Erosion Control Plans

► Considered Temporary Construction Plans

► PE Seal not Required or Recommended

► Level III/IIIA Certification Name & No. required on all NCDOT Erosion Control Plans
  ▪ EC Title Sheet Only
Reasons to **Not** Seal EC Plans

- Temporary, not Permanent
- Revisions would require new sealed plan sheet
- Sediment Law/Land Quality does not require
- Sediment Law is performance-based

Perimeter Devices

- Temporary Silt Fence (TSF)
- Special Sediment Control Fence (SSCF)
- Wattle Barrier (EW, CFW)
- Temporary Silt Ditch
- Earthen Berm - for this application
Temporary Silt Fence

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement – Along stream banks and at the toe of fill slopes

Function - Silt Fence temporarily traps sheet flow from disturbed slopes allowing sediment to settle on the flow side

Silt Fence Tips

► Commonly Overused in EC design!

► Placement Locations on EC Plans:
  - Toe of Bridge Approach Fill Slopes
  - Toe of Fill Slopes in Wetlands
  - Toe of Fill Slopes in Urban Areas
  - Above Culvert Inlets and Outlets, esp. on Final Grade Phase
  - Perimeter of Streams and Fill Slopes inside Riparian Buffers
Silt Fence Guidelines

► Drainage Area is not greater than ¼ acre per 100 ft. of silt fence – Rule of Thumb!

► Maximum Slope Length behind Silt Fence

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<th>Slope</th>
<th>Slope Length (ft)</th>
<th>Maximum Area (ft²)</th>
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<td>2 to 5%</td>
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Table 6.62a, Erosion and Sediment Control Planning and Design Manual NCDENR

Silt Fence Drainage Breaks

► Special Sediment Control Fence

► Excelsior Wattle

► Coir Fiber Wattle
Special Sediment Control Fence

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement – Short Sections between Silt Fence unless longer sections required

Function - Special Sediment Control Fence provides a drainage break for Silt Fence Sections in Low Areas

SSCF Tips

► Commonly Overused in EC design!

► Can be used in wetlands, but difficult to remove

► Placement Locations on EC Plans:
  ▪ Drainage Breaks in Silt Fence (Max. Spacing of 200 ft.)
  ▪ Adjacent to Stream Relocations
  ▪ Some Permit Conditions require Special Sediment Control Fence at Toe of Bridge Approach Fills parallel to stream
Silt Fence Wattle Breaks

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement – Between Long Segments of Silt Fence

Function – Wattle provides a drainage break for Silt Fence Sections and in Low Areas

Wattle Break Tips

► Design for Wattle of 10 ft. in length

► Can be used in wetlands, easy to remove (or not!)

► Maximum Spacing of 200 ft.

► Use Coir Fiber Wattles (CFW) for projects > 1 year
  ▪ Environmentally Sensitive Areas (Trout, 303(d), etc.)
Wattle Barrier

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement - At the toe of bridge approach fill slopes and along slopes

Function - Wattle Barrier temporarily traps sheet flow from disturbed slopes allowing sediment to settle on the flow side

Wattle Barrier Tips

► Utilize where Silt Fence can’t be installed

► Can be used in wetlands, easy to remove (or not!)

► Maximum Spacing of 20 ft. for breaks on slopes

► Use Coir Fiber Wattles (CFW) for projects > 1 year
  ▪ Environmentally Sensitive Areas (Trout, 303(d), etc.)
Wattle Barrier Update

► Utilize where vertical clearance between ground and bottom of bridge is less than 4 ft.

► Increased Minimum Diameter from 12” to 18”

► Deepened Trench from 1” to 2” to 2” to 3”

► Pay Item – Wattle Barrier, Coir Fiber Wattle Barrier

Temporary Silt Ditch

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement - Toe of fill slopes

Function - TSD directs sheet flow from fill slopes into sediment traps and basins
TSD Tips

► Extend TSD to inflow side of sediment basins without leaving any gaps

► Place velocity checks (either a Rock Silt Check or Wattle) with TSD

► Do not place inside slope stake lines in the footprint of the project!

Earth Berm

Design - Utilized on Clearing & Grubbing and Final Grade Phases of Erosion Control Plans

Placement - Toe of fill slopes

Function – Provides sediment storage for large fill slopes where sediment basins are not feasible
Earth Berm Tips

► Consider for:
  - Fill Slopes > 20 ft. in height measured along slope
  - Fill Slopes > 2 acres in area

► Place Stone Drainage Breaks, DA < 1 acre
  - Temporary Rock Silt Check Type A
  - Temporary Sediment Dam Type A

► Place Geotextile Spillways, DA > 1 acre

Temporary Earth Berm Detail

TEMPOrary Earth berm

(Not to Scale)

D = 2 ft.
B = 1 ft.

*STABILIZE Earth berm*
Earth Berm at Toe of Fill Slope

Runoff Diversion Devices

- Temporary Diversion (TD)
- Temporary Earth Berm
- Clean Water Diversion (CWD)
- Temporary Berms and Slope Drains
Temporary Diversion

Design - Utilized on Clearing & Grubbing Phase of Erosion Control Plans

Placement - Outside proposed cuts and across graded areas to reduce slope length

Function - TD diverts sheet flow from exposed slopes into rock dams, sediment traps and basins; used to reduce the size of drainage areas

Temporary Diversion Tips

► Place in small proposed ditches on Clearing & Grubbing phase so that ditch can be built early

► Place velocity checks (either a Rock Silt Check or Wattle) with TD

► Utilize TD to divert runoff inside footprint of project to perimeter sediment basins (Cuts)

► Can be used in Buffer Zones in proposed permitted ditches
Temporary Earth Berm

Design - Utilized on Clearing & Grubbing and Final Grade Phases of EC Plans

Placement - Outside cuts and fills and parallel to the ROW; across graded areas to reduce slope length (Fills)

Function - Earth Berms divert offsite runoff to minimize the runoff flowing to erosion control devices; used to reduce the size of drainage areas

Earth Berm Tips

► Include Earth Berm Detail on plan sheets where utilized

► Place velocity checks (either a Rock Silt Check or Wattle) with Earth Berms

► Place Earth Berms inside footprint of fill slopes to divert runoff to sediment basins
Clean Water Diversion

Design - Utilized on Clearing & Grubbing and Final Grade Phases of EC Plans

Placement - Outside cuts and fills and parallel to the ROW

Function – Clean Water Diversions divert offsite runoff to minimize the runoff flowing to erosion control devices; used to reduce the size of drainage areas

Clean Water Diversion Tips

► Include Clean Water Diversion Detail on plan sheets where utilized

► Place Type B Silt Checks for velocity control with CWD’s every 2 ft. of elevation change

► Place Type A Silt Checks at outlets

► Do not show wattles in Diversions
Clean Water Diversion Detail

Temporary Slope Drains

Design - Utilized on Clearing & Grubbing and Final Grade Phases of EC Plans

Placement – On large cuts and fills

Function – Convey concentrated runoff to bottom of slopes in a non-erosive manner
Slope Drains

► Utilize on fill slopes with 3:1 grade or steeper and fill slope height of:
  - 8 ft. and higher in Piedmont & Mountains
  - 5 ft. and higher in Sand Hills & Coastal Plain

► Don’t need on fills with 4:1 or flatter slope

► Make sure slope drain outlets to a basin, trap, check dam or stone energy dissipater

► Use maximum spacing of 200 ft.

Slope Drains on EC Plans
NCG-01 Construction Permit

► Effective August 3, 2011
► Outlet devices must withdraw from basin surface unless drainage area is < 1 acre
► Ground Stabilization Time Frames of 7 or 14 days

Surface Dewatering Devices

► Skimmer Devices
► Infiltration Basins
► Silt Basin B (excavated below ground)
► Riser Basins
► Earth Berm at Toe of Fill Slopes
NOT Surface Dewatering Devices

- Temporary Rock Silt Checks
- Temporary Rock Sediment Dams
- Silt Fence
- Stone Inlet Protection Devices
- Wattles

Standard Sediment Basins

- Silt Basin Type B
- Temporary Rock Sediment Dam Type B
- Infiltration Basin
Sediment Basin FYI

► Optimal Length:Width Ratio is 3:1, with 2:1 minimum and 6:1 maximum - exceptions

► NCDOT Sediment Basins have 1.5:1 side slopes
  - Not Required but Flatter Side Slopes = Less Volume

► Don’t place basins in following locations:
  - Riparian Buffer Zones (unless permitted)
  - Wetlands (unless permitted)
  - Close to Homes or Businesses
  - In live streams

Ideal design!
Silt Basin Type B

► Surface Area Requirement
  - 435 ft² per cfs of $Q_{10}$ or $Q_{25}$ peak inflow
  - 325 ft² per cfs of $Q_{10}$ or $Q_{25}$ peak inflow at drainage inlet structures (i.e. DI’s, CB’s, etc.)

► Sediment Storage Requirement
  - 3600 ft³ per disturbed acre
  - 1800 ft³ per disturbed acre at drainage inlet structures (i.e. DI’s, CB’s, etc.)

Silt Basin Type B Tips

► Can be utilized in medians at drainage inlets

► Utilize adjacent to Rock Pipe Inlet Sediment Traps (PIST-A, PIST-B)
  - Surface Area = 435 ft² per cfs of $Q_{10}$ or $Q_{25}$
  - Sediment Storage = 3600 ft³ per disturbed acre

► Use Silt Basin B’s for additional sediment storage upgrade of drainage outlet
Sediment Dam Type B

► Surface Area Requirement
  - $435 \text{ ft}^2$ per cfs of $Q_{10 \text{ or } 25}$ peak inflow

► Sediment Storage Requirement
  - $3600 \text{ ft}^3$ per disturbed acre

► Minimum Weir Length is 4 ft.

► Maximum Drainage Area is 1 Acre (NCG-01)

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Sediment Dam Type B Tips

► Place Temporary Rock Sediment Dams Type B (TRSD-B) at drainage outlets that do not drain directly to a jurisdictional water body

► Place TRSD-B’s inside footprint of project on Clearing & Grubbing EC Plans

► TRSD-B’s are relatively inexpensive, but have largest basin footprint
Infiltration Basin

► Surface Area Requirement
  - 325 ft² per cfs of $Q_{10}$ or $Q_{25}$ peak inflow

► Sediment Storage Requirement
  - 1800 ft³ per disturbed acre

► Minimum Weir Length is 4 ft.

► Maximum Dewatering Time is 3 days

Infiltration Basin Tips

► Infiltration Basins can be placed at drainage outlets that drain directly to jurisdictional water bodies and Riparian Buffer Zones

► Utilize Infiltration Basins at toe of fill slopes; do not use in proposed ditches

► Recommend knowing ground water elevation for berm height construction

► Do not place in “Soils Prone to Flooding”
Break!

Skimmer Devices

► Skimmer Basin
► Tiered Skimmer Basin
► Earthen Dam with Skimmer
► Stormwater Basin with Skimmer
Skimmer Device Update

► Removed references to “Faircloth Skimmer”
► Revised Appearance of Skimmer in Detail
► Changed “Emergency” to “Primary” Spillway
► Revised Spillway Weir Formula to Q/0.4
Skimmer Device Spillway Update

► Impermeable Geomembrane for Spillways
  ▪ Polypropylene
  ▪ Polyethylene

► Divisions 1, 2, 3, 4, 6

► Cost More than Soil Stabilization Geotextile

► Skimmer, Tiered Skimmer, Infiltration, Dam

Skimmer Basin Design Criteria

► Surface Area Requirement
  ▪ 325 ft² per cfs of Q₁₀ or 25 peak inflow

► Sediment Storage Requirement
  ▪ 1800 ft³ per disturbed acre

► Minimum Primary Spillway Weir Length is 4 ft.

► Minimum Dewatering Time is 24-48 hours
Skimmer Basin Tips

► Place Skimmer Basins at drainage outlets that drain directly to jurisdictional water bodies and Riparian Buffer Zones

► Skimmer Orifice is sized to dewater basin in 2 to 3 days in DOT Basin Design spreadsheet

► Skimmer Basins are more expensive than TRSD-B’s, but have smaller footprint

Tiered Skimmer Basin Tips

► Place Tiered Skimmer Basins at drainage outlets that drain directly to jurisdictional water bodies and Riparian Buffer Zones

► Utilize Tiered Skimmer Basin when elevation difference is greater than 6 ft. from inflow to outflow ends of basin

► Label length, width and weir dimensions of upper basin (Modified Silt Basin Type B) and lower basin
Earthen Dam with Skimmer Design Criteria

- **Surface Area Requirement**
  - 325 ft\(^2\) per cfs of \(Q_{10} \text{ or } 25\) peak inflow

- **Sediment Storage Requirement**
  - 1800 ft\(^3\) per disturbed acre

- **Minimum Weir Length is 4 ft.**

- **Minimum Dewatering Time is 24-48 hours**

Skimmer Dam Tips

- Place Earthen Dam with Skimmer in ditches with Large Cross Section (i.e. Base Ditch)

- Utilize when ditch grade is less than 2%

- Label weir length and height of designed dam

- Economic and Construction Benefits if feasible
Stormwater Basin with Skimmer Design Criteria

► Surface Area Requirement
  - 435 ft$^2$ per cfs of $Q_{10 \text{ or } 25}$ peak inflow

► Sediment Storage Requirement
  - 1800 ft$^3$ per disturbed acre

► Primary Spillway (Riser) to Convey 2-yr Storm

► Minimum Dewatering Time is 24-48 hours

Stormwater Basin Tips

► Size Skimmer and Orifice Diameter for provided Stormwater Basin volume

► Size orifice to dewater volume 1 ft. from basin bottom

► Show Skimmer attached to Riser with label

► Include Note to use Stormwater Basin during construction
Stormwater Basin Construction Concerns

► Rock Layer or Water Table Too Close to Surface
► Unsuitable Material for Berms
► Inadequate Compaction in Berms
► Stormwater Basin may be too large to maintain

Stormwater Basin Construction Specs

► Minimum of 3 Baffles with Equal Spacing
► Anti-Seep Collars
► Berm Material
  -Compact Embankment to at least 90% of AASHTO T 99 Test
► Specify Matting and Permanent Seed Mix for Slopes
When surface area and/or sediment storage requirement for a basin cannot be achieved:

► Design sediment basin or sediment trap to the maximum practical length and width dimensions

► Utilize Polyacrylamide (PAM) devices (Wattle, Silt Check A with Matting) upgrade of the sediment basin/trap

PAM Devices

► Excelsior Wattle

► Coir Fiber Wattle

► Silt Check Type A with Matting
Excelsior Wattle

► Can be used with or without PAM

► When utilized, place wattles every 50 ft. in temporary and/or permanent ditches

► Use Excelsior Wattles on short term projects (one year project duration or less)

Coir Fiber Wattle

► Can be used with or without PAM

► When utilized, place coir wattles every 50 ft. in temporary and/or permanent ditches

► Use Coir Fiber Wattles on long term projects (project duration of more than a year)
  ▪ Environmentally Sensitive Areas (Trout, 303(d), etc.)
Silt Check Type A with Matting

- When utilized, place Silt Check Type A (TRSC-A) with Matting and PAM in temporary and/or permanent ditches

- When utilized, place TRSC-A’s with Matting and PAM every 50 ft. in temporary and permanent ditches

- Use TRSC-A’s with Matting and PAM on short and long term projects where ditch grade > 2.5%

Environmentally Sensitive Areas

- 50 ft. zone from top of streambank (TOB)
  - 50 ft. from water’s edge if TOB is not delineated on plans

- Shown inside and to ROW/Easement; do **not hatch the water surface**!

- Match ESA hatch spacing to ESA plan sheet note
ESA Locations

- DWQ High Quality Waters & Critical Area (CA) Waters
  - WS-I, WS-II, HQW, ORW, SA, CA
- DWQ and WRC Trout Streams
- Streams with Riparian Buffers
- Relocated Streams
- 303(d) Streams for Turbidity Impairment
  - 2010 Construction-related Impairments
  - 2012 Final 303(d) List
- Design Standards in Sensitive Watersheds Commitment

EC in Riparian Buffers

- No excavated erosion control devices inside Riparian Buffer, unless permitted by DWQ!
- Runoff treated separately inside and outside Buffer
- Protect Buffer and Stream with Perimeter EC Devices
Allowed EC Devices in Buffers

- Temporary Silt Fence
- Special Sediment Control Fence
- Rock Silt Checks
- Wattles
- Stone Inlet Protection
- Special Stilling Basins

Temporary Rock Silt Check Type A

- Utilize at the outlet of diversion ditches and berms for offsite runoff
- Place at the outlet of permitted ditches in Buffer Zones
- Utilize at outlet of proposed tail ditches
Temporary Rock Silt Check Type B

► Utilize in diversion ditches and berms for offsite runoff
► Place in any temporary and permanent ditch
► Use spacing of 250 / % ditch grade
► Use at inlets of sediment basins and driveway pipes

Type A Inlet Protection

► Use Type A Rock Inlet Sediment Traps (RIST-A, PIST-A) in high flow situations
► Utilize Type A Inlet Protection devices in medians and ditches on new alignments
► Must be at least 30 ft. from travel lane
Type B Inlet Protection

► Use Type B Rock Inlet Sediment Traps (RIST-B, PIST-B) in moderate flow situations

► Utilize Type B Inlet Protection devices in urban areas; widening projects

► No minimum offset distance from travel lane

Type C Inlet Protection

► Use Type C Rock Inlet Sediment Traps (RIST-C) in low to moderate flow situations

► Utilize Type C Inlet Protection devices in urban areas with C&G; widening projects

► Use RIST-C’s for fill slope drainage inlets at shoulder break points
Culvert/Pipe Phasing

► Provide Phasing for Pipes 48” and up
► Do not show EC design on phasing
► Make sure all phasing measures are labeled
► Be consistent with label and text language
Design-Build Updates

► Vegetation Management Plan

► Field Verification of EC devices

► Monthly Field Reviews for Intermediate EC

► Approval for Modification of EC Devices
Vegetation Management Plan

- Narrative (Tables, Charts, etc.)
- Address Short, Mid & Long Term Stabilization
- Incorporate 7/14 Day Stabilization Timeframes
- Address ESAs – Timely and Stage Seeding
- Stage Seeding Slopes over 25 ft. in length

Field Verification of EC Devices

- After Clearing & Grubbing Measures Installed
- Monthly (Every 30 Days)
- Verify Device Drainage and Disturbed Area
- Provide Documentation of Field Verifications
Devices Requiring Calculations and Approval to Modify

► Sediment Basins (Silt Basin B, Infiltration, etc.)
► Skimmer Basin and all devices with skimmers
► Riser Basin
► Temporary Rock Sediment Dam Type A & B
► Temporary Rock Silt Check Type A
► Culvert Construction Sequence
► Temporary and Permanent Stream Channel Relocations
Low Impact Bridge (LIB) EC Plans

- Include Erosion Control Title Sheet
- Stabilization Timeframe Sheet required
- Utilize PAM devices
- Include all Details and Reforestation if needed

LIB Additional Info

- Checklist and Water Quality Sheet
- Cross Sections
- Permit Drawings – Draft & Final
- General Structure Drawing
General EC Plan Review

► Clip/Move All Labels and Notes
► Make Sure EC Measures Print on Top
► Don’t Modify EC Title Sheet
► Use Soil & Water Color Scheme for EC devices

Final EC Thoughts

► Consider Final Grade erosion control while designing Clearing & Grubbing phase
► Submit Water Quality AND Checklist sheets
► Don’t place EC devices in streams!
► Soil & Water Engineering Section is open to new ideas!
Erosion Control Resources

► REU Soil & Water Engineering Web Page
   http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/soil_water/

► NCDOT Construction BMP Manual
   http://www.ncdot.gov/doh/forms/files/BMPMANUAL.pdf

► NCDOT Highway Stormwater Program
   https://connect.ncdot.gov/resources/hydro/Pages/Stormwater-Program.aspx

Questions?

ROADSIDE ENVIRONMENTAL UNIT
SOIL & WATER ENGINEERING

NORTH CAROLINA

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