2014 Soil Erosion Control Standards
Summary and Overview of Revisions

New Jersey Department of Agriculture
February 2014
Vegetative Standards Overview
• Added dredged sediment as a source of exposed Acid Soil in: Definition
• Expanded description of Acid Soil in: Purpose
• Added two counties to the list of: Where Applicable
• Added the limestone layer rate of 10 tons/acre under the cap: Methods and Materials
Dune Stabilization

- Removed Rugosa Rose
  \((Rosa \ rugosa)\)

- Removed Japanese Black Pine
  \((Pinus \ thunbergii)\)
Permanent Vegetation for Soil Stabilization

• Invasive species were removed from seed mixtures & were reconciled with New Jersey Department of Environmental Protection requirements

• Seed mixtures were revised along with seeding rates, optimal/acceptable planting dates, and fertilizer and lime requirements to be consistent with Rutgers recommendations

• A note regarding acceptable seed testing dates was incorporated

• Emulsified asphalt was removed as an acceptable option to bring the Standard up to date with current science.
Permanent Vegetative Stabilization Standard-
(new) Pinelands National Reserve Specifications

4-14 – “Where the intended land use permits or requires
native plant re-growth, natural re-colonization by native
plants is preferable.”

These practices are limited to areas of relatively flat terrain
which do not experience concentrated surface runoff

natural re-colonization = allow existing seedbed to grow
(do not seed)
Permanent Vegetation for Soil Stabilization

• Specific methods for alternative natural regeneration were established within the Pinelands National Reserve in areas of non-stormwater concentrated flows (roadbanks, site peripheral areas, etc.)

• Preferred Pinelands seed mixtures were provided, as well as reduced lime/fertilizer rates for natural regeneration areas

• A procedural flow chart was added for builders wishing to propose natural regeneration area(s)
Pinelands National Reserve
Natural Regeneration Process

Satisfactory Establishment or Supplementary Planting/seeding

Monitor growth
Re-apply mulch (if needed)

Mulch (Straw/Bark)

Seedbed Preparation

Spread Native A-Horizon layer

Post Bond pursuant to an Engineer’s (PE) estimate

Temporary Stabilization Where Permanent Native Vegetation is encouraged

Re-establishment of Native Vegetation Without Seeding

Re-seeding with Pinelands Approved Seed Mixtures

Mulch Pursuant to mulch Standard

Seed with Preferred Mixture See Table 4-4

Seedbed Preparation

Spread Native A-Horizon layer

Permanent Stabilization with Pinelands approved seed mixtures. (Table 4.4)
Standard for Stabilization with Mulch

- Removed Emulsified Asphalt from: *Methods and Materials*
Standard for Permanent Stabilization with Sod

• Added a Kentucky bluegrass-Turf-Type Tall fescue sod as a recommendation for dry sites. (MM # 5)

• Added the incorporation of organic matter to: Site Preparation, #1A

• Brought fertilizer application rates and recommendations to current science: Soil Preparation #2A
Temporary Vegetative Cover for Soil Stabilization

- Emulsified asphalt was removed as an acceptable option to bring the Standard up to date with current science

- Invasive species (weeping lovegrass) have been removed from seed mixtures

- Seed mixtures have been reconciled with New Jersey Department of Environmental Protection requirements
Temporary Vegetative Cover for Soil Stabilization

- Seed mixtures, seeding rates, optimal/acceptable planting dates, as well as fertilizer and lime requirements have been revised to be consistent with Rutgers recommendations including a note regarding acceptable seed testing dates.

- Annual ryegrass has been added as an alternative seed mixture under specified conditions.
Standard for Top-soiling

- This Standard is currently under revision for future release to address requirements for soil quality and restoration. As of February 2014, the 1999 version of the Topsoiling Standard is in effect.
Standard for Tree Protection During Construction

- Brought up to current science, added (protected root zone, PRZ)

- Inserted Figure 9-3 with PRZ calculation
Standard for Tree Protection During Construction

- Added current science tables on potential construction impacts to tree genus/species

Table 9-1

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>ROOT SEVERENCE</th>
<th>SOIL COMPACTION &amp; FLOODING</th>
<th>SOIL pH PREFERENCE</th>
<th>MATURE TREE HEIGHT (feet)</th>
<th>MATURE CROWN SPRED (feet)</th>
<th>HAZARD TREE RATING*</th>
<th>DAMAGE CAUSING ROOTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>American elm</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>5.5-8.0</td>
<td>70-100</td>
<td>100-150</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Slippery elm</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>6.6-8.0</td>
<td>60-70</td>
<td>40-60</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Hackberry</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>6.0-8.0</td>
<td>30-130</td>
<td>50+</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Hawthorn</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>6.0-7.5</td>
<td>20-40</td>
<td>20-30</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Blackjack</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>6.0-6.5</td>
<td>40-75</td>
<td>30+</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>Ironwood</td>
<td>Sensitive</td>
<td>Sensitive</td>
<td>6.1-8.0</td>
<td>25-50</td>
<td>20-30</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Basswood</td>
<td>Intermediate</td>
<td>Sensitive</td>
<td>5.5-7.3</td>
<td>70-100</td>
<td>50-75</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>Black locust</td>
<td>Tolerant</td>
<td>Sensitive</td>
<td>4.6-8.2</td>
<td>30-60</td>
<td>20-50</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>Red maple</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>4.5-7.5</td>
<td>50-70</td>
<td>40-60</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Silver maple</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>5.5-6.5</td>
<td>60-90</td>
<td>75-100</td>
<td>High</td>
<td>Yes</td>
</tr>
<tr>
<td>Sugar maple</td>
<td>Intermediate</td>
<td>Sensitive</td>
<td>5.5-7.3</td>
<td>60-80</td>
<td>60-80</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Mountain-ash</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>4.0-7.0</td>
<td>15-25</td>
<td>15-25</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>Black oak</td>
<td>Sensitive</td>
<td>Sensitive</td>
<td>6.0-6.5</td>
<td>50-80</td>
<td>50-70</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>But oak</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>4.0-8.0</td>
<td>70-80</td>
<td>40-80</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Pin oak</td>
<td>Sensitive</td>
<td>Sensitive</td>
<td>5.5-7.5</td>
<td>50-75</td>
<td>30-50</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>Red oak</td>
<td>Tolerant</td>
<td>Sensitive</td>
<td>5.5-7.5</td>
<td>50-75</td>
<td>30-50</td>
<td>Medium</td>
<td>No</td>
</tr>
<tr>
<td>Swamp white oak</td>
<td>Tolerant</td>
<td>Intermediate</td>
<td>6.0-6.5</td>
<td>60-70</td>
<td>40-50</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>White oak</td>
<td>Sensitive</td>
<td>Sensitive</td>
<td>6.5-7.5</td>
<td>60-100</td>
<td>50-90</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Plum</td>
<td>Tolerant</td>
<td>Sensitive</td>
<td>6.5-6.0</td>
<td>20-25</td>
<td>15-25</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Serviceberry</td>
<td>Intermediate</td>
<td>Sensitive</td>
<td>6.5-6.0</td>
<td>20-25</td>
<td>15-25</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Black walnut</td>
<td>Sensitive</td>
<td>Intermediate</td>
<td>6.6-8.0</td>
<td>70-100</td>
<td>60-100</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>Black willow</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>6.5-8.0</td>
<td>30-60</td>
<td>20-40</td>
<td>High</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Hazard tree rating: refers to the relative potential for a tree to become hazardous. For a tree to be considered hazardous, a potential "target" e.g., a house, a sidewalk, pedestrians must be present. A high hazard tree rating does not imply that the tree will always fail.

Standard for Trees and Vines

- Removed any invasive species
- Included - current science tree planting detail. 

*Figure 10-1*
Engineering Standards Overview
Stream Restoration Guidelines

- Mimic natural conditions
- Soil Bioengineering for low risk areas
- Assess cause of degradation
- Avoid alignment changes
- Avoid treatments in channels undergoing rapid changes in geometry
- Use Toe Protection
Detention Structures

• Combined Detention Basins, Rooftop, Parking Lot and Underground Storage since they all do the same thing.
• Clarified the use of infiltration:
  – Ok to use for offsite where reductions are proposed (low risk of failure)
  – Must still examine failure for point discharge stability
• Added restrictions for discharging to Ag fields
• Revised Detention Basin Summary Form to include information on Best Management Practices for water quality which may be used (on behalf of NJDEP). New form can be downloaded here: http://www.nj.gov/agriculture/divisions/anr/nrc/njerosion.html
Grass Waterway

Added two additional levels of velocity increase with two new levels of TRM rating from Texas DOT Labs

<table>
<thead>
<tr>
<th>“Class 2” Flexible Channel Liner Designation</th>
<th>Allowable Shear Stress (psf)</th>
<th>Incremental increase in velocity (fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type &quot;E&quot;</td>
<td>0 to 2</td>
<td>1.0</td>
</tr>
<tr>
<td>Type &quot;F&quot;</td>
<td>0 to 4</td>
<td>1.5</td>
</tr>
<tr>
<td>Type &quot;G&quot;</td>
<td>0 to 6</td>
<td>2.0</td>
</tr>
<tr>
<td>Type &quot;H&quot;</td>
<td>0 to 8</td>
<td>3.0</td>
</tr>
<tr>
<td>Type “I”</td>
<td>0 to 10</td>
<td>4.0</td>
</tr>
<tr>
<td>Type “J”</td>
<td>0 to 12</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Offsite Stability

- Reorganized text to ‘flow’ more logically
- Added criteria for infiltration:
  - Ok to use for reductions (redundancy)
  - Not ok for point discharge stability (different criteria)
- Not intended to assess discharging to Ag fields; don’t use it for this condition
- Added option to use multiple outlets (for point discharge stability peak flow)
- Removed velocity from Table 21-1 since the primary criteria are slope, soils and veg

Point of Discharge Stability Analysis

When infiltration practices are proposed, an alternate analysis (failure analysis) must be provided which ignores infiltration (no dead storage volume available, no static or dynamic infiltration loss rates in the routing calculations, etc) and demonstrates that no erosion will occur at the point of discharge if infiltration fails to function. Flow rates based solely upon basin inlet and outlet hydraulics must be used in comparison to table 21-1 (below) to document a stable outlet.

Downstream (off-site) Stability Analysis.

Infiltration may be used to meet peak flow reduction requirements (outlined below) for the purposes of documenting stability of the downstream receiving channel, provided that the complete loss of infiltration function does not result in an increase in peak flow values above the predevelopment levels.
Figure 21-1
Offsite Stability Flow Chart

1. Point Discharge Stability
   - Defined Waterway?
     - Yes
       - Retain Predeveloped
       - Is channel stable under design conditions?
         - Yes
           - Retain Predeveloped
         - No
           - Modify channel to stable condition
     - No
       - Retain Predeveloped
       - Table 21-1 Apply?
         - Yes
           - Conduct convergence analysis
         - No
           - Continue downstream analysis

2. Downstream Stability
   - Use new or existing unaltered model to assess downstream channel stability
   - Reduce peak flows to 50% and 15% of predeveloped peak rates for 2 and 10 yr return periods.
Offsite Stability- Table 21-1

Table 21-1  Non-Erosive Conditions for Point Discharges

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Perennial, Natural Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Slope (%)</td>
</tr>
<tr>
<td>Sands</td>
<td>1.8</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>2.0</td>
</tr>
<tr>
<td>Silt loam, loam</td>
<td>2.5</td>
</tr>
<tr>
<td>Sandy clay loam</td>
<td>3.5</td>
</tr>
<tr>
<td>Clay loam</td>
<td>5.0</td>
</tr>
<tr>
<td>Graded loam to gravel</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Stability Criteria (in conjunction with table 21-1)

i. The maximum discharge rate shall be 10 cfs or less for the twenty-five (25) year storm.

ii. Multiple outlets may be utilized to reduce individual outlet flow rates to levels below the thresholds noted above. Outlets should be spaced no closer than 50 ft horizontally to avoid re-mixing of flows.

iii. Flow over the outlet area shall be less than 0.5 cfs/ft. Designers shall not design excessive widths which will cause flows to concentrate.

iv. Conduit outlet protection shall be provided in accordance with that Standard and may include: flat aprons, preformed scour holes, impact basins, stilling wells, plunge pools, etc. **Level spreaders are not an acceptable design**
Rip Rap

Added cross-reference to Soil Bioengineering:

Chpt. 16 of the NRCS EFH

Ishbash Curve or Lane’s Method for sizing rip rap (used with veg)
Steeper than 2H:1V using Curve 22-6

Larger stone stacked 0.5h : 1 v (evaluate bank and bed conditions)
Ishbash Curve

Note specific stone density

Enter here with v

Read this as D50
Lane’s Method of sizing Rip Rap

Lane's Method is included in the NRCS Engineering Field Handbook, Chapter 16 for Streambank and Shoreline Protection...

This chapter is referenced by NJDEP for stream work. Lane's Method is more of a tractive stress based approach condensed to one Figure. Note, it solves for D75 Not D50. Results are usually fairly consistent with Isbash and other procedures.
Figure 16A-2  Rock size based on Far West States (FWS)-Lane method

\[ D_{50} = \frac{D_{75}}{1.25} \]

Notes:
1. Ratio of channel bottom width to depth (T) greater than 4.
2. Specific gravity of rock not less than 2.56.
3. Additional requirements for stable riprap include fairly well graded rock, stable foundation, and minimum section thickness (normal to slope) not less than \( D_s \) at maximum water surface elevation and 3 \( D_s \) at the base.
4. Where a filter blanket is used, design filter material grading in accordance with criteria in NRCS Soil Mechanics Note 1.

<table>
<thead>
<tr>
<th>( R_c/W_s )</th>
<th>C</th>
<th>Slide slope</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
<td>0.5</td>
<td>1 1/2:1</td>
<td>.82</td>
</tr>
<tr>
<td>6-9</td>
<td>0.75</td>
<td>1 3/4:1</td>
<td>.63</td>
</tr>
<tr>
<td>9-12</td>
<td>0.90</td>
<td>2:1</td>
<td>.72</td>
</tr>
<tr>
<td>straight channel</td>
<td>1.0</td>
<td>2 1/2:1</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3:1</td>
<td>.87</td>
</tr>
</tbody>
</table>

\( R_c \) = Curve radius
\( W_s \) = Water surface width
\( S \) = Energy slope or channel grade
\( w = 62.4 \)

**Procedure**
1. Determine the average channel grade or energy slope.
2. Enter fig. 16A-2 with energy slope, flow depth, and site physical characteristics to determine basic rock size.
3. Basic rock size is the \( D_{75} \) size.
Sediment Barrier – “Super Siltfence”

Dig 6 in deep trench, bury bottom flap, tamp in place

Fence Post - 8 ft on centers

Fabric secured to post with metal fasteners and reinforcement between fastener and fabric

Silt Accumulation

Optional wire fence behind fabric for “Super” silt fence

Drawstring running through fabric along top of fence

Not to be used
In lieu of a properly designed diversion!
Sediment Basins

Added references to floating risers or “skimmers” – now being required by EPA in the Stormwater Permit

Added references to dosing with flocculants – PAM with a source of Calcium ions to help in binding PAM to colloids

Reorganized text for clarity
Slope Protection

Added simple method to calculate stone size for channels on slopes steeper than 10% (i.e., Rock chutes down basin slopes)

For channel slopes between 2% and 10%:

\[ D_{50} = \left[ q \left( \frac{S}{10} \right)^{1.5} / 4.75(10)^{-3} \right]^{1/1.89} \]

Where:
- \( D_{50} \) = Particle (stone) size for which 50% of the sample is finer, in.
- \( S \) = Bed slope, ft./ft.
- \( z \) = Flow depth, ft. – note, \( z \) is depth, not side slope!
- \( q \) = Unit discharge, ft\(^3\)/s/ft
  (Total discharge \( \div \) Bottom width)

For channel slopes between 10% and 40%:

\[ D_{50} = \left[ q \left( \frac{S}{10} \right)^{0.58} / 3.93(10)^{-2} \right]^{1/1.89} \]
\[ z = \left[ \frac{n(q)}{1.486(S)^{0.50}} \right]^{3/5} \]
\[ n = 0.047(D_{50}S)^{0.147} \]

Maximum Side Slope is 2:1 for this method
Slope Protection Continued

Added guidance for draining **unconcentrated** runoff down a slope (i.e., runoff from a parking lot down into a swale or basin)

Reference to NJDEP BMP Manual for Vegetative Filter Strips (used to be NJDA Erosion Control Standard)

Maximum Slopes:

<table>
<thead>
<tr>
<th>Soil type</th>
<th>Maximum Slope (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>7</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>8</td>
</tr>
<tr>
<td>Loam, Silt Loam</td>
<td>8</td>
</tr>
<tr>
<td>Sandy Clay Loam</td>
<td>8</td>
</tr>
<tr>
<td>Clay Loam, Silty Clay, Clay</td>
<td>8</td>
</tr>
</tbody>
</table>

8% slope = 12.5 : 1, or 4.6 degrees.
Soil Bioengineering

Added the following charts for design guidance:

Figure 26-1 – Simplified Channel Evolution Model

<table>
<thead>
<tr>
<th>Channel Boundary Condition</th>
<th>Design Consideration Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant sediment load and moveable channel boundaries</td>
<td>Alluvial channel design techniques</td>
</tr>
<tr>
<td>Boundary material smaller than sand size</td>
<td>Allowable Velocity</td>
</tr>
<tr>
<td>Boundary material larger than sand size</td>
<td>Allowable shear stress</td>
</tr>
<tr>
<td>Boundary material does not act as discrete particles</td>
<td>Tractive Power</td>
</tr>
<tr>
<td>No base flow in channel. Climate can support permanent vegetation</td>
<td>Grass lined (retardance) / tractive stress</td>
</tr>
</tbody>
</table>
Stabilized Construction Access

WAS:

Where the slope of the access road exceeds 5%, a stabilized base course of fine aggregate bituminous concrete (FABC) shall be installed. The type and thickness of the FABC and use of a dense graded aggregate sub-base shall be as prescribed by local municipal ordinance or other governing authority.

IS:

Where the slope of the access road exceeds 5%, a stabilized base of Hot Mix Asphalt Base Course, Mix I-2 shall be installed. The type and thickness of the base course and use of a dense graded aggregate sub-base shall be as prescribed by local municipal ordinance or other governing authority.

**Note:**

The use of fine aggregate bituminous concrete (FABC) and hot mix asphalt base course, Mix I-2, are specified here as examples. The actual materials and specifications should be determined by local municipal ordinance or other governing authority.
Stream Crossing

Added guidance for permanent culvert crossing

Three (3) areas of concern should be must be considered for natural stream bed or three (3) sided “bottomless culvert” designs:

1. The corners and abutments of the Inlet section of the culvert
2. The barrel section of the culvert
3. The outlet or discharge section of the culvert

The Corners and Abutments of the Inlet Section of the Culvert –

Avoid contraction and scour at the inlet or provide protection.

The Barrel Section of the Culvert –

Erodability of the channel bed/bottom must be evaluated when designing open-bottom culverts. High velocities may require anti-scour measures

The Outlet Section or the Discharge end of the Culvert –

COP Standard may be required if the conduit contracts and/or causes higher velocities
Questions and inquiries may be made to:

John Showler, P.E.
State Erosion Control Engineer
NJ Department of Agriculture
PO Box 330
Trenton, NJ 08625
john.showler@ag.state.nj.us
main: 609.292.5540
cell: 609.775.8203

2014 Standards and forms may be downloaded from:

http://www.nj.gov/agriculture/divisions/anr/nrc/njerosion.html