

# THE EVOLUTION OF EROSION CONTROL TECHNOLOGY

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# Welcome!

**Pete Hanrahan, CPESC**  
**E. J. Prescott, Inc.**  
**Gardiner, Maine**  
**[pete.hanrahan@ejprescott.com](mailto:pete.hanrahan@ejprescott.com)**

# EROSION CONTROL

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- **HAS BEEN PRACTICED FOR THOUSANDS OF YEARS**
- **CLEAN WATER ACT & ENFORCEMENT HAVE STIMULATED RAPID TECHNOLOGY DEVELOPMENT**



BEFORE SEBASTOPOL.—ZOUAVES MAKING GABIONS.—(SEE NEXT PAGE.)

# GABIONS YESTERDAY AND TODAY

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# BOSTON MARCH 1776

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# AMERICA'S VICTORY

- ARTILLERY MOVED TO DORCHESTER HEIGHTS AT NIGHT
- BATTERY PROTECTED BY MAKESHIFT GABIONS
- BRITISH FORCES EVACUATE



# ESTABLISHING VEGETATION

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## THE BASICS

- SEED
- MULCH
- SEED BED  
PROTECTION
- TURF  
REINFORCEMENT



# SEED SELECTION

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- **CHOOSE SEED APPROPRIATE FOR SOILS, CLIMATE AND SPECIFIC SITE NEEDS**
- **SEEK ADVICE FROM QUALIFIED SOURCES**



# MULCH

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**“MULCHES CONTROL WEEDS. MULCHES CUT  
DOWN ON EVAPORATION FROM THE SOIL.  
MULCHES KEEP SOIL WARMER IN THE  
AUTUMN AND COOLER IN THE SUMMER.  
MULCHES PREVENT SOIL EROSION.  
MULCHES CONTROL DISEASES.”**

*David Robson, University of Illinois Extension*

# VEGETATION ESTABLISHMENT

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- BARE GROUND SEEDING
- LOOSE MULCH
- CRIMPED MULCH
- HYDROMULCH
- BONDED FIBER MATRIX
- EROSION CONTROL BLANKETS
- TURF REINFORCEMENT MATS

# BARE GROUND SEEDING

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- VERY INEXPENSIVE
- VERY RISKY
- FAILURE CAN LEAD TO COSTLY REMOBILIZATION
- PARTICULARLY VULNERABLE ON SLOPING AREAS, CONCENTRATED FLOW AREAS AND ALONG SHORELINES

# MULCHES

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## LOOSE MULCH

- PROVIDE SEED PROTECTION AND ENHANCE VEGETATIVE GROWTH
- VULNERABLE TO EROSION

## CRIMPED MULCH

- SAME POSITIVE CHARACTERISTICS AS LOOSE MULCH
- MUCH LESS VULNERABLE TO EROSION THAN LOOSE MULCHES

# HYDROMULCHES

**HYDROSEEDING—SEED AND  
WATER**

**HYDROMULCHING—SEED,  
WATER, MULCH**

**BONDED FIBER MATRIX—  
SEED WATER MULCH  
AND TACKIFIER**

**FLEXIBLE GROWTH  
MEDIUMS**



# ABOUT HYDROMULCHES

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- **EASY TO APPLY, VERSATILE**
- **MANY APPLICATIONS**
- **ESPECIALLY PRACTICAL IN AREAS WITH ROCKY OUTCROPPINGS**
- **SELDOM APPROPRIATE ON STEEP SLOPES OR IN AREAS WITH HIGH CONCENTRATED FLOWS**

# HYDROMULCHES

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- **HIGH  
PERFORMANCE  
HYDROMULCH  
CONTINUING TO  
EVOLVE**

# EROSION CONTROL BLANKETS

- **TEMPORARY PRODUCTS**
- **PROTECT SEED AND DEGRADE AS VEGETATION BECOMES ESTABLISHED**
- **PROVIDE UNIFORM COVERAGE**



# BLANKET BENEFITS

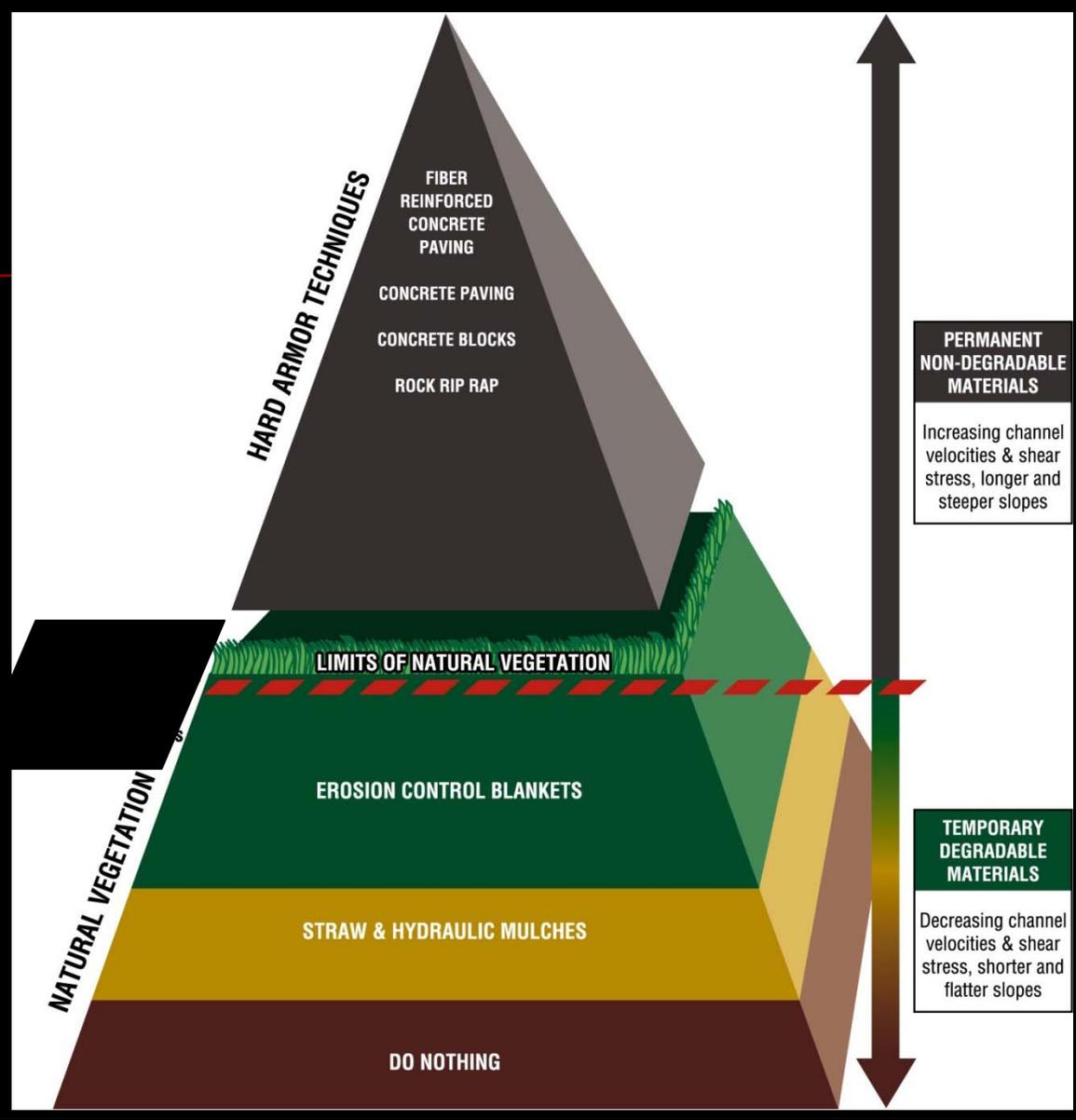
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- **INCREASED GERMINATION RATES**
- **AN INEXPENSIVE INSURANCE POLICY**
- **FLEXIBILITY IN SEED SELECTION**
- **CONSISTENT RESULTS**

**The  
Traditional  
Range of  
Techniques  
offers limited  
options.**

**Erosion  
Control  
Blankets  
opened a new  
window.**



# BLANKET TYPES

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- **ONE GROWING SEASON (STRAW OR WOOD FIBER)**
- **TWO GROWING SEASONS (STRAW/COCONUT)**
- **THREE GROWING SEASONS (COCONUT)**

# BLANKET NETTING OPTIONS

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- **CLEAR PLASTIC**
- **GREEN PLASTIC**
- **JUTE/ORGANIC**
- **BLACK PLASTIC**

# NETTING CHARACTERISTICS

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- **CLEAR—PHOTODEGRADABLE—WILL BREAK DOWN IN 45-60 DAYS**
- **GREEN—SLOWER DEGRADING—CAN TAKE 1-2 YEARS TO BREAK DOWN**

**GREEN NETTED PRODUCTS**  
**SHOULD NEVER BE USED IN AREAS**  
**THAT WILL BE MOWED!**





# WHEN SHOULD I USE?

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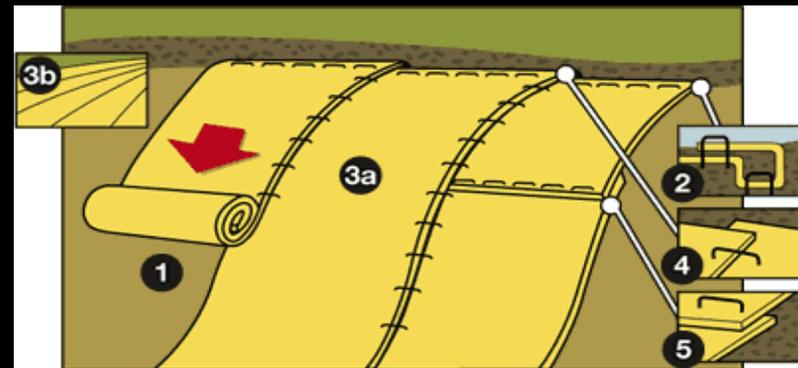
**Q.**

**A.**

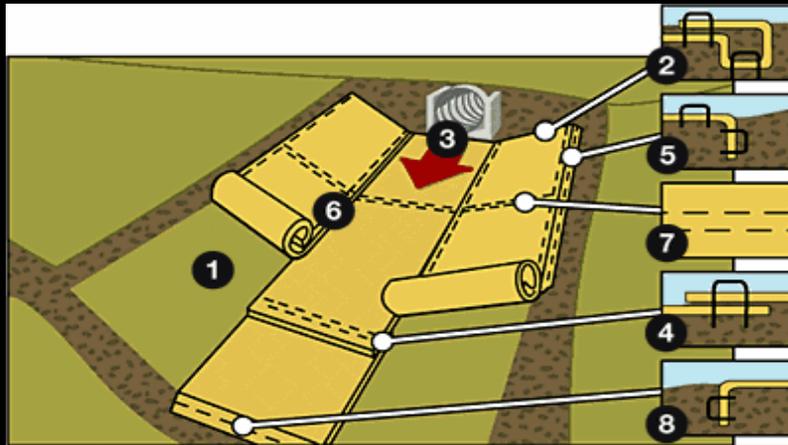
- ❑ GREEN NET**
- ❑ ORGANIC NET**
- ❑ STRAW/COCONUT**
- ❑ 100% COCONUT**

**NO MOW AREAS**  
**SITE SPECIFIC**  
**2 YEAR LIFE**  
**3 YEAR LIFE**

# SLOPES

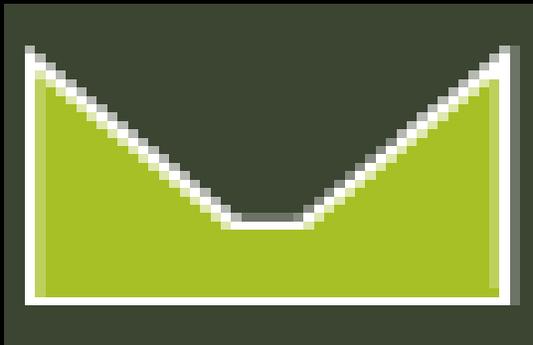
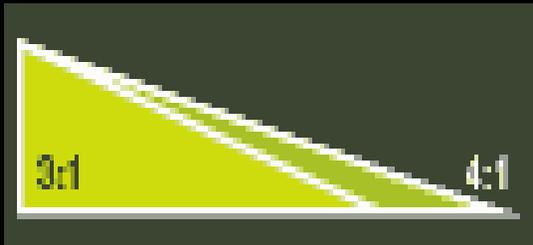


# CHANNELS



# PRODUCT SELECTION

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- **SLOPE OR CHANNEL?**
- **STEEPNESS OF SLOPE?**
- **AREA BEING DRAINED BY CHANNEL OR SLOPE?**
- **HOW LONG IS TEMPORARY PROTECTION NEEDED?**

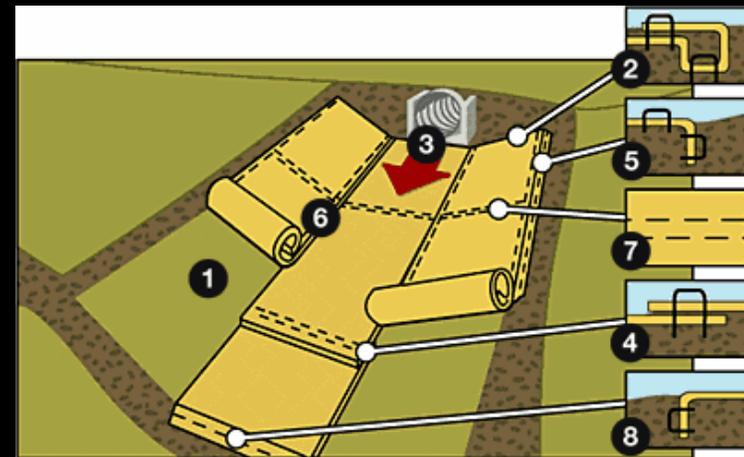
# BLANKET FACTS

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- **CAN BE INSTALLED FOR ABOUT HALF THE PRICE OF SOD – YET PRODUCE EXCELLENT TURF!**
- **COST EFFECTIVENESS HAS LED TO TREMENDOUS GROWTH IN SALES**
- **HELP SUPPRESS WEED GROWTH**
- **QUICKER GERMINATION**

# TURF REINFORCEMENT MATS

- PERMANENT REINFORCEMENT OF THE ROOT AND STEM STRUCTURE OF THE VEGETATION
- ABOUT 1/3 THE COST OF RIPRAP



# TURF REINFORCEMENT MATS VS. RIPRAP

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- ATTRACTIVE APPEARANCE
- LOWER COST
- SAFETY
- SEDIMENT & POLLUTANT FILTRATION
- LOWER MAINTENANCE COSTS

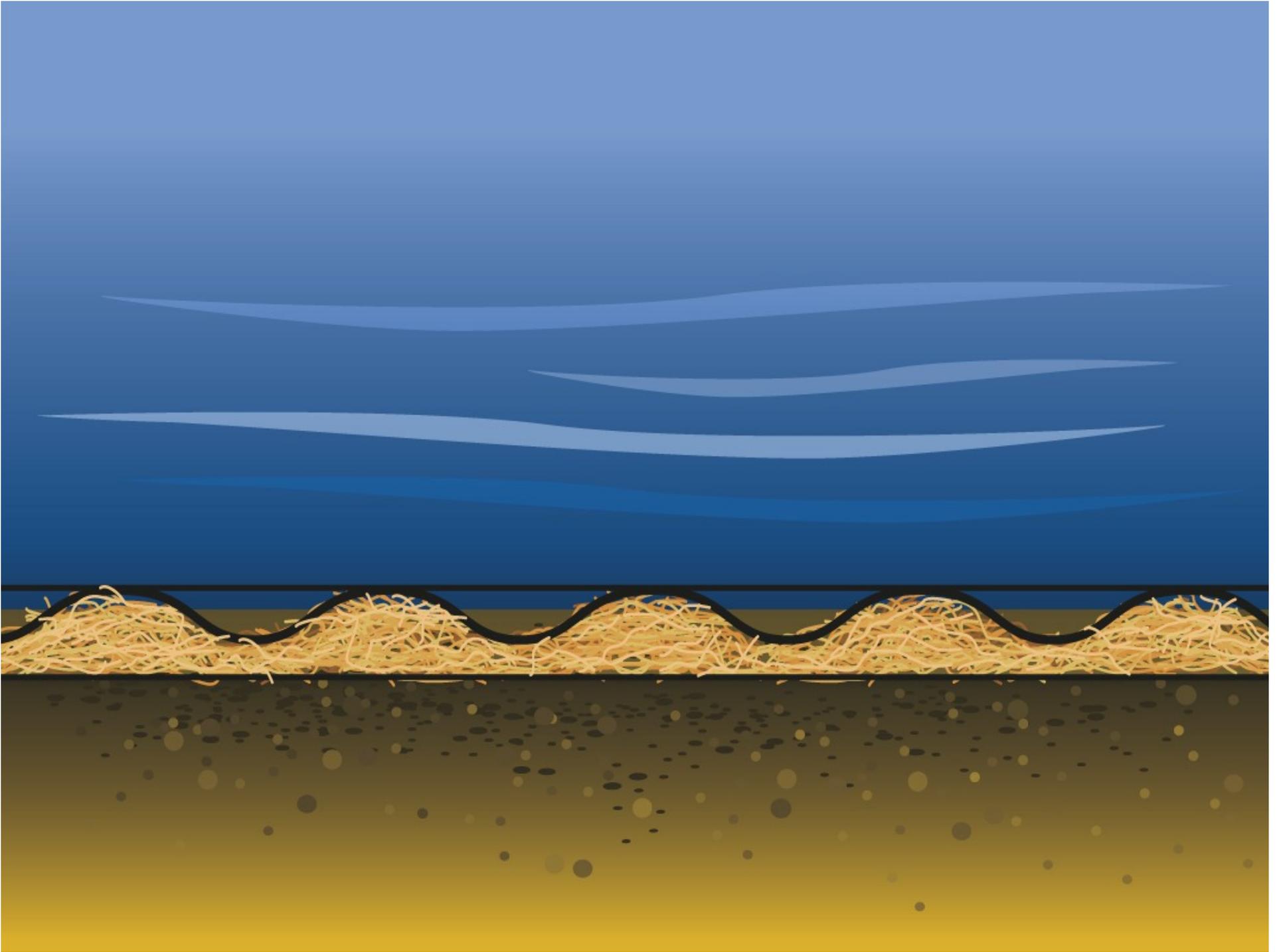
# SHEAR STRESS

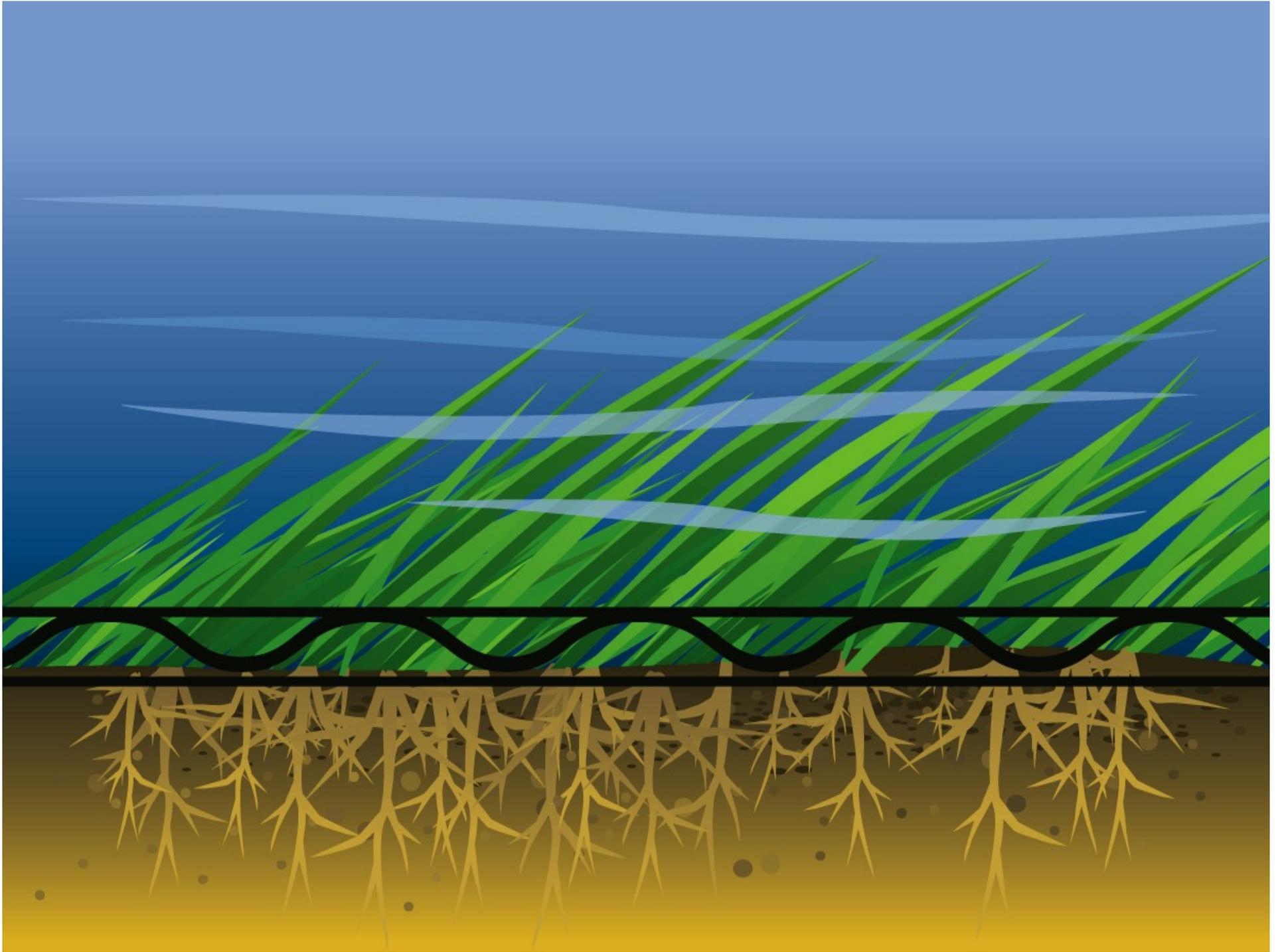
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**CAN BE  
DESCRIBED AS  
THE PULLING  
OR TEARING  
ACTION CAUSED  
BY  
CONCENTRATED  
FLOWS**

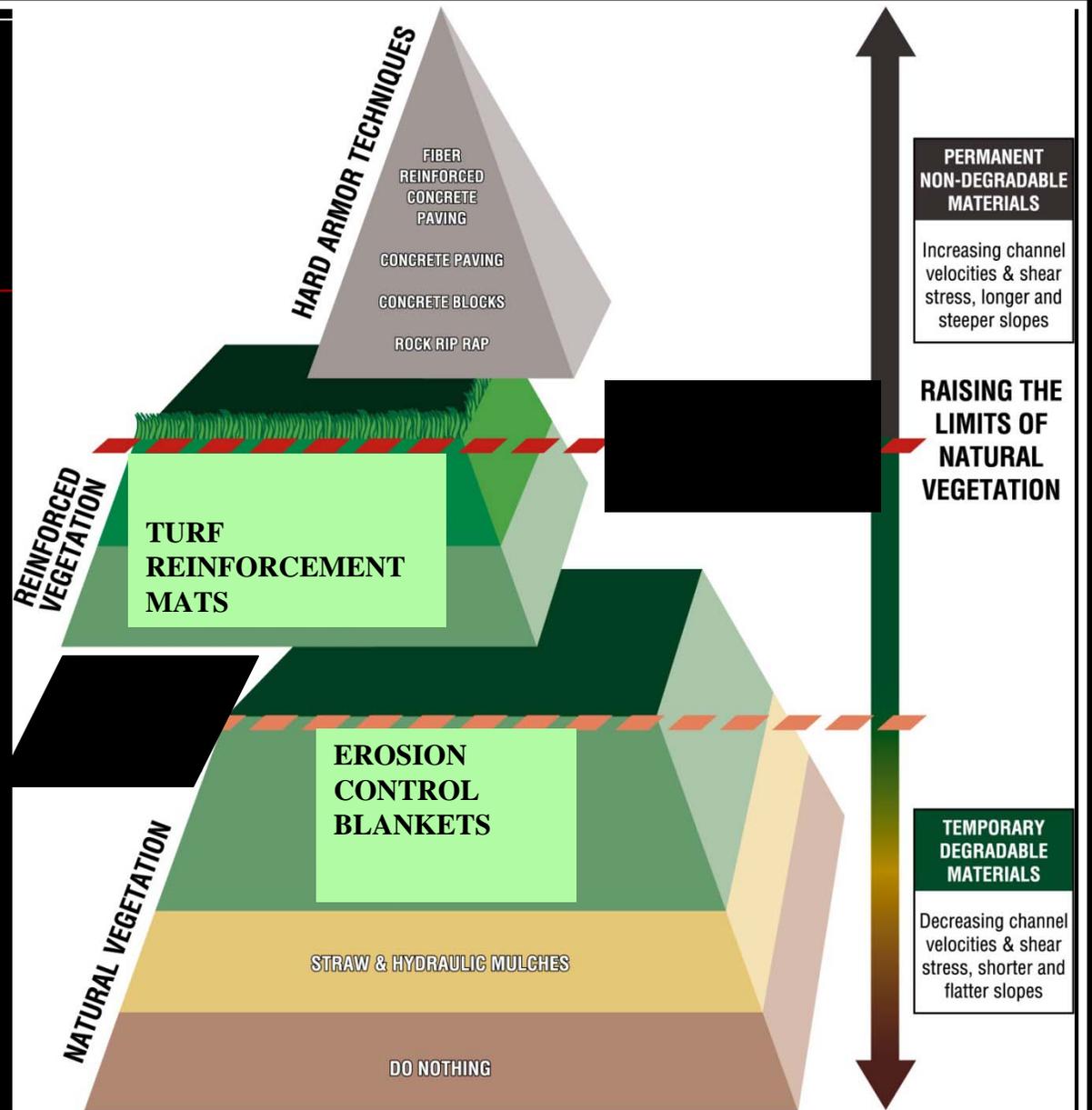
## **SHEAR STRESS TOLERANCE (LBS/FT)**

<b>BARE SOIL</b>	<b>0.0</b>
<b>SOD</b>	<b>1.0</b>
<b>STRAW EC BLANKET</b>	<b>1.55</b>
<b>ESTABLISHED TURF</b>	<b>2.7</b>
<b>TRM</b>	<b>10.0</b>
<b>TRM</b>	<b>12.0</b>
<b>TRM</b>	<b>14.0</b>





# THE TURF REINFORCEMENT MAT WINDOW!



# CASE STUDY

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**MOLINE, ILLINOIS**

**SUMMER, 2004**

**RESEARCH &  
DESIGN**

**FALL, 2005**

**INSTALLATION OF  
DOWNSTREAM  
SECTION**



# PROGRESSION

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- **CALL TO DISTRIBUTOR**
- **PRESENTATION TO ILLINOIS DISTRICT 2**
- **DESIGN SOFTWARE ANALYSIS**
- **SPECIFICATION OF TURF REINFORCEMENT  
MAT**
- **BIDDING**
- **INSTALLATION**



# RESULTS

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- **RIP RAP  
ESTIMATED  
INSTALLED COST  
WAS \$2,000,000**
- **INSTALLATION OF  
TURF  
REINFORCEMENT  
MAT COST \$400,000**



# PROBLEM!

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- **FAILURE TO STABILIZE UPSTREAM CHANNEL CAUSED A HOST OF PROBLEMS**
- **CORRECTION COSTS WERE MINOR**

# BOTTOM LINE

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- **PROJECT RESULTED IN A NEW TURF REINFORCEMENT MAT SPECIFICATION FOR THE ILLINOIS DOT!**

# CASE STUDY #2

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## *The Links at Ireland Grove*

- **BLOOMINGTON,  
ILLINOIS**
- **NEW GOLF COURSE  
CONSTRUCTION**
- **FOUR PONDS**



# SUPERINTENDENT'S WISH LIST

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- **NATURAL VEGETATION ALONG SHORELINE**
- **NO ROCK!**
- **PONDS ARE CENTERPIECE OF COURSE—MAKE THEM LOOK NATURAL**

# PROGRESSION

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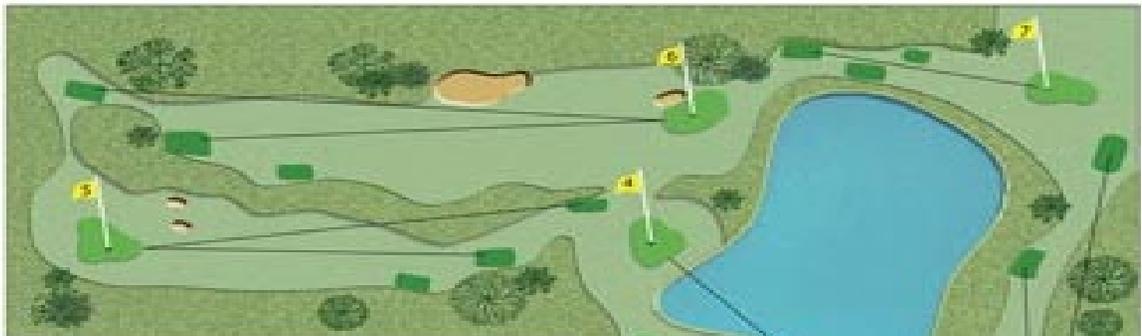


# RESULTS

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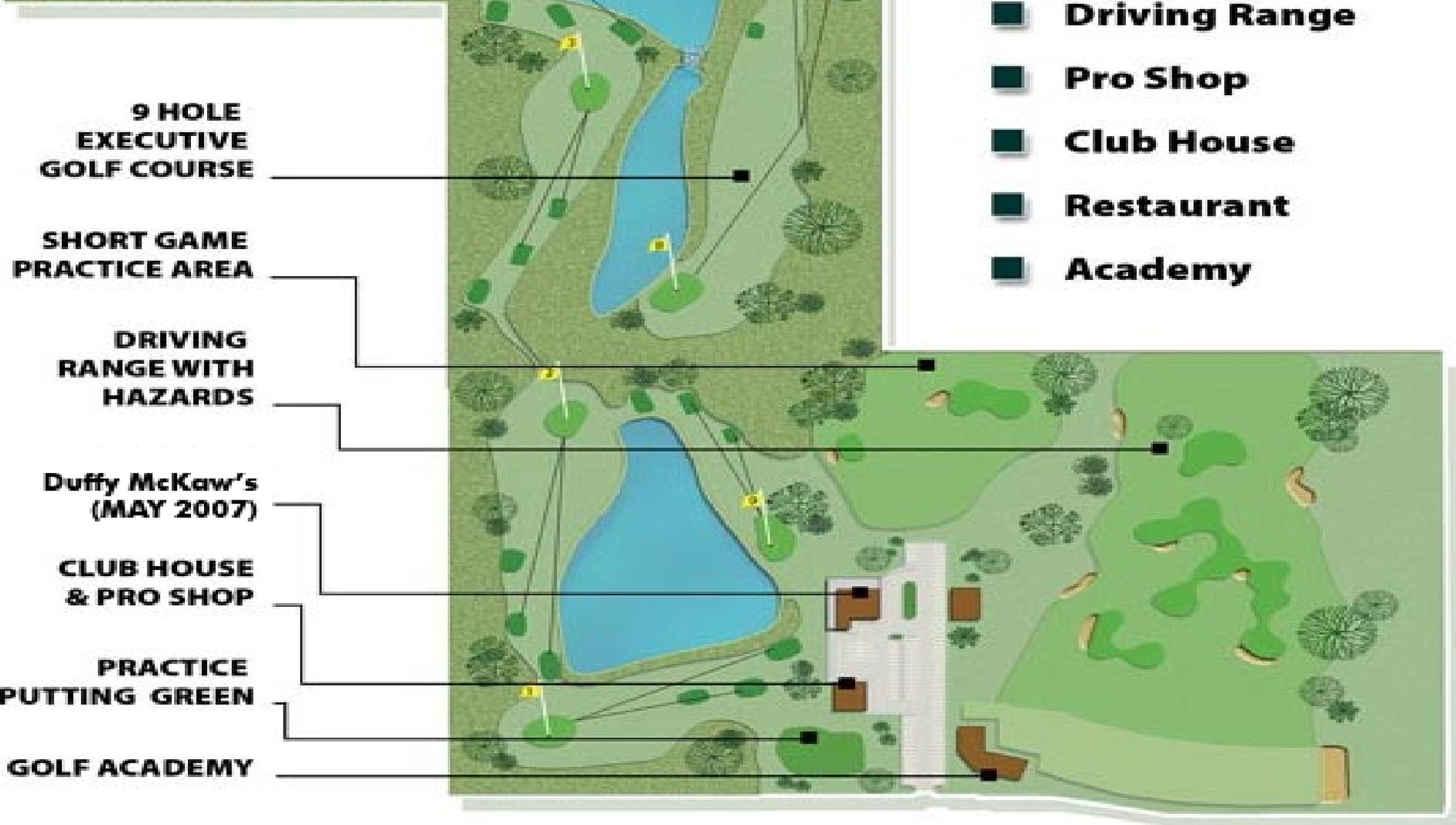
- **A VERY SATISFIED CUSTOMER**
- **DOZENS OF REFERRALS**
- **DOZENS OF CART TOURS!**
- **A SIMPLE SOLUTION THAT WORKS**





# Executive 9 Hole Golf Course

- Driving Range
- Pro Shop
- Club House
- Restaurant
- Academy



# GERMANTOWN HILLS, IL

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# BIOENGINEERING

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**NATURAL  
SOLUTIONS FOR  
STREAM BANK  
REMEDIATION  
AND SHORELINE  
RESTORATION**



# BIOLOGS

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- **STAKED AND SECURED AT HIGH WATER MARK**
- **PRODUCT LIFE CAN BE UP TO 5-7 YEARS**
- **CAN BE PLUGGED WITH LIVE PLANTS**
- **OFTEN USED IN CONJUNCTION WITH OTHER NATIVE PLANT MATERIALS**

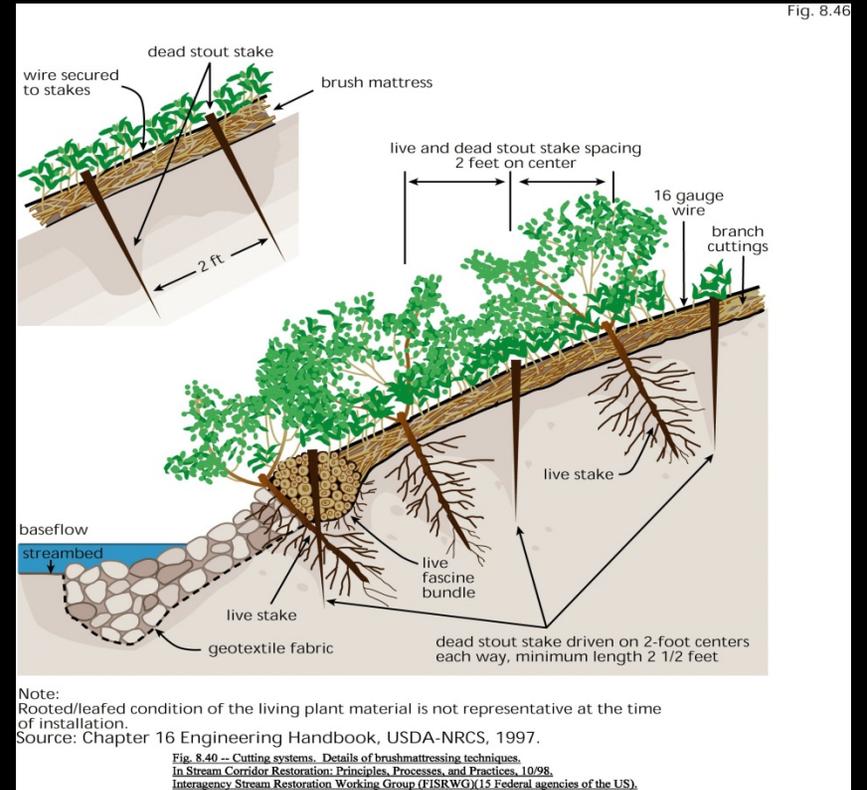
# SOIL ENVELOPES

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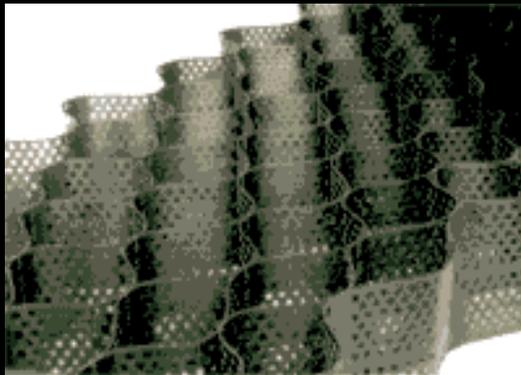
PLUM ISLAND, MA

# SWALE TREATMENT



# CELLULAR CONFINEMENT

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- **CAN BE INFILLED WITH TOPSOIL, STONE, GRAVEL OR CONCRETE**
- **MANY VARIED APPLICATIONS**
- **DEVELOPED IN THE LATE 1970'S**

# Cellular Confinement System

- Varied Cell Sizes
  - Varied Cell Depths
  - Varied Section Lengths
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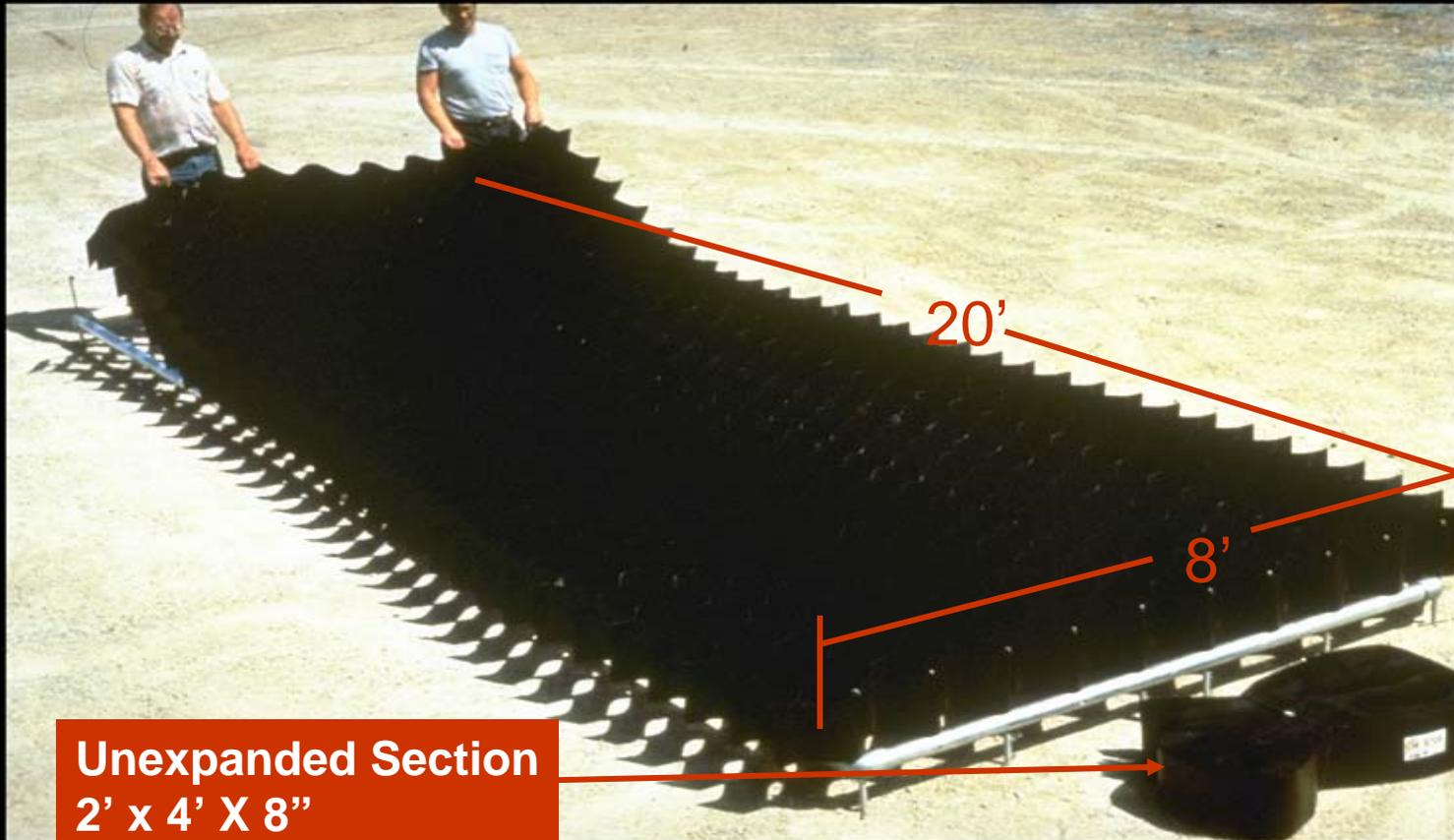
# CELLULAR CONFINEMENT APPLICATIONS

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- **STEEP SLOPE STABILIZATION**
- **LOAD SUPPORT AND DISTRIBUTION**
- **SOIL REINFORCEMENT**
- **VEGETATED RETAINING WALLS**



# Cellular Confinement Section



# Cellular Confinement Load Support

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## Applications

- **Airstrips**
- **Boat Ramps**
- **Low Water Crossing**
- **Permeable Parking**
- **Roadways (Shoulders, Surface Stabilization & Base Stabilization)**
- **Intermodal/Railroad**
- **Sludge Beds**
- **Trails**

# LOAD SUPPORT BLOCK

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- **EMERGENCY  
VEHICLE ACCESS  
LANES AT  
HOSPITALS OR  
COMMERCIAL  
BUILDINGS**
- **PERMANENT  
SOLUTION**

# Porous Pavement System

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## H-10 and H-20 Loading



## **Load Support Block Benefits**

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- **Protects Turf in Load-bearing Applications**
- **Promotes Infiltration / Reduces Storm Water Runoff**
- **Improves Storm Water Quality**
- **Can reduce Storm water management fees**
- **Offers Aesthetics of Green Space**
- **Can Reduce Need for Storm Water Containment Facility**

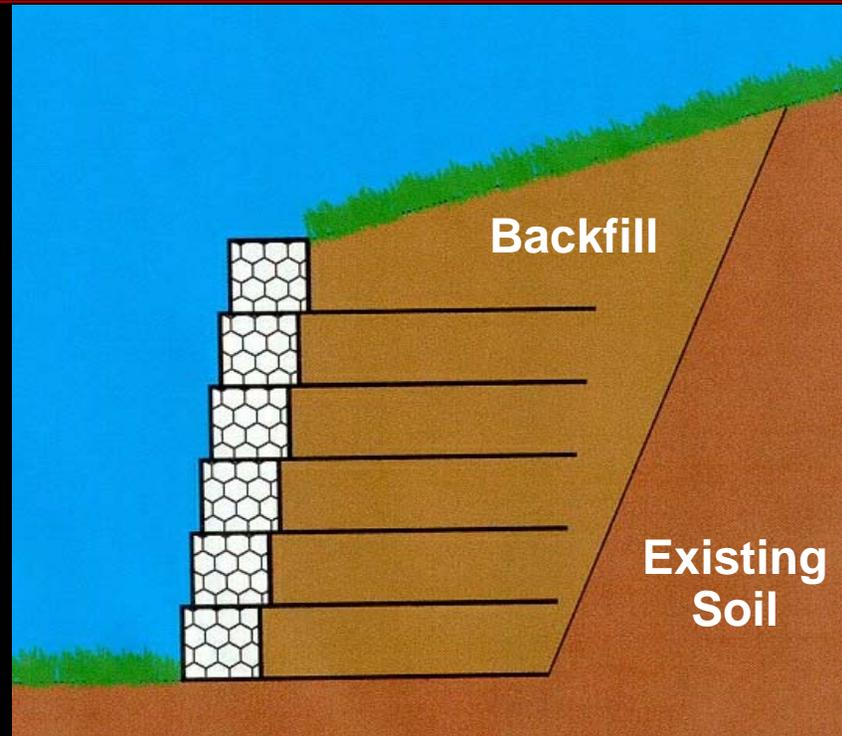
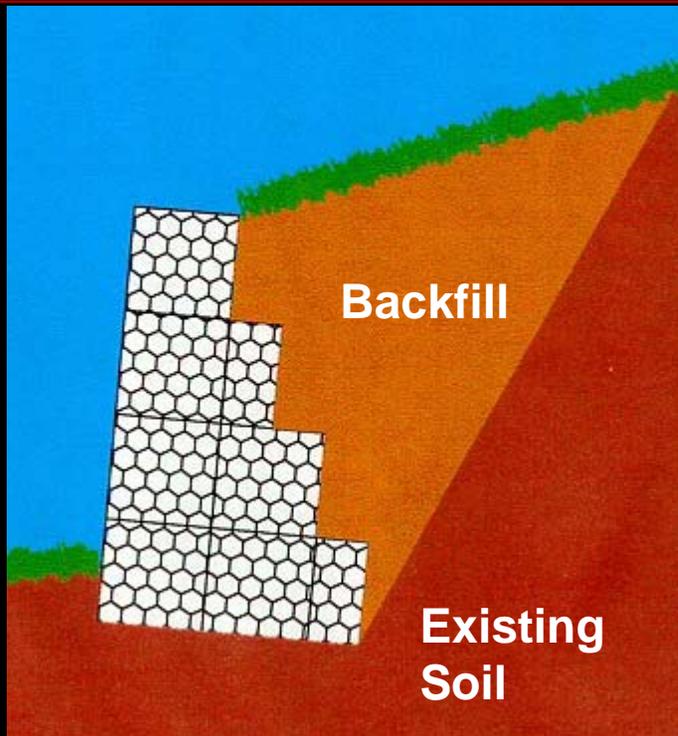
# Grass Fire Access Lanes



# GABIONS

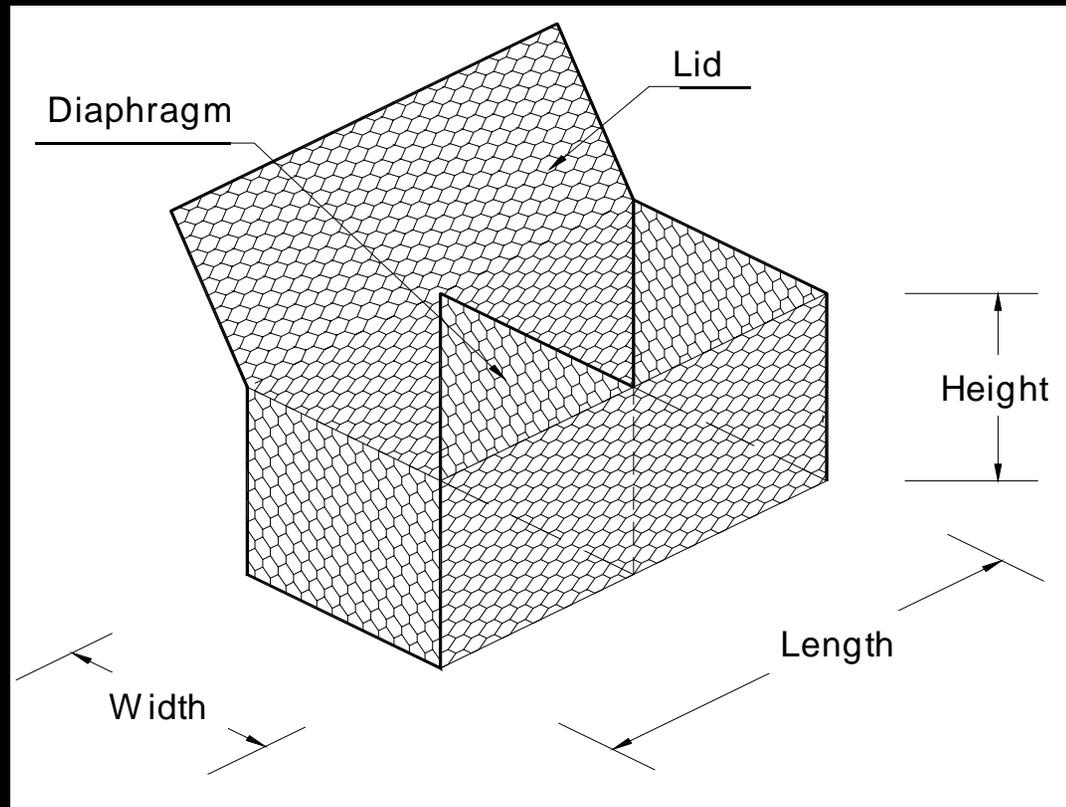
- GALVANIZED OR PVC COATED WIRE
- RETAINING WALLS
- DAMS
- BRIDGE SCOUR PROTECTION
- WEIRS
- SHORELINES





# GABION CONSTRUCTION

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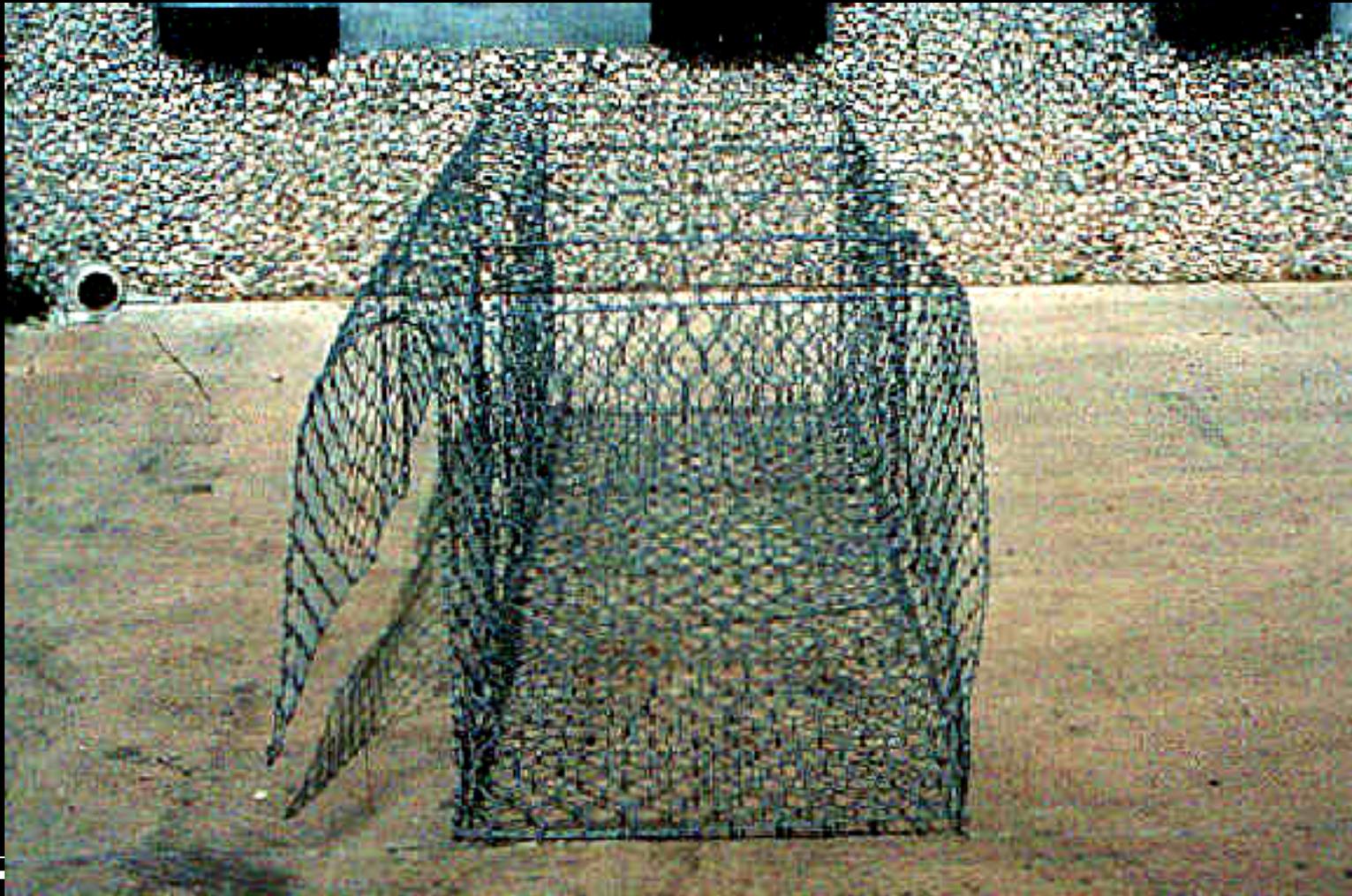


# CLIP INSTALLATION

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# Rock Size

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**6 in. Mattress:      3 in. rock**

**9 in. Mattress:      3 to 6 in. rock**

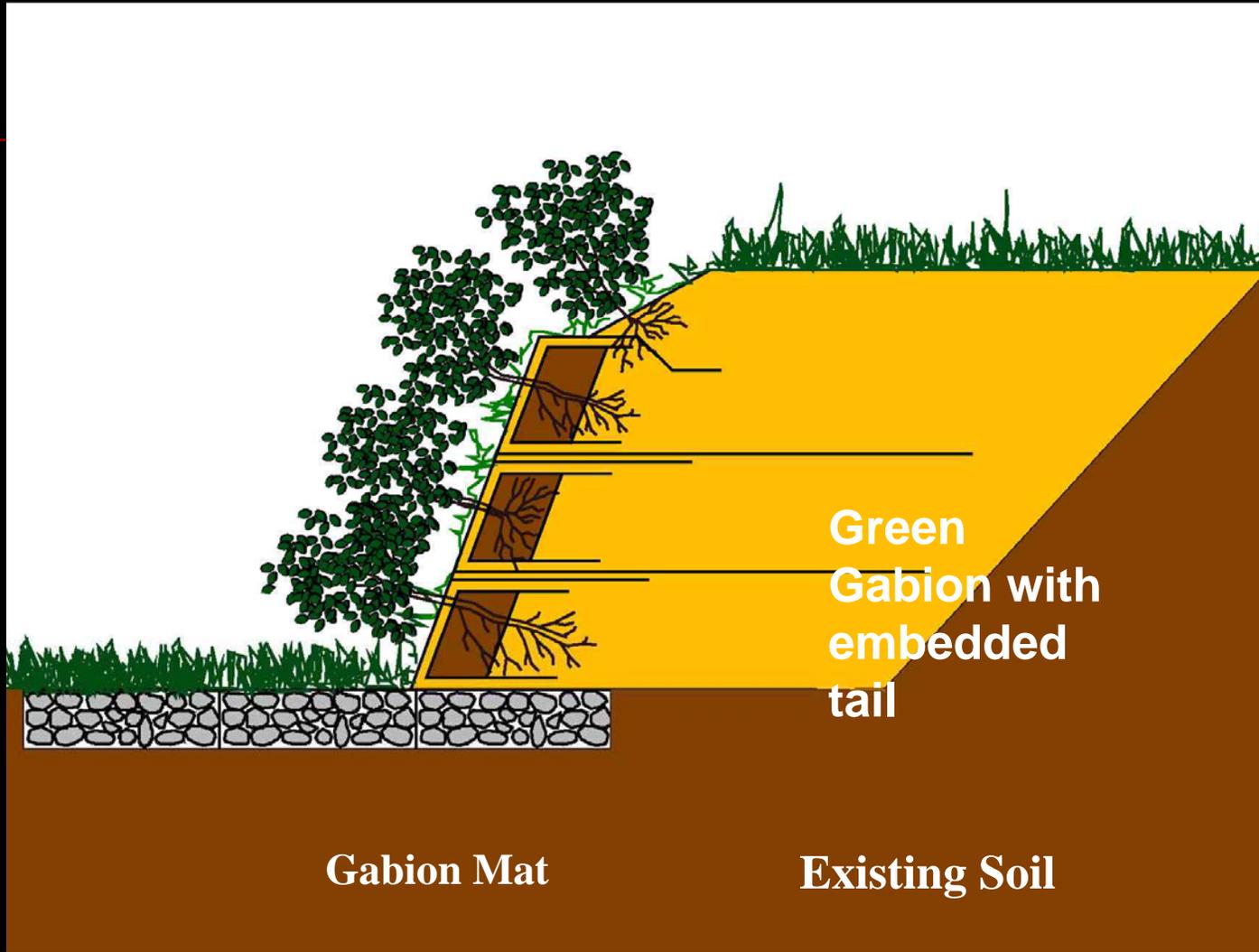
**12 in. Mat:            4 to 8 in. rock**

**18 in. Mat:            4 to 8 in. rock**

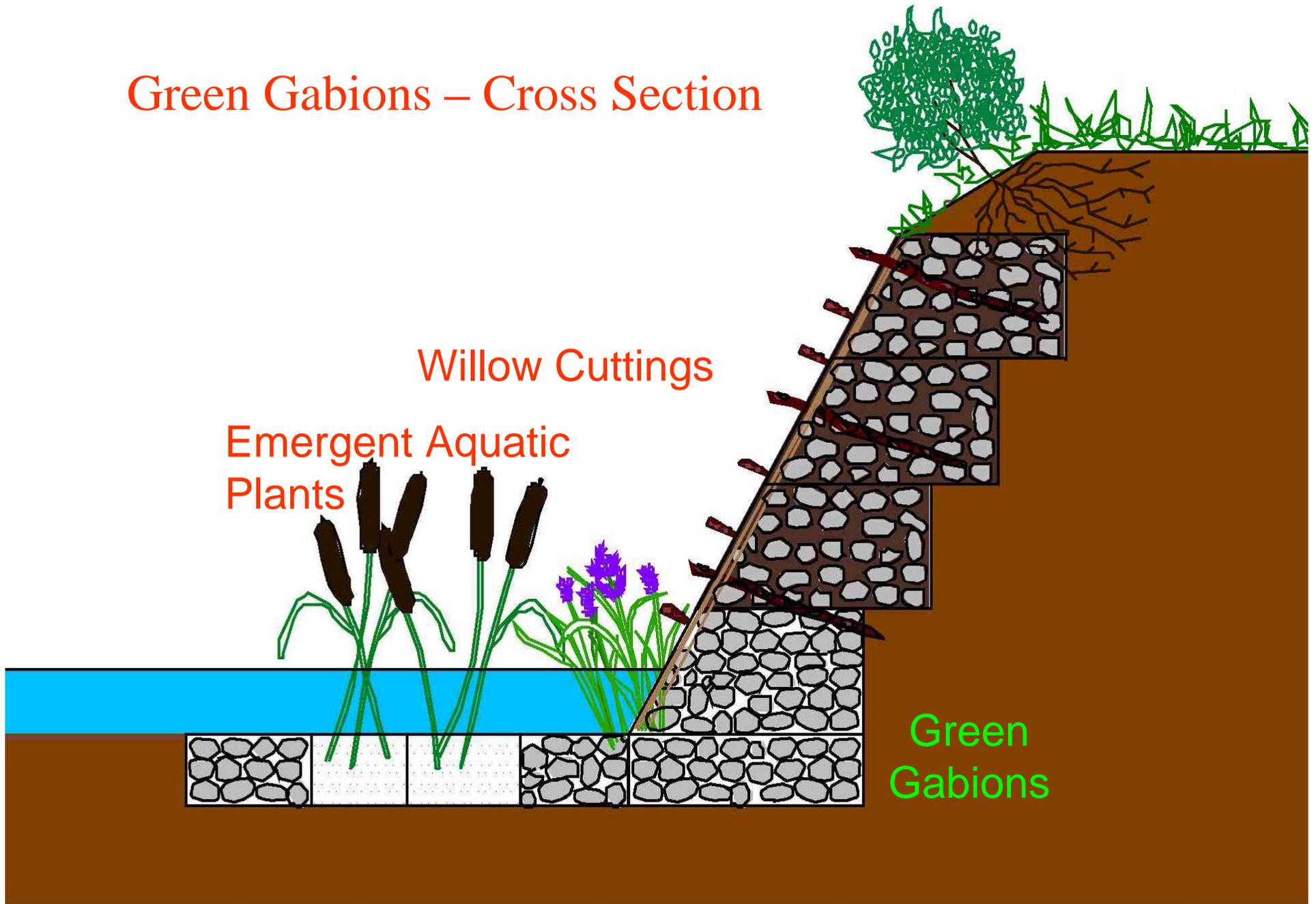
**Gabions:                4 to 8 in. rock**



# Green Gabion with embedded tail– Cross Section



# Green Gabions – Cross Section

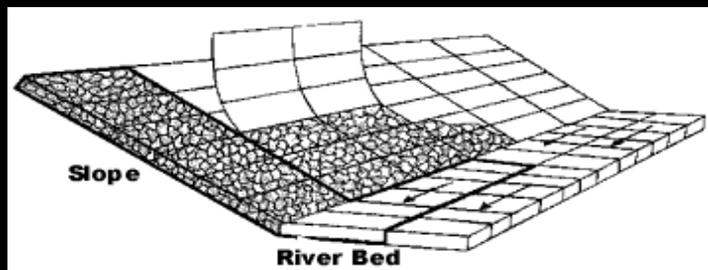


# Mechanically Stabilized Earth (MSE)



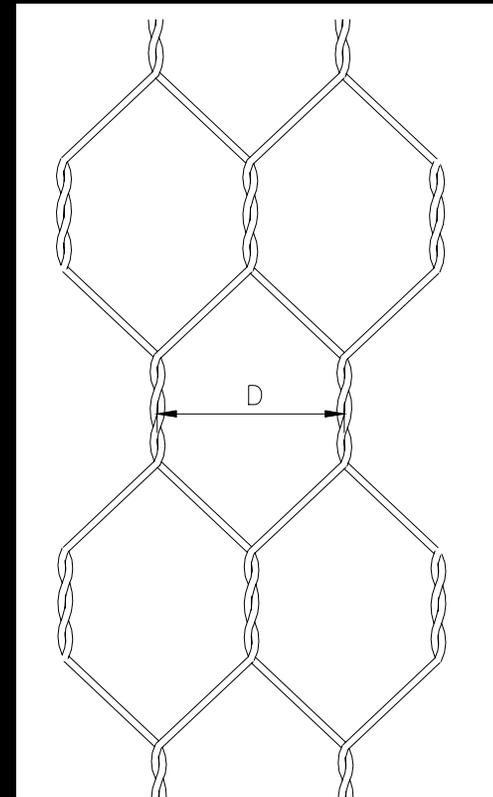
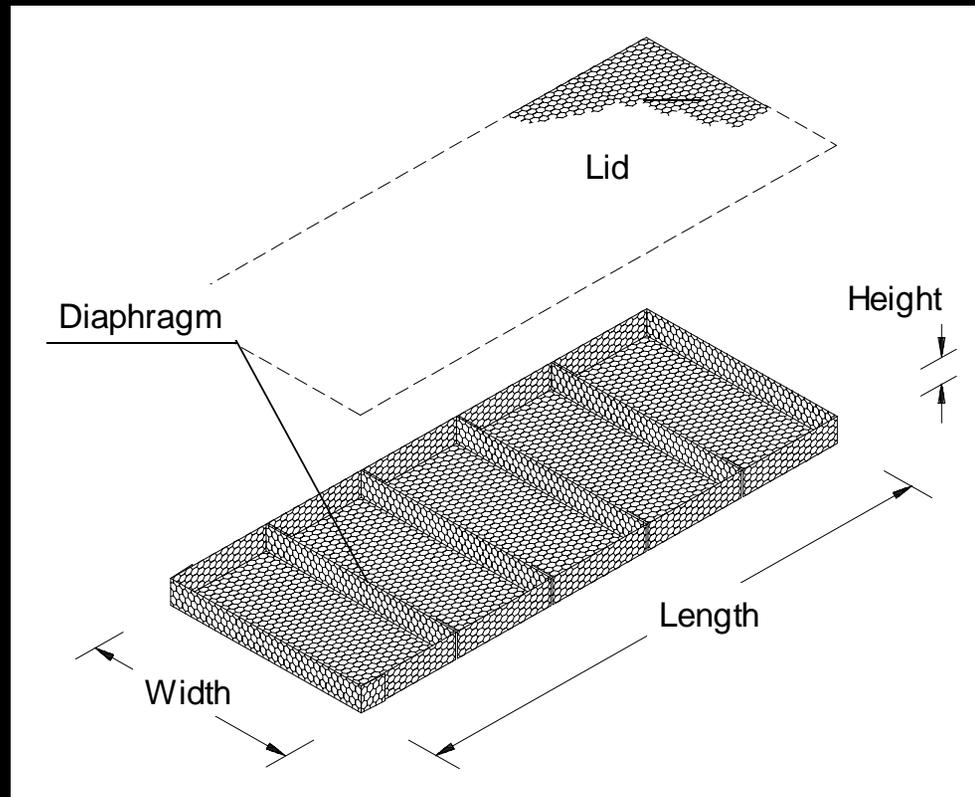
# RENO MATTRESSES

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- **A LOW PROFILE WIRE FILLED BASKET**
- **SPELLWAYS**
- **STREAM BOTTOMS**
- **SLOPES**

# Reno Mattress (6 x 8 Type)



# Dam Rehabilitation

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# OTHER HARD ARMOR



- **ROCK RIPRAP**
- **SCOUR PROTECTION BLOCKS**
- **REVTMENT MATS**
- **ARTICULATED CONCRETE**
- **CONCRETE PAVEMENT**
- **MODULAR RETAINING WALLS**

# A NOTE TO SPECIFIERS

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- PAY ITEMS
- ON-SITE ASSISTANCE
- DESIGN HELP
- EXPANDED TOOL BOX
- CREATIVITY

# CONCLUSIONS

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*Say yes to:*

- **PERFORMANCE BASED TESTING**
- **PAY ITEMS**
- **INDEPENDENT RESEARCH**
- **CASE STUDIES**
- **AN OPEN MIND**

*Say no to:*

- **PROPRIETARY SPECIFICATIONS**
- **LUMP SUM SPECIFICATIONS**
- **PROPRIETARY RESEARCH**
- **BASELESS CLAIMS**
- **A CLOSED MIND**

# WHAT'S AHEAD?

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*"It's about the relationship between land and water"* --Jay Riggs

- Water Conservation and Reuse
- Storm Water Management
- Storm Water Treatment
- Continued Advancements in Technology
- Continued BMP Evolution

# THANK YOU!

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