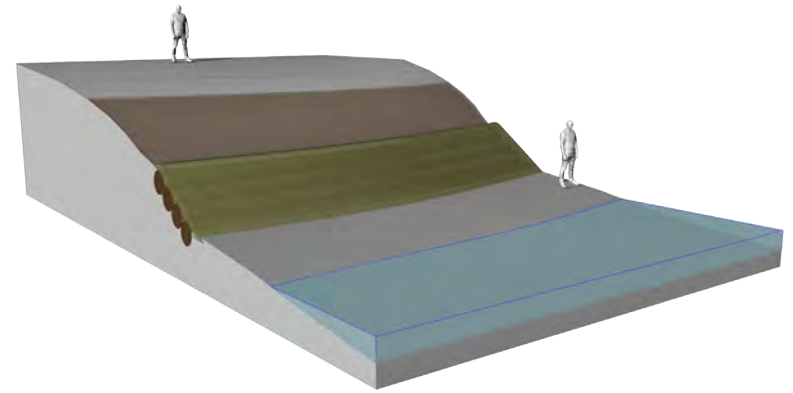
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Waves reached
above fiber roll
array with no
damage.

INSTALLATION & CASE STUDIES

Condition of fiber roll array following
named storm Nemo
2/2013

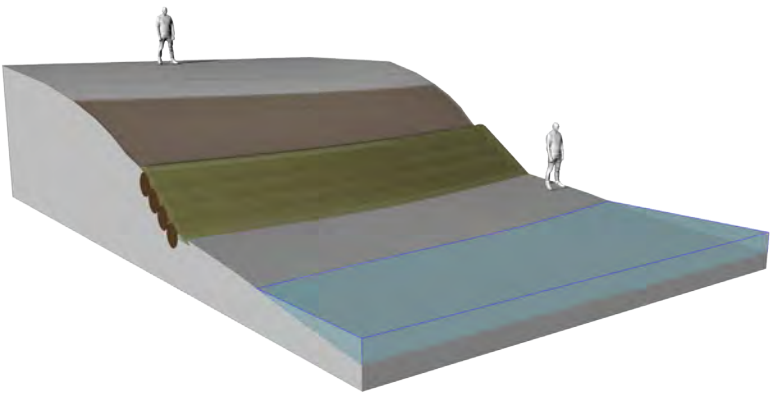


1 2 3 4 5 6 7 8



INSTALLATION & CASE STUDIES

Condition of fiber roll array following
named storm Nemo
2/2013



1 2 3 4 5 6 7 8

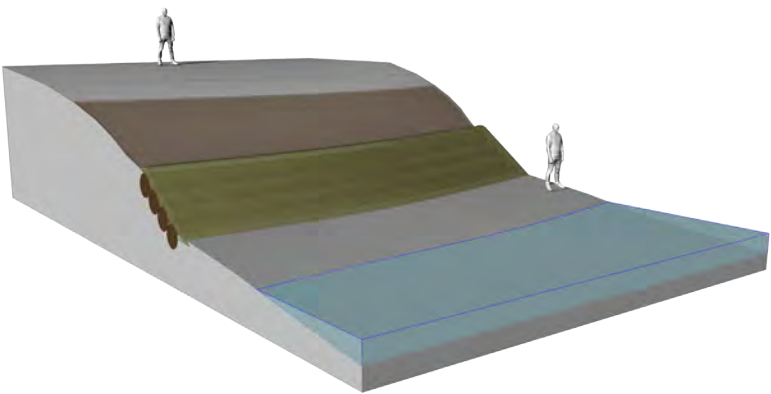


Waves reached
above fiber roll
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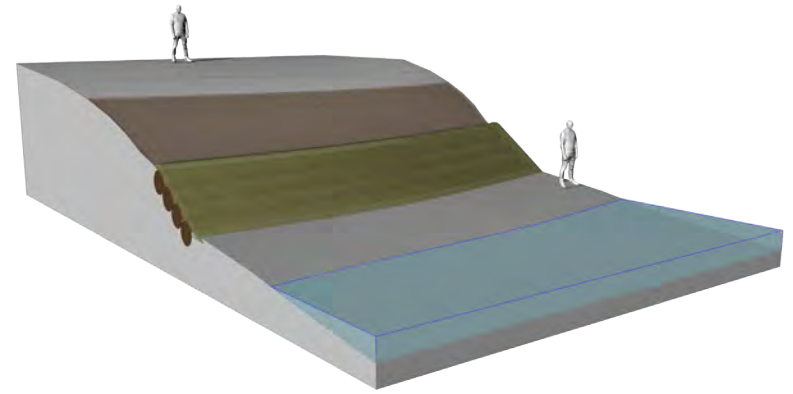
INSTALLATION & CASE STUDIES

Fiber roll array increased in length by 90'

6/2013



INSTALLATION & CASE STUDIES



1 2 3 4 5 6 7 8 9 10

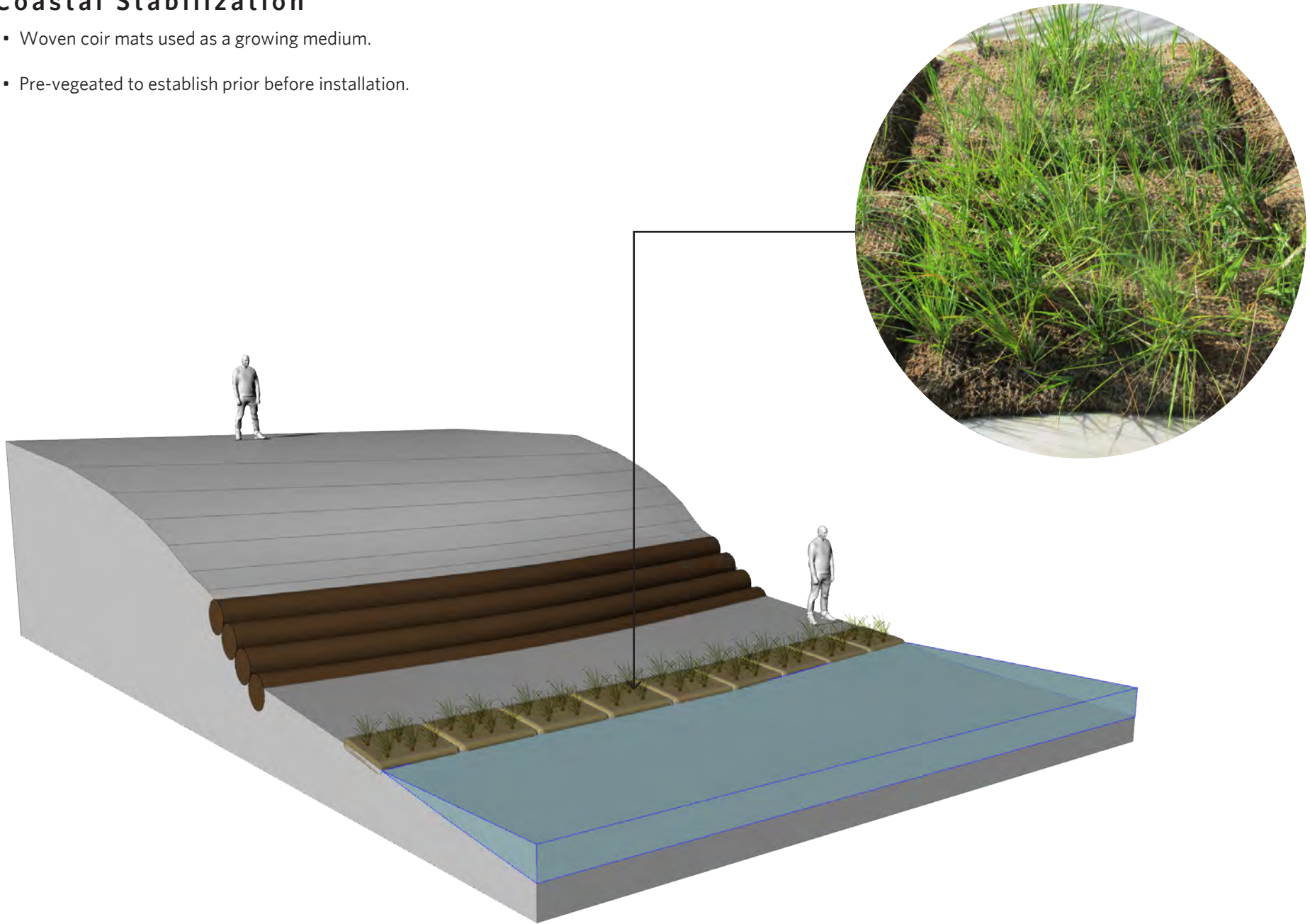


Importance of Fringe Marshes in Coastal Stabilization

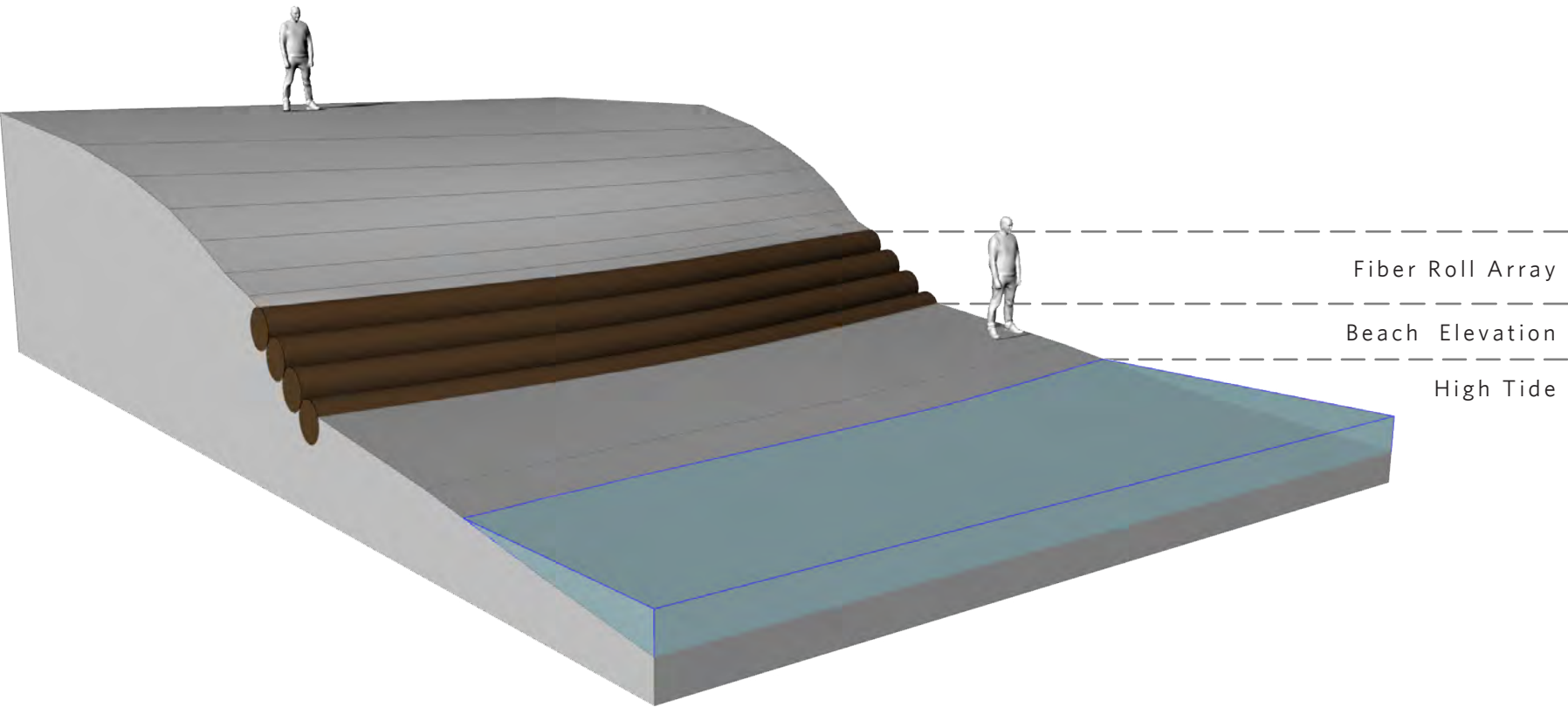


Importance of Fringe Marshes in Coastal Stabilization

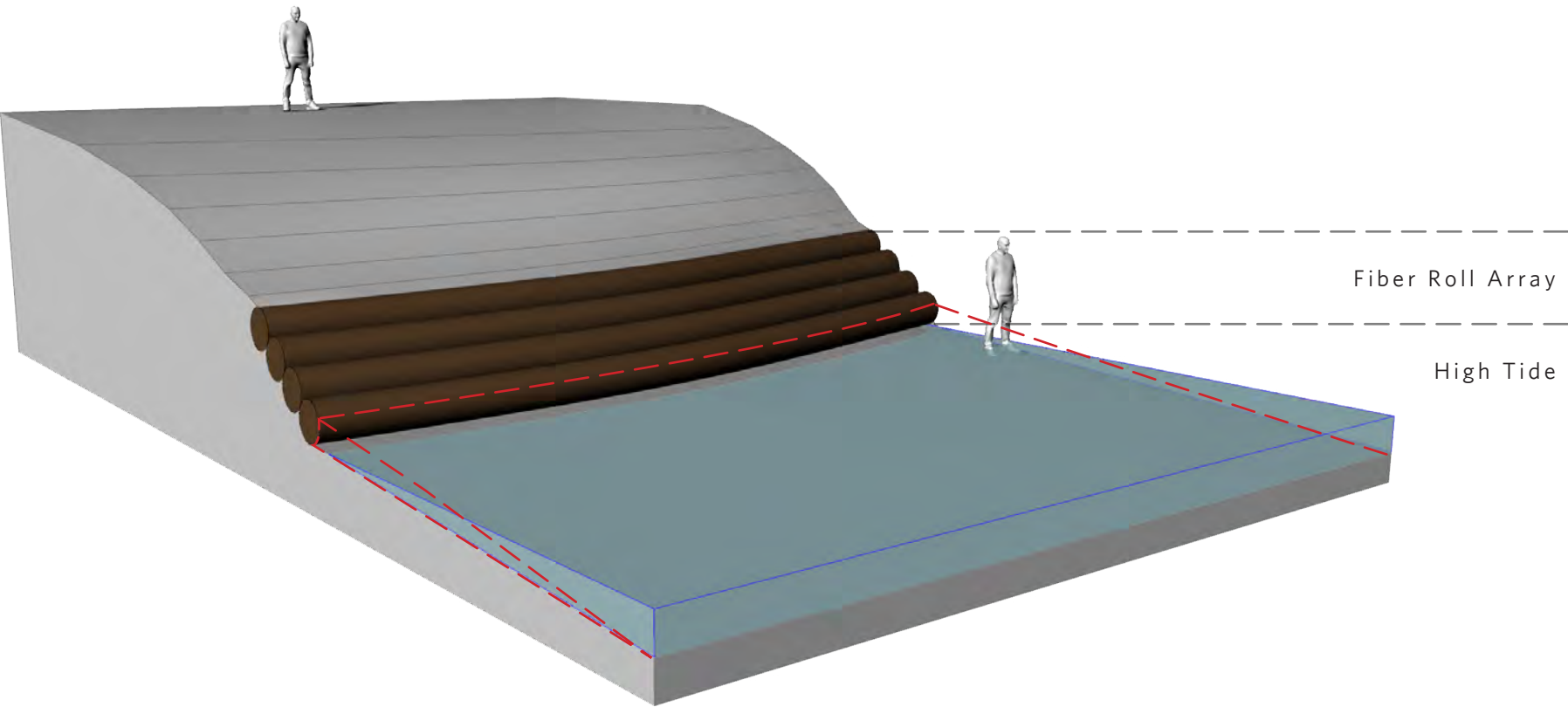
- Woven coir mats used as a growing medium.
- Pre-vegetated to establish prior before installation.



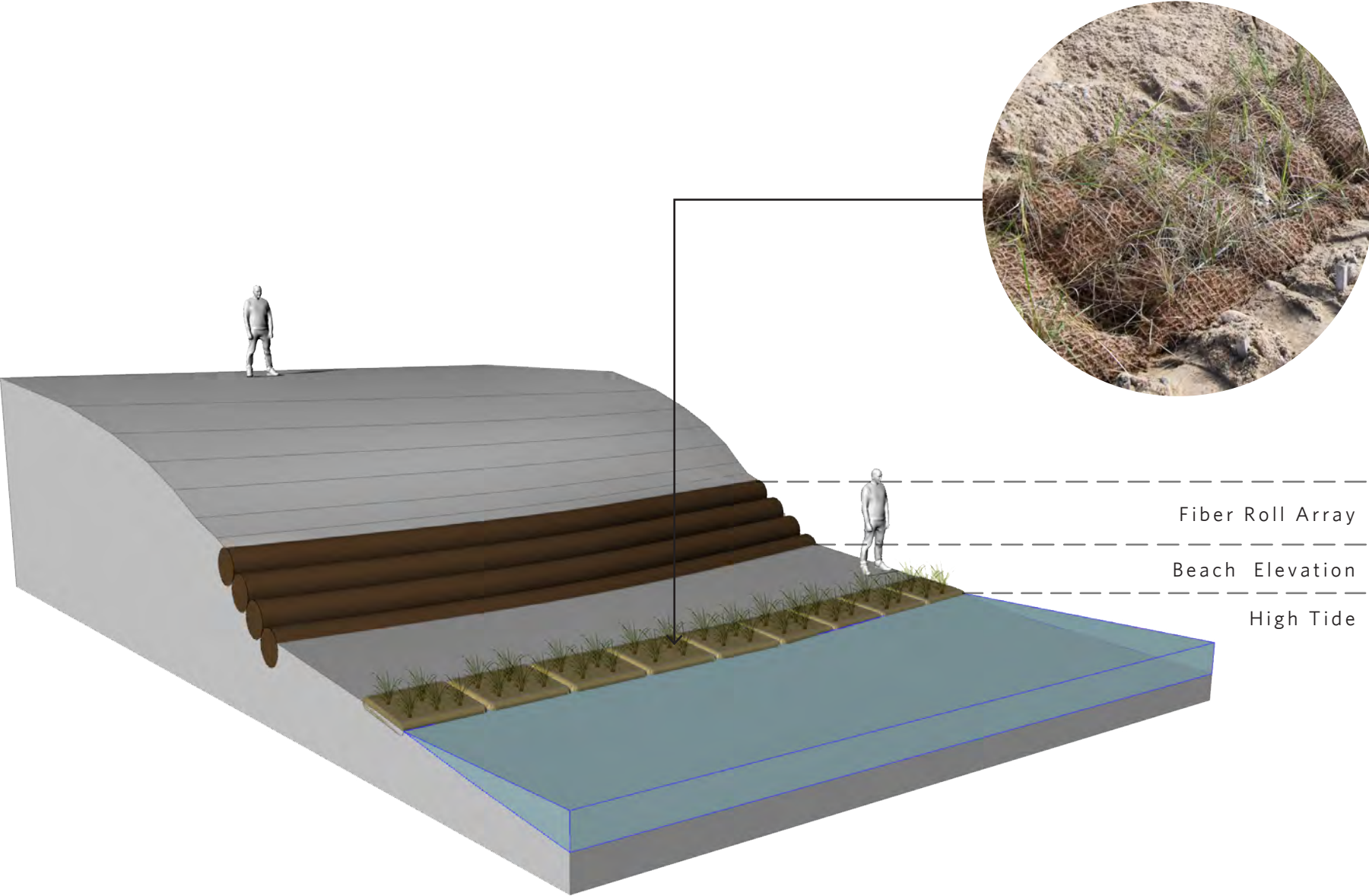
Importance of Fringe Marshes in Coastal Stabilization



Importance of Fringe Marshes in Coastal Stabilization

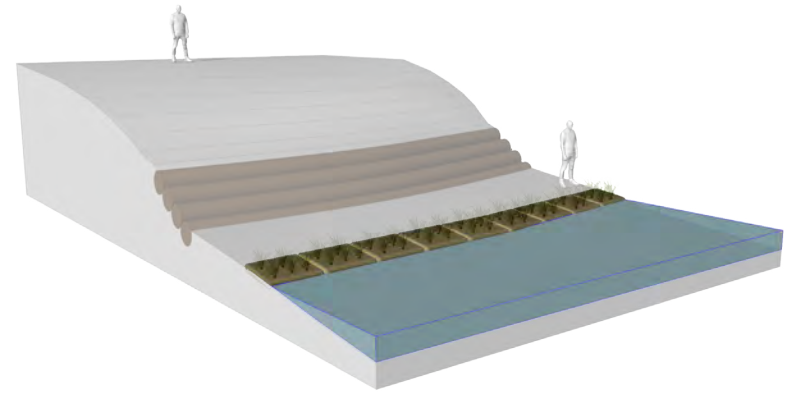


Importance of Fringe Marshes in Coastal Stabilization



INSTALLATION & CASE STUDIES

Fringe Marshes

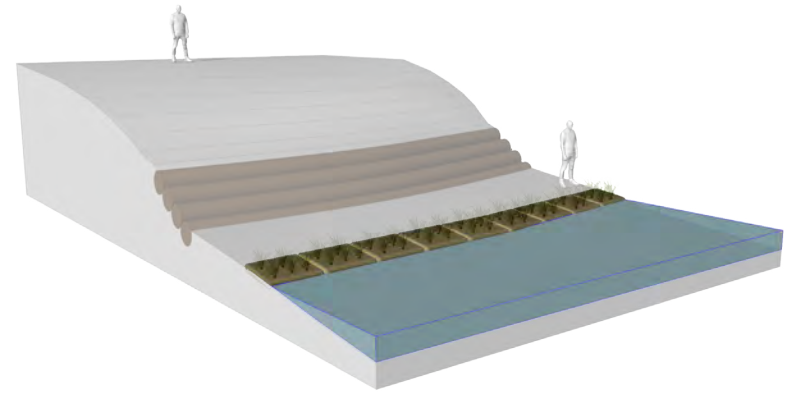


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INSTALLATION & CASE STUDIES

Fringe Marshes

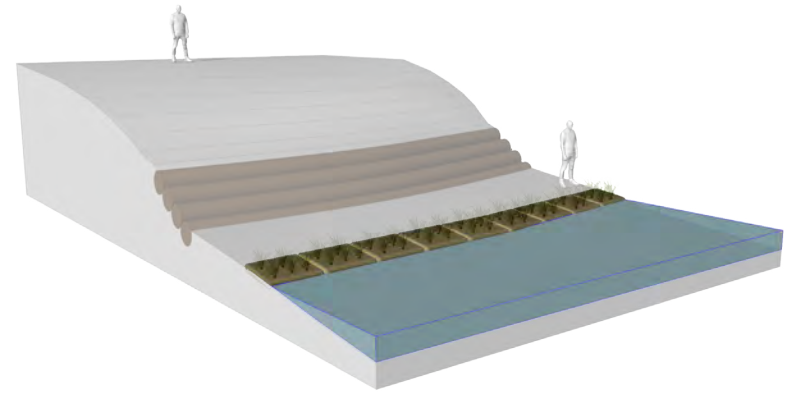


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INSTALLATION & CASE STUDIES

Fringe Marshes

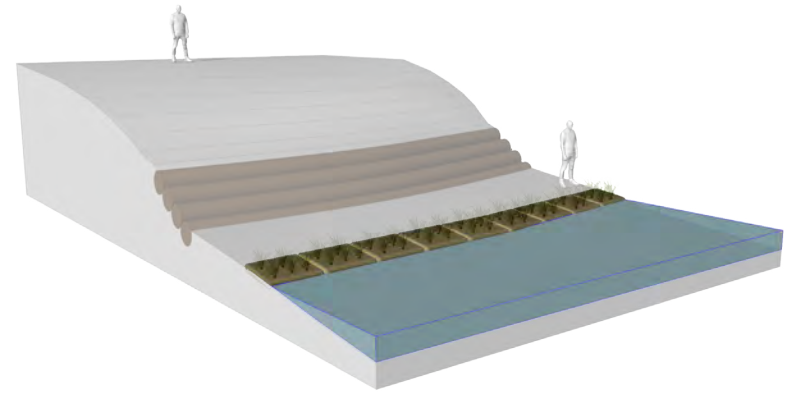


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INSTALLATION & CASE STUDIES

Fringe Marshes

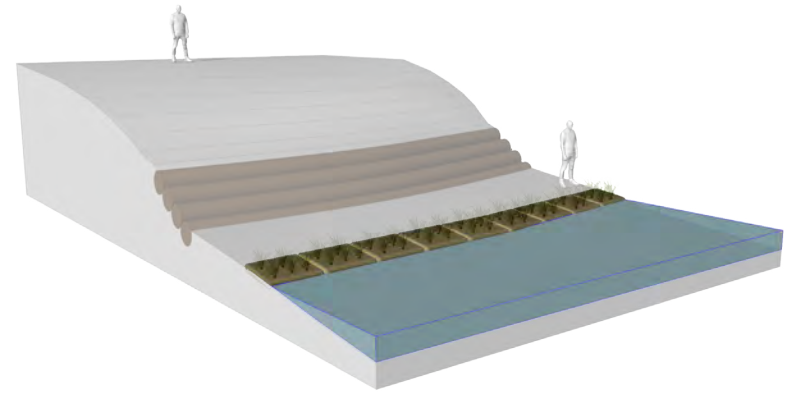


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INSTALLATION & CASE STUDIES

Fringe Marshes

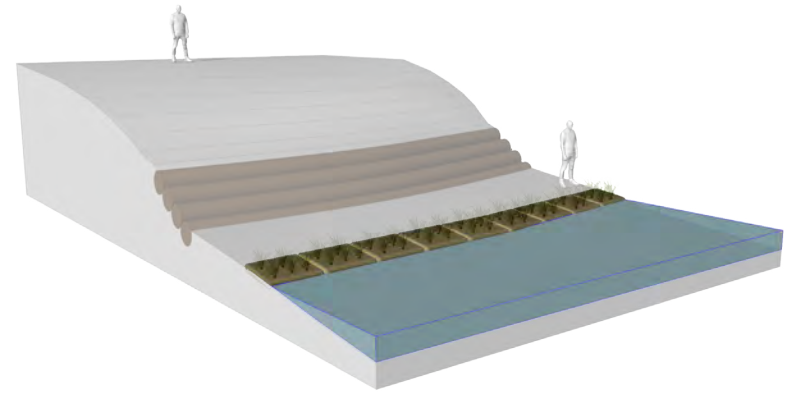


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INSTALLATION & CASE STUDIES

Fringe Marshes

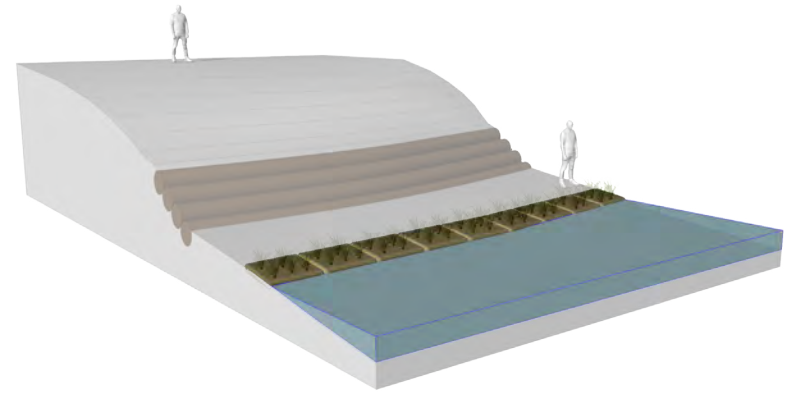


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INSTALLATION & CASE STUDIES

Fringe Marshes





BIOENGINEERING STRATEGIES

Reducing Coastal Erosion and Coastal Storm Damage While Minimizing Impacts

