What’s covered in this module?

1. Definition of temporary erosion and sediment control
2. Physical erosion and sediment control measures
3. Operational erosion and sediment control measures
4. Dewatering and pumping
What are the module’s learning objectives?
1. Explain the difference between temporary and permanent erosion and sediment control in the Special Provisions
2. Identify temporary and permanent erosion and sediment control measures and their appropriate applications
3. Evaluate requirements that influence the installation, maintenance, inspection, and removal of erosion and sediment control measures

Construction ESC
Temporary vs. Permanent
– What does temporary vs. permanent mean in the Special Provision?

  What is temporary erosion control?
  What is temporary sediment control?
  Are the two mutually exclusive terms?
Construction ESC

Key Considerations:

- Installation (constructability)
- Maintenance
- QA/QC
- Inspection
- Removal

Site visits are needed to properly plan the project

- Critical areas
- Does the ESC design match what is needed in the field?

Think about progression through the project

- What should be one of the first things to do when you move on to a site?
- What comes next?
Phasing

Construction phasing is a great ESCM
– Phasing the project
– Phasing the ESC plan

Plan construction activities to minimize the areas of disturbance and minimize impact

Complete grading activities and establish permanent controls as soon as possible

Phasing
Phasing

Perimeter Controls
Installing perimeter controls should be one of the first tasks before beginning earthwork operations

Options Available:
– Silt fence
– Fiber rolls
– Berms

Should consider location and type to maintain proper control
Silt Fence (Section 260)

Consists of partially buried fabric that is supported by posts used to control sediment from small disturbed areas

Only good for low-flow situations

Proper placement and installation are critical to their success

Silt Fence

Construction Considerations:

– Drainage area: ¼ acre per 100 feet of fence (½ acre per 100 feet of fence when reinforced with wire backing)

– Longevity: approximately 6 months
Silt Fence

Placement:

– Placed along elevation contours or as perimeter control

<table>
<thead>
<tr>
<th>Slope (%)</th>
<th>Slope Length (ft)</th>
<th>Maximum Drainage Area (ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>100</td>
<td>10,000</td>
</tr>
<tr>
<td>2 to 5</td>
<td>75</td>
<td>7,500</td>
</tr>
<tr>
<td>5 to 10</td>
<td>50</td>
<td>5,000</td>
</tr>
<tr>
<td>10 to 20</td>
<td>25</td>
<td>2,500</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>15</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Flare ends upslope

Flow
Silt Fence

Placement:

– “J” hooks increase ponding and prevents flow along the silt fence perimeter

Silt Fence Supported

Supported silt fence

Woven Wire 28” min height above ground

Fabric entrenchment

Existing ground

Flow

Contours

Silt fence

Standard Drawing D-260-1
Silt Fence (Section 260.04 B. & C.)

Maintenance:
– Remove accumulated sediment when it reaches 1/3 of the exposed height of the silt fence
– Repair/replace damaged sections

Removal:
– Prep soil and seed and mulch removal area to match existing conditions

Fiber Rolls (Section 261.04 A. & B.)

Maintenance:
– Remove accumulated sediment when it reaches 1/3 of the exposed height of the fiber roll
– Repair/replace damaged sections

Removal:
– Prep soil and seed and mulch removal area to match existing conditions
Berms

Slows sediment-laden water and filters sediment in low-flow areas

Common types:
- Topsoil
- Compost

May be used in conjunction with other sediment control measures
Inlet Protection

Multiple options available to prevent sediment from entering inlets

- Fabric
- Fiber rolls
- Gravel
- Manufactured (bags/domes/curb inlets)
Module 3: Temporary Erosion & Sediment Control Measures – NDDOT Erosion & Sediment Control – Construction Course

Standard Drawing D-708-6

Standard Drawing D-708-6
Sediment Traps

Small basins used for drainage areas that are 5 acres or less

Storage should provide for 3,600 cubic feet per acre of drainage area
– Should safely pass 2-yr, 24-hr design storm

Sediment Trap Guidelines

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam height</td>
<td>Maximum of 5 ft.</td>
</tr>
<tr>
<td>Top width (embankment)</td>
<td>Minimum of 5 ft.</td>
</tr>
<tr>
<td>Fill slopes (embankment)</td>
<td>2.5:1 or flatter</td>
</tr>
<tr>
<td>Dam settlement</td>
<td>10% or less</td>
</tr>
<tr>
<td>Principal spillway</td>
<td>Rock-lined open channel or perforated riser</td>
</tr>
<tr>
<td>Bottom width</td>
<td>Minimum of 5 ft.</td>
</tr>
<tr>
<td>Freeboard</td>
<td>1.5 ft.</td>
</tr>
</tbody>
</table>
Sediment Basins

Structures that impound water and allow sedimentation of finer particles

Stormwater quality:
- Total suspended solids (TSS)
- Pollutants (heavy metals, nutrients, chemicals)

Stormwater quantity:
- Slow release of stormwater
Sediment Basins

Parts of a Sediment Basin:

- Freeboard (1 ft minimum)
- Additional Storage (25-yr, 24-hr storm)
- Water Quality Storage
- Permanent Storage
- Sediment Storage

Location of the Basin:

- Never locate in natural drainage ways (perennial streams, wetlands, etc.)
- Should be placed to receive the maximum amount of runoff from the site
- Divert run-on to avoid travel through the basin
- Discharge point
Sediment Basins

Settled sediment should be removed to maintain capacity of basin

– May be necessary multiple times during the life of the project

– Should design sediment basin to allow access for cleanout

Sediment Basins

Baffles increase the flow length and reduce velocity of flow through basin
Sediment Basins

Forebays create a small detention area before inflow reaches main part of basin

Flocculants and coagulants can aid in sedimentation

– Passive vs. active applications
Stockpiles

Locate stockpiles as far away from bodies of water as possible

Protection of Stockpiles:
– Seeding (temporary or permanent)
– Plastic/geotextile
– Sediment barriers around piles
Track-out

Soil tracked out onto roadways by equipment causes numerous problems

Methods to prevent track-out:

– Stabilized construction access (Section 265)
– Rumble plates
– Wheel wash stations
Cat Tracking

Equipment tracking (or cat tracking) and roughening of the soil surface slows water flow over slopes
Tillage (Section 251.04 B.)

During construction soils can become very compacted

Tillage introduces air into the soil and aids in the establishment and growth of vegetation

– Need approximately 3 inches of loosened soil for seedbed preparation
Seed and Mulch Stabilization

Permanent stabilization as soon as possible is the most cost effective method

– May also be temporary

Should be considered during the planning stages of the project

– Phasing of the project

– When and where to seed and mulch

Mulches (Section 253)

Benefits of Mulches:

– Protects soil by providing ground cover

– Healthy environment for seed and young plants

– Only resistant to raindrop impact and sheet flow

– Not for use in areas with concentrated flow
Mulches

Construction Considerations:

– Preparation of site (soil, seed, fertilizer)
– Slope gradient and length
– Longevity
– Constructability
– Stability

Hay or Straw Mulch (Section 253.04 C.)

Method of placement: Manually or with commercial blowers

Application rates: 2 tons per acre

Coverage: 90% minimum

Usage: Slopes < 2H:1V (see spec 253 D)

Longevity: Approximately 1 month
Hydraulically applied erosion control products (HECP)

Matrix of fibers and additives

Requires specialized equipment to apply

Better protection and extended functional longevity compared to loose mulches

Hydromulch (Section 253.04 B.)

Shredded wood and/or paper fibers

Application rates: 2,000 lbs/acre

Coverage: 95% of the seedbed

Usage: Slopes < 4H:1V

Longevity: Up to 3 months
Bonded Fiber Matrix (BFM) (Section 253.04 D)

Wood fibers and tackifiers

Application rate: Manufacturer’s recommended rate or 3,900 lbs/acre

Coverage: 100%

Usage: Slopes ≤ 2H:1V

Longevity: 6 to 12 months

Flexible Growth Medium (FGM)

Natural and crimped synthetic fibers

Application rate: 3,000 to 4,500 lbs/acre

Coverage: 100%

Usage: Slopes ≤ 1H:1V

Longevity: Minimum of 12 months
Polyacrylamide (PAM)

Flocculating agent used in erosion/sediment control

Anionic PAM should only be used

Must be tailored to soils on site

Most effective when used with in conjunction with mulches

Rolled Erosion Control Products (RECP)

Range from simple nets to high performance products

Come in degradable or permanent forms

High performance RECPs can be used in areas with concentrated flow
Rolled Erosion Control Products (RECP)

Construction considerations for RECPs:
- Application
- Soils
- Longevity
- Maintenance
- Constructability

### RECP Property
<table>
<thead>
<tr>
<th>RECP Property</th>
<th>Common Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>ASTM D6525</td>
</tr>
<tr>
<td>Density</td>
<td>ASTM D792</td>
</tr>
<tr>
<td>Tensile strength/elongation</td>
<td>ASTM D6818</td>
</tr>
<tr>
<td>Bench scale testing:</td>
<td></td>
</tr>
<tr>
<td>• Soil loss ratio</td>
<td>ECTC Method 2</td>
</tr>
<tr>
<td>• Shear resistance</td>
<td>ECTC Method 3</td>
</tr>
<tr>
<td>• Germination</td>
<td>ECTC Method 4</td>
</tr>
<tr>
<td>Large scale testing:</td>
<td></td>
</tr>
<tr>
<td>• Slope</td>
<td>ASTM D6459</td>
</tr>
<tr>
<td>• Channel</td>
<td>ASTM D6460</td>
</tr>
</tbody>
</table>
Erosion Control Blankets (ECB) (Section 255 & 856)

Straw, coconut, excelsior, or combination used in matrix

Netting used on both sides, one side, or not at all

Slope and channel applications

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Slope Applications</th>
<th>Channel Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Permissible Shear Stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(lbs/ft²)</td>
</tr>
<tr>
<td>Netless</td>
<td>Up to 3H:1V</td>
<td>Up to 1</td>
</tr>
<tr>
<td>Single-net</td>
<td>Up to 2H:1V</td>
<td>Up to 1.5</td>
</tr>
<tr>
<td>Double-net</td>
<td>Up to 1H:1V</td>
<td>1.5 – 2.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Functional Longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra short-term</td>
<td>Up to 3 months</td>
</tr>
<tr>
<td>Short-term</td>
<td>3 to 12 months</td>
</tr>
<tr>
<td>Extended-term</td>
<td>12 to 24 months</td>
</tr>
<tr>
<td>Long-term</td>
<td>24 to 36 months</td>
</tr>
</tbody>
</table>
## Erosion Control Blankets (ECB)

### ECB Type 1
- **Material**: 100% straw
- **Min. Thickness (ASTM D 6525)**: 0.25 inch
- **Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)**: N/A
- **Slope Gradient Application**: ≤ 3H:1V
- **Functional Longevity**: ≤ 3 months

### ECB Type 2
- **Material**: Straw
- **Min. Thickness (ASTM D 6525)**: 0.25 inch
- **Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)**: 1.50 lbs/sf
- **Slope Gradient Application**: ≤ 2H:1V
- **Functional Longevity**: ≤ 12 months

<table>
<thead>
<tr>
<th>Material</th>
<th>ECB Type 1</th>
<th>ECB Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw</td>
<td>100% straw</td>
<td>100% straw</td>
</tr>
<tr>
<td>Wood</td>
<td>100% excelsior fibers</td>
<td>100% excelsior fibers</td>
</tr>
<tr>
<td>Min. Thickness (ASTM D 6525)</td>
<td>0.25 inch</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)</td>
<td>N/A</td>
<td>1.50 lbs/sf</td>
</tr>
<tr>
<td>Slope Gradient Application</td>
<td>≤ 3H:1V</td>
<td>≤ 2H:1V</td>
</tr>
<tr>
<td>Functional Longevity</td>
<td>≤ 3 months</td>
<td>≤ 12 months</td>
</tr>
</tbody>
</table>

---

### ECB Type 3
- **Material**: 70% straw and 30% coconut fibers
- **Min. Thickness (ASTM D 6525)**: 0.25 inch
- **Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)**: 1.75 lbs/sf
- **Slope Gradient Application**: ≤ 1.5H:1V
- **Functional Longevity**: 12 to 24 months

### ECB Type 4
- **Material**: Coconut
- **Min. Thickness (ASTM D 6525)**: 0.25 inch
- **Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)**: 2.00 lbs/sf
- **Slope Gradient Application**: ≤ 1.5H:1V
- **Functional Longevity**: > 24 months

<table>
<thead>
<tr>
<th>Material</th>
<th>ECB Type 3</th>
<th>ECB Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw/Coconut</td>
<td>70% straw and 30% coconut fibers</td>
<td>100% excelsior fibers</td>
</tr>
<tr>
<td>Wood</td>
<td>100% coconut fibers</td>
<td>100% coconut fibers</td>
</tr>
<tr>
<td>Min. Thickness (ASTM D 6525)</td>
<td>0.25 inch</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)</td>
<td>1.75 lbs/sf</td>
<td>2.00 lbs/sf</td>
</tr>
<tr>
<td>Slope Gradient Application</td>
<td>≤ 1.5H:1V</td>
<td>≤ 1.5H:1V</td>
</tr>
<tr>
<td>Functional Longevity</td>
<td>12 to 24 months</td>
<td>&gt; 24 months</td>
</tr>
</tbody>
</table>

Section 856.01 Table 856-01

Section 856.01 Table 856-02
Turf Reinforcement Mats (TRM)

Turf reinforcement mats (TRM) are a type of permanent RECP with non-degradable, synthetic fibers and nettings.

Provides reinforcement for the soil and vegetation.

Usage Areas:
- High shear stress areas (concentrated flows)
- Very steep slopes
- Shorelines
- Pipe inlets and outlets
Module 3: Temporary Erosion & Sediment Control Measures –
NDDOT Erosion & Sediment Control – Construction Course

Turf Reinforcement Mats (TRM)

<table>
<thead>
<tr>
<th>Matrix Fill Material</th>
<th>TRM Type 1</th>
<th>TRM Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood excelsior, coconut or polymer fibers</td>
<td>0.25 inch</td>
<td>0.50 inch</td>
</tr>
<tr>
<td>Min. Thickness (ASTM D 6525)</td>
<td>0.625 lbs/sy</td>
<td>0.625 lbs/sy</td>
</tr>
<tr>
<td>Min. Mass Unit Area (ASTM D 6475 for natural fibers)(ASTM D 6566 for synthetic fibers)</td>
<td>6.0 lbs/sf</td>
<td>8.0 lbs/sf</td>
</tr>
<tr>
<td>Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460 under vegetated conditions)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section 856.02 Table 856-03

Permanent RECPs

TRM Placement Types:

– Topically – directly applied over soil/seed

– Soil filled – typically requires sod or an ECB and seed over the TRM to hold soil in place

– Hydro injected – seed, place TRM, hydro-inject FGM (total coverage)
RECP Construction

Should always consider the edges of RECPs

- Higher erosion potential

General RECP Installation Considerations:

- Site preparation (clods, bridging)
- Stapling
- Trenching in
- Overlapping

RECP Construction

Standard Drawing D-255-2
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**Module 3: Temporary Erosion & Sediment Control Measures – NDDOT Erosion & Sediment Control – Construction Course**

**Standard Drawing D-255-2**

**Module 3: Temporary Erosion & Sediment Control Measures – NDDOT Erosion & Sediment Control – Construction Course**

**Standard Drawing D-255-2**
RECP Construction

Standard Drawing D-255-2

<table>
<thead>
<tr>
<th>DIA</th>
<th>X</th>
<th>Y</th>
<th>Surface area to be protected</th>
<th>ECB</th>
</tr>
</thead>
<tbody>
<tr>
<td>In</td>
<td>Ft</td>
<td>Ft</td>
<td>SF</td>
<td>SV</td>
</tr>
<tr>
<td>15</td>
<td>9.0</td>
<td>20.0</td>
<td>176.0</td>
<td>20</td>
</tr>
<tr>
<td>18</td>
<td>9.5</td>
<td>20.7</td>
<td>190.7</td>
<td>22</td>
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<td>21</td>
<td>9.5</td>
<td>21.0</td>
<td>190.9</td>
<td>22</td>
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<td>24</td>
<td>10.5</td>
<td>21.2</td>
<td>214.1</td>
<td>24</td>
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<tr>
<td>27</td>
<td>11.0</td>
<td>23.0</td>
<td>226.3</td>
<td>25</td>
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<tr>
<td>30</td>
<td>11.6</td>
<td>23.5</td>
<td>241.5</td>
<td>27</td>
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<td>36</td>
<td>12.7</td>
<td>23.3</td>
<td>265.8</td>
<td>30</td>
</tr>
<tr>
<td>42</td>
<td>13.0</td>
<td>23.3</td>
<td>279.0</td>
<td>31</td>
</tr>
<tr>
<td>48</td>
<td>13.8</td>
<td>24.0</td>
<td>295.2</td>
<td>33</td>
</tr>
<tr>
<td>54</td>
<td>14.8</td>
<td>23.4</td>
<td>300.6</td>
<td>34</td>
</tr>
<tr>
<td>60</td>
<td>15.0</td>
<td>23.0</td>
<td>307.5</td>
<td>36</td>
</tr>
<tr>
<td>66</td>
<td>15.6</td>
<td>24.0</td>
<td>335.6</td>
<td>37</td>
</tr>
<tr>
<td>72</td>
<td>16.2</td>
<td>24.5</td>
<td>346.6</td>
<td>38</td>
</tr>
</tbody>
</table>

*Note: Quantities based on 2:1 slope.*
Interceptor Ditches

Interceptor ditches are used to divert run-on safely around the active construction areas

- May be temporary or permanent structures
- Channels and swales may be unlined or use linings depending on length of use
Slope Diversions

Berms can be used to prevent run-on onto the site or down slopes

– Direct flow to a stable channel
– Short-term usage until more permanent conveyance systems are in place

<table>
<thead>
<tr>
<th>Ridge Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side slopes</td>
</tr>
<tr>
<td>Top width</td>
</tr>
<tr>
<td>Freeboard</td>
</tr>
<tr>
<td>Settlement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side slopes</td>
</tr>
<tr>
<td>Grade</td>
</tr>
</tbody>
</table>
Slope Diversions

Temporary slope drains are used to safely convey runoff down the slope.

Slope drain considerations:
– Drainage area
– Type and size of drains
– Drain location
– Inlet type
– Outlet protection
Slope Diversions

- Hold-down Stakes
- Diagonally Spaced Dike
- 3:1 Gradient
- Inlet Over Pipeline
- Inlet (Optional T-section)
- Plastic Corrugated Pipe
- 4 ft. Min. Level Section
- Stabilized Outlet
- 10 ft. Spacing
Temporary Seeding

Short-term establishment of vegetation to protect exposed areas
– Can be used with permanent seeding

Site considerations:
– Time of planting
– Soils

Oats, rye, and winter wheat application rate is 64 lbs. of pure live seed per acre (Section 251.03 E.)

Dust Control (Sections 107.07 E. and 216)

Phasing and physical controls are the best way to prevent wind erosion
– Vegetation
– Mulches/blankets

Other methods:
– Water
– Barriers
– Chemical applications (emulsions, tackifiers)
Slope Breaks

Fiber rolls used to shorten a slope and prevent rill erosion

– Slows sediment-laden water and filters sediment in low-flow areas

May be used with or without RECPs

---

**Slope Breaks**

Recommended spacing of fiber rolls on slopes (ft):

<table>
<thead>
<tr>
<th>Fiber Roll Nominal Diameter</th>
<th>6”</th>
<th>9”</th>
<th>12”</th>
<th>20”</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤4H:1V</td>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>3H:1V</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>2H:1V</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>1H:1V</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Sediment retention fiber roll (SRFR) general usage and installation guidelines, Erosion Control Technology Council (ECTC), 2011
Module 3: Temporary Erosion & Sediment Control Measures –
NDDOT Erosion & Sediment Control – Construction Course

Standard Drawing D-261-1

For stake installations see staking detail

Stagger joints between rows of fiber rolls

For staking of overlap see Detail C

Stake at each end and 4' max, O.C., along centerline length

For stake installation see staking detail

PLAN VIEW FOR SLOPE APPLICATION
Flotation Silt Curtain (Section 262)

Geotextiles with floats and an anchorage system to prevent significant sediment from reaching watercourse

Available in different lengths and depths to match conditions

Should avoid placing completely across high flow channels or ditches
Flotation Silt Curtain (Section 262)

Flotation Silt Curtain - Type Work Area

Plan View

FLOTATION SILT CURTAIN - TYPE WORK AREA

For containing overflows from weirs, standpipes, settling ponds

Design Guidelines:
- When temporary fill approaches less than 1/4 of the width of stream.
- Maximum Water Velocity: 5 ft/sec.
- Maximum Water Depth: 11 ft.
Flotation Silt Curtain (Section 262)

Checks

Barriers built to dam water across concentrated flow

– Provides both erosion and sediment control

Can be made of rock or tubes filled with straw, excelsior, or other materials

Should consider drainage area, depth of flow, and water velocity
Rock Ditch Checks

Construction considerations:
- Spacing between checks
- Minimum 18 inches in height
- Center of rock ditch check should be lower than the ends (spillway)
- Back end of check should be protected to prevent erosion
- Remove sediment when it has reached ½ the height of the check
Fiber Roll Ditch Checks (Section 261)
May be filled with straw or wood excelsior
Available in multiple tube diameters
– 6 inch to 20 inch
Placed on ECBs or bare soil
– Must be trenched in on bare soil (2 to 3 inches)
Stake spacing should not exceed 4 feet

Spacing of fiber rolls in a channel:

\[ Spacing = \frac{D_{FR} - TD}{S_{Channel}} \]

Where:
\( D_{FR} \) = nominal diameter of fiber roll (ft)
\( TD \) = trench depth (ft)
\( S_{Channel} \) = slope of channel (ft/ft)
Fiber Roll Ditch Checks

Spacing of fiber rolls in a channel (Example):
20” roll trenched in 3” in a 4% (0.04 ft/ft) slope

\[
Spacing = \frac{20/12 - 3/12}{0.04}
\]

\[
Spacing \approx 35 \text{ ft between rolls}
\]
Ditch Checks

Inspect checks after significant rainfall events

Should watch for erosion at the ends of the check, downstream toe, and undercutting

Good Housekeeping

Waste management

Sanitary waste management (portable toilets)

Petroleum/chemical/hazardous waste management

Concrete washout
Good Housekeeping
Dewatering/Pumping

Dewatering on a construction site is a common practice

– Remove water from excavated areas

– Provide storage room in a sediment trap or basin before a rain event

For projects that require dewatering or pumping, sediment laden water cannot be pumped directly into surface waters
Dewatering/Pumping

Water treatment options:
– Sediment basins and traps
– Filtration
– Flocculants
– Weir tanks

Dewatering/Pumping

General Guidance:
– Draw water from top of water column for improved efficiency
– Know pump rates and filtration rates
– Knowledge of particle size within sediment laden water
– Stabilization of discharge
Vegetation (Seeding) (Section 251)

Permanent vegetation provides excellent erosion and sediment control benefits

– Should aim to establish permanent vegetation as quickly as possible

Temporary cover crop may be used to help perennial vegetation growth

### Seed Class Mix Requirements

<table>
<thead>
<tr>
<th>Grass Species</th>
<th>Variety</th>
<th>Pounds Pure Live Seed per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td>Park</td>
<td>4.0</td>
</tr>
<tr>
<td>Perennial Rye grass</td>
<td>--</td>
<td>5.4</td>
</tr>
<tr>
<td>Blue Gamma</td>
<td>Bad River</td>
<td>2.4</td>
</tr>
<tr>
<td>Sideoats Grama1</td>
<td>Killdeer, Pierre, Butte</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>19.0</strong></td>
</tr>
</tbody>
</table>

1Substitute Thickspike or Stream bank Wheatgrass of the Critana, Banstock, Sodar, AC Polar, or Elbee variety if Sideoats Grama is unavailable.

Section 251.03 D. Table 251-01
### Seed Class Mix Requirements

<table>
<thead>
<tr>
<th>Grass Species</th>
<th>Variety</th>
<th>Pounds Pure Live Seed per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class II – Early Season</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td>Rodan, Rosana, Walsh, Flintlock, W. R. Poole, Recovery</td>
<td>9.6</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>Dacotah, Forestburg, or Sunburst, Summer</td>
<td>3.2</td>
</tr>
<tr>
<td>Green Needlegrass</td>
<td>Lodorm, AC Mallard, Fowler</td>
<td>2.4</td>
</tr>
<tr>
<td>Sideoats Grama&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Killdeer, Pierre, Butte</td>
<td>3.6</td>
</tr>
<tr>
<td>Slender Wheatgrass</td>
<td>Revenue, Primar, Adanac, Pryor, Firstrike</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>23.8</strong></td>
</tr>
<tr>
<td><strong>Class II – Late Season</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td>Rodan, Rosana, Walsh, Flintlock, W. R. Poole, Recovery</td>
<td>9.6</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>Dacotah, Forestburg, or Sunburst, Summer</td>
<td>1.6</td>
</tr>
<tr>
<td>Green Needlegrass</td>
<td>Lodorm, AC Mallard, Fowler</td>
<td>3.6</td>
</tr>
<tr>
<td>Canada Wild-rye</td>
<td>Mandan</td>
<td>5.2</td>
</tr>
<tr>
<td>Slender Wheatgrass</td>
<td>Revenue, Primar, Adanac, Pryor, Firstrike</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>25.0</strong></td>
</tr>
</tbody>
</table>

<sup>1</sup>Substitute Thickspike or Stream bank Wheatgrass of the Critana, Banstock, Sodar, AC Polar, or Elbee variety if Sideoats Grama is unavailable.

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### Vegetation

#### Wetland Seed Mix

<table>
<thead>
<tr>
<th>Grass</th>
<th>Common Name</th>
<th>Variety</th>
<th>Pounds Pure Live Seed per Acre</th>
<th>East of HWY 83</th>
<th>West of HWY 83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fox Sedge</td>
<td>Common</td>
<td></td>
<td></td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>American Manna Grass&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Common</td>
<td></td>
<td></td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Fowl Manna Grass&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Common</td>
<td></td>
<td></td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Bluejoint Grass&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Common</td>
<td></td>
<td></td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Virginia Wild-rye</td>
<td>Omaha</td>
<td></td>
<td></td>
<td>2.0</td>
<td>---</td>
</tr>
<tr>
<td>Canada Wild-rye</td>
<td>Mandan</td>
<td></td>
<td></td>
<td>---</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>4.4</strong></td>
<td><strong>3.4</strong></td>
</tr>
</tbody>
</table>

<sup>1</sup>American, Fowl, or may be used. If only one is used the seeding rate of other species does not need to be increased.

<sup>2</sup>Seed may not be available and can be removed without increasing the seeding rate of other species.
### Vegetation

<table>
<thead>
<tr>
<th>Seeding Type</th>
<th>Seeding Dates</th>
<th>Before April 20</th>
<th>April 20 to July 15</th>
<th>July 16 to August 9</th>
<th>August 10 to ground freeze</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Class II – Early Season mixture</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class II – Late Season mixture</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Temporary cover crop</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Section 251.04 C.**

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### Vegetation

Sodding provides immediate erosion control

Must select grass variety for region and intended use and maintenance

Must consider irrigation while sod is establishing
Outlet Protection

Riprap aprons and hard armor are common methods of reducing the impact of water exiting an outlet.

Other Options:
– Energy dissipators
– Transition mats
Outlet Protection
Outlet Protection

Vegetative Buffer Strips

Vegetative buffer strips are used to slow down runoff and intercept sediment.

Must have a minimum width of 1 foot for every 5 feet of disturbed area which drains to the buffer.

Buffer strip should be uniform and have a slope less than 5%.

Area draining to the buffer should have a slope of 6% or less.
Level Spreaders

Level spreaders convert concentrated flows to sheet flow

Typically used with vegetative buffer strips to safely release flow
Module 3: Temporary Erosion & Sediment Control Measures – NDDOT Erosion & Sediment Control – Construction Course

Level Spreaders

- Level spreader lip
- Footing (if necessary)
- Reinforced channel
- Clean stone
- Undisturbed soil and vegetation

Stabilization Measures

Banks of streams and channels may need remediation or extra protection against increased flows

- Soil bioengineering techniques are becoming increasingly popular for their effectiveness and aesthetics
Stabilization Measures

Structural stabilization:
- Riprap
- Gabions
- Precast elements

Geotextiles:
- TRM
- Geogrids
- Cellular confinement systems
Module 3: Temporary Erosion & Sediment Control Measures – NDDOT Erosion & Sediment Control – Construction Course

Stormwater Management

Bioswales/bioretention
Underground storage
Infiltration basins
Grit chambers

What are the module’s takeaway points?
Difference between temporary and permanent ESCMs
Temporary Erosion Control Measures:
– Mulches/HECP
– Temporary RECPs
– Ditch checks
– Interceptor ditches and slope diversions
– Slope breaks
– Temporary seeding
– Dust control
What are the module’s takeaway points?

Temporary Sediment Control Measures:
- Silt fence
- Inlet protection
- Sediment traps
- Silt curtain/turbidity barrier
- Good housekeeping

Phasing and operational measures
Dewatering/pumping operations

What are the module’s takeaway points?

Definition of permanent erosion and sediment controls

Permanent Erosion and Sediment Controls:
- Vegetation
- TRMs
- Outlet protection
- Level spreaders
- Stabilization measures
Questions?