NCDOT ESC
Erosion & Sediment CONTROL MANUAL

3.1 Section

Bid Build Projects

Developing the E&SC Plan for Bid Build Projects

Bid Build (BB) projects, or design-bid-build projects as they are frequently called, involve NCDOT or a contracted firm supplying the E&SC design plans for a transportation project, and then separate construction firms competitively bid on the construction proposal. NCDOT's District or Resident Engineer and REU's Field Operations Engineer work together so that NCDOT E&SC plan is implemented in the field and project commitments are managed throughout the project.

Prior to development of the E&SC plans, the steps in Figure 3.1 should be addressed:

Environmental Document Review

- Review the Green Sheets for E&SC commitments made during permit negotiations.
- Scan permit conditions for any unique E&SC items that may not be captured on the Green Sheets.

Base Plans

- Lead Designer furnishes contours, vertical and horizontal alignment with hydraulic design, cross sections and profile.
- Identify areas where easements are needed to allow the basins to be placed outside of fill slopes and remain functional for up gradient disturbances.

Water Quality Review

- Ask if there are any applicable:
  - HQWs? (HQW, ORW, WS-I, WS-II, SA, PNA)
  - Trout (Tr) streams? Riparian Buffer rules?
  - Critical Area? (CA)
  - 303(d) streams listed for Turbidity impairment?
  - T&E species sensitive to sediment present?
- If yes to any, all jurisdictional streams require a 50 ft. ESA on both sides of stream.

Other Environmental Considerations

- Identify adjacent wetland boundaries and surface waters as high risk, including impoundments downstream of the right of way (ROW).

E&SC Design Standards

- Calculate peak flow, Q_p for the 25-year storm for the five water quality items listed above or other commitments made for Design Standards in Sensitive Watersheds.
- Calculate Q_p for the 10-year storm on all other sites.

Figure 3.1 Steps to follow before developing the E&SC plans.

Bid Build Project Work Flow for E&SC Plans

The NCDOT REU shall review and accept all E&SC plans prepared by others. Figure 3.2 shows the major phases of a BB project, which are described in detail in this section.

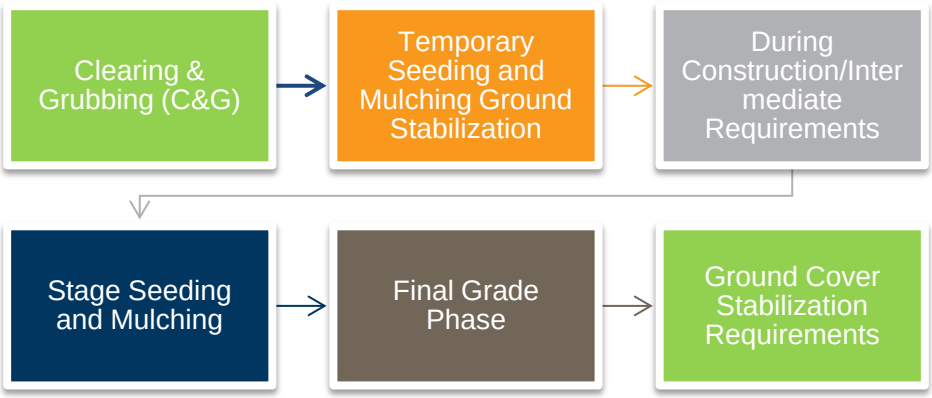

Figure 3.2 The major work flow steps of a BB transportation project.

C&G Phase Design

Good planning is essential to designing and executing an effective E&SC plan. Recall the ten key concepts of E&SC planning and design (presented in Chapter 2) as the C&G plans (which are the first phase of E&SC plans) are developed. Along with the ten key concepts, implement the following NCDOT-required guidelines:

General

Adhere to the following general guidelines when developing the C&G plan:

- Use correct NCDOT symbology.
- Obtain adequate easement for design of E&SC controls outside of the slope stake limits to prevent controls from being impacted by roadway or embankment footprint as construction progresses.
- Account for existing topography and include contours for the C&G phase only.
- Determine drainage areas and disturbed areas.
- Consider clean water diversions to route run-on water around disturbed areas.

- Protect existing streams and wetlands; do not place E&SC devices in live streams unless authorized through Section 401 and 404 permits.
- If needed, include 50-foot ESAs on C&G plans only.
- Do not place E&SC devices that require excavation (e.g., basins, silt ditches) in wetlands or buffer zones.
- Provide disturbed and undisturbed drainage areas for the entire project limits in MicroStation format.

Access and Haul Roads

Temporary access and haul roads, other than public roads, constructed or used in connection with the project shall be considered a part of the project and addressed in the E&SC plans. While the specific details around the number and location of access and haul roads may not be known at this stage, the E&SC design engineer should consider their placement.

- Note that construction access is normally the first land-disturbing activity and should be carefully planned.
- Refer to the gravel construction entrance section in Chapter 4 for construction details.
- Include access and haul road details and quantities.

Inlet and Perimeter Controls

Inlet protection at this stage involves protecting existing inlet structures while perimeter controls provide the outer boundary of protection.

- Protect all existing drainage structure inlets that may receive stormwater with Rock Inlet Sediment Traps - Type A, Type B and Type C (RIST-A, RIST-B, and RIST-C), and Rock Pipe Inlet Sediment Traps – Type A and Type B (PIST-A, PIST-B).
- Provide inlet protection that can handle the volume of water from the respective drainage area.
- Maintain natural areas to the maximum extent possible.
- Utilize adequate perimeter runoff controls such as temporary silt ditches, temporary silt fence. , etc.
- Supplement natural vegetation with silt fences and wattles around the perimeter, focusing on the down gradient areas.
    - Use these barriers to protect stream buffers, riparian areas and waterways where sheet flow occurs.

Runoff Management Conveyances

Install stormwater conveyances with inlet and outlet protection devices early in the project to avoid the development of gullies and washes (NCDENR, 2008).

- Provide velocity control in conveyances and include all calculations.
- Utilize Temporary Rock Silt Checks - Type B (TRSC-B) to reduce velocity in existing and proposed roadway ditches. Spacing between the silt checks should be so that the elevation at the top of the lower check is the same as the toe elevation of the upped check. In other words, the silt checks should be installed so that runoff flows in ditch in a "stair" step pattern. Also utilize TRSC-Bs in proposed temporary silt ditches, temporary diversions, and clean water diversions.
- Incorporate devices with flocculant in ditches that drain directly to jurisdictional streams and wetlands.
- Where approved by the REU, utilize wattles with flocculant and/or TRSC-A with matting and flocculant in temporary and permanent, existing and proposed ditches at a spacing of 50 feet in areas where:
    - Sediment basins are not feasible at drainage outlets; and
    - Sediment and silt basins at drainage outlets cannot be properly sized to surface area and/or sediment storage requirements due to safety concerns, right-of-way restrictions, utility conflicts or other construction limitations exist.

Sediment Basins, Skimmer Basins and Barriers

Install perimeter sediment basins and barriers as soon as access to the site is gained. Additional basins will likely be needed when grading begins.

- Utilize skimmer basins and rock measures with sediment control stone (Temporary Rock Sediment Dam - Type B [TRSD-B], TRSC-A, etc.) at drainage outlets and include calculations.
- Provide adequate sediment storage for 3,600 cubic feet per disturbed acre and size basins such that the surface area equals 435 square feet per cubic foot per second (cfs) of the peak inflow rate, Q_p, using 10 or 25-year peak rainfall data (NCDENR - *Erosion and Sediment Control Planning and Design Manual* or NOAA's National Weather Service website [http://dipper.nws.noaa.gov/hdsc/pfds/] for partial duration (ARI) time series type).

- Provide adequate silt storage with skimmer basins for 1,800 cubic feet per disturbed acre with the surface area equal to 325 square feet per cfs of the peak inflow rate, Q_p, using the 10 or 25-year peak rainfall data (see link/reference in preceding bullet).
- Request sediment and/or skimmer basin designer spreadsheets as needed from the NCDOT REU.
- The minimum and maximum length-to-width (l:w) ratio of all sediment basins shall be 2:1 and 6:1, respectively. With REU approval, basins may be of different l:w ratios due to topography, ROW or other constraints.
- Install coir fiber baffles in all silt basins and sediment dams at drainage outlets.
    - For silt basins with a 20-foot or longer length, three coir fiber baffles shall be installed with a spacing of 1/4 the basin length.
    - For silt basins with a length less than 20 feet, a minimum of two coir fiber baffles shall be installed, with a spacing of 1/3 the basin length.
    - The E&SC design engineer is not required to show the individual baffles on the E&SC plans.
- Designers may be asked to provide a written explanation for all drainage outlets where the runoff cannot be treated with a sediment basin and/or the sediment basin cannot be constructed to the required sediment storage or surface area requirements.
- Place all perimeter sediment basins outside of fill slopes.
- Incorporate and transition temporary basins into permanent stormwater devices, as applicable. See Chapter 2 for more guidance on transitioning E&SC devices to permanent controls.
- Sediment basins that drain directly into jurisdictional waters or have a total drainage area of 1 acre or more shall be designed and constructed with outlet structures that only withdraw water from the surface; otherwise, stone outlets may be provided.

Culvert and Pipe Construction

Provide a pipe and culvert phasing plan or note in accordance with NCDOT's *Best Management Practices for Construction and Maintenance Activities* for managing the watercourse during construction. The phasing plan for box culverts is typically provided by the NCDOT Hydraulics Unit.

- Include any culvert and/or pipe construction sequence plan sheets in the C&G plans, including BMP and construction narratives, for all box culverts and any pipes 60 inches or larger, or any combination of pipes that total 60 inches or more.

Provide E&SC sequence phasing, including BMP and construction narratives, for all box culverts and any pipes, or combination of pipes, greater than or equal to 60 inches.

During Construction

The NCDOT District or Resident Engineer is responsible for obtaining approval for E&SC plan revisions and maintaining accurate E&SC plans for the life of the construction project.

- During construction, any substantial deviation from the E&SC plan will require design revisions. NCDOT REU central unit will faciliatate the design revisions and submit them through the REU Field Operations Engineer. Updated versions of E&SC plans may be requested by the District or Resident Engineer at any time during construction.
- Prior to installation of any E&SC devices, the NCDOT Division's construction staff shall verify boundaries of jurisdictional areas in the field and delineate with safety fence or flagging.
- For guidance on safety fence and flagging in jurisdictional areas, see Section 4.2.2 in Chapter 4.
- Whenever the Engineer determines that significant erosion and sedimentation continues despite the installation of approved protective practices, the District or Resident Engineer, in consultation with the REU Field Operations Engineer, is required to take additional protective action.

Intermediate Phase Design

Intermediate E&SC plans are required to address additional E&SC design for phases not covered in the C&G and/or final grade E&SC plans. For any

intermediate phase, comply with the Final Grade Phase Design and provide for phases not adequately addressed in C&G or final phase plans. Examples of project stages that would trigger the need for intermediate phase design include any key operation changes that are more than a minor deviation, detours for bridge or overpass construction, utility construction and bridge demolition or bridge operations.

Intermediate E&SC plans are often required due to the dynamic nature of highway construction projects.

Redesign for any Major Deviation on Selected Measures

For revisions to E&SC devices that require design calculations or approval by REU for dimension modifications and/or relocations, other than minor shifts for accurate placement, includes, but not limited to, the devices noted below:

- Riser basin
- Skimmer basin and all devices with skimmers
- TRSD-A
- TRSD-B
- TRSC-A
- Culvert construction sequences
- Temporary and permanent stream channel relocations

Utility Construction

Utility-related construction is one of the greatest challenges the E&SC design engineer encounters. When utilities have to be relocated or new facilities installed, this work typically is done ahead of the proposed construction and grading activities. In many cases, the following utilities require land disturbances at watercourses near bridges, box culverts and pipes, including:

- Water
- Sewer

- Electric (underground)
- Gas
- Communication lines

Occasionally, underground utilities are scheduled to be relocated within project limits during the construction timeframe and additional E&SC measures can be designed and shown on the E&SC plans to help prevent offsite sediment from this work.

Bridge Phasing Operations

Construction activities occurring at bridges may also warrant intermediate phase design plans. E&SC should be considered for the following operations:

- Bridge demolition
- Bridge construction operations (jetting, dredging, shaft/caisson drilling)
- Temporary bridges
- Temporary causeways
- Temporary equipment work pads
- Temporary stockpiles
- Managing the watercourse

Final Grade Phase Design

It is important to establish seeding and mulching as early as possible on graded surfaces as grading progresses rather than waiting until the entire slope reaches final grade.

The most effective E&SC practice available is proper establishment of a good vegetative cover.

General

Observe applicable design components listed for C&G as well as:

- Protect existing and proposed drainage structure inlets and utilize adequate perimeter controls – refer to the Inlet and Perimeter Controls section under the C&G section.
- Refer to the Sediment Basins, Skimmer Basins and Barriers section within the C&G section if additional basins or barriers need to be erected at this stage.

Slope Protection

Slope protection is a critical step in the E&SC process and the grading plan forms the basis of the E&SC plan (NCDENR, 2008). All practices necessary for controlling erosion on the graded surface must be included in the final grade phase plan and steps utilized in the C&G phase may be repeated.

- Utilize temporary slope drains and earth berms at the top of fill slopes and where there are super elevations on tall fill slopes. For slope drain design and location guidance, refer to Section 4.4.1 on page 4-51. Maximum spacing between slope drains should be 200 feet.
- Utilize a rock energy dissipater at the outlet of the slope drain.
- Unless otherwise directed by the REU's Soil & Water Engineering Section, provide matting for erosion control on all slopes (cut and fill) that are 2:1 or steeper and a height of 8 feet or greater.
- Refer to Appendix C for regional seed mixes that provide stabilization of graded areas, including specific seed species for slopes.

Runoff Management Conveyances

As median and roadway ditch lines reach final grade, install E&SCs that sufficiently manage the stormwater runoff velocity and sediment loss as there is great potential for soil erosion in this phase.

- Utilize TRSC-B's to reduce velocity in existing and proposed roadway ditches with a spacing between the silt checks so that the elevation at the top of the lower check is the same as the toe elevation of the upped check. Also utilize TRSC-Bs in proposed temporary silt ditches, temporary diversions, and clean water diversions.
- Provide temporary matting for erosion control in all ditch lines, including but not limited to temporary ditch lines utilized to divert off-site runoff around construction areas, where the velocity is greater than 2.0 feet/sec, and the shear stress is 1.55 pounds per square foot (psf) or less.

- For ditch lines with a shear stress above 1.55 psf, permanent soil reinforcement mat or riprap shall be utilized.

Storm Drainage Network

As the storm drain drop inlets and catch basins are being finalized, inlet protection is critical to keep the new pipe network sediment free where runoff is contacting unpaved areas.

- Utilize infiltration, skimmers or sediment control stone devices (TRSD-B, TRSC-A, etc.) and a spillway with an adequately designed base length to distribute outflow for devices at all drainage turnouts.
- Protect all new drainage inlets within the final storm drain network until pavement is in place (RIST-A, B, C and PIST-A, B).

Cover Stabilization Requirements

Ground cover stabilization shall comply with the timeframe guidelines specified in NCG01. Excluding the slopes noted below, temporary and permanent ground cover stabilization shall be provided within seven calendar days from the last land-disturbing activity. The E&SC design engineer shall include the ground cover stabilization requirements summary sheet with all E&SC plans submitted to the Department for review and acceptance.

- For the slopes noted below, temporary and/or permanent ground cover stabilization shall be provided within 14 calendar days from the last land-disturbing activity:
  - Slopes between 2:1 and 3:1, with a slope length of 10 ft. or less
  - Slopes 3:1 or flatter, with a slope length of 50 ft. or less
  - Slopes 4:1 or flatter
- Temporary and/or permanent ground cover stabilization shall be provided in accordance with the provisions in each project's contract and NCG01.

Reclamation Plans for any Off-Site Borrow or Waste Pits

Borrow or waste areas that are part of the project shall require a separate reclamation plan, unless the borrow or waste activity is regulated under the Mining Act of 1971, or is a landfill regulated by NCDENR's Division of Solid Waste Management (DSWM). For newly-created borrow pits that require

dewatering, borrow pits dewatering basins are required and shall be in accordance with the applicable special provision available at the website noted in the Special Provisions section below. The contractor shall submit the location and permit number for waste/borrow sites covered by the Mining Act or regulated by DSWM concurrently to the Transportation Program Management Director and the District or Resident Engineer. For reclamation procedures, refer to Section 3.7 in Chapter 3 of this manual.

Special Provisions

NCDOT has developed special provisions to provide guidance for E&SC designers. Chapter 2 focuses on the watershed/regulatory guidelines while Chapter 4 focuses on E&SC BMPs and discusses those provisions that provide guidance on installation and placement of structural BMPs. Special provisions often reference NCDOT's Standard Specifications, but include project specific information. Review special provisions as needed at the following link: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/special_provisions/

Title Sheet

BB projects shall include a title sheet for the proposed E&SC plans. The title sheet shall include the following information:

- Correct notes: NCG01, HQW, ESA, C&G, etc.
- Correct standards for project
- List of standard NCDOT symbology
- Name and certification number of Level III-certified individual responsible for designing and/or reviewing E&SC plans

Detail and Summary Sheets

BB projects shall include detail sheets and notes for the proposed E&SC plans. The detail sheet and notes shall include the following information:

- E&SC device detail drawing sheets
- Matting quantity summary sheets
- Ground Cover Stabilization Timeframe sheet

Reforestation

Reforestation should be provided when ESAs are applied to jurisdctional streams on the project during the C&G phase. Streambank Reforestation is applied to stream relocation and mitigation sites. Reforestation is also included when there is significant pavement removal for onsite detours, road closings, etc. and on large projects with interchanges and wide ROW corridors.

Additional Plan Requirements

In addition to the guidelines presented throughout this section, NCDOT REU requires the following conditions be addressed by the E&SC design engineer:

- Plan submittals shall include all pertinent design information required for review, such as design calculations, (furnished on REU design calculation spreadsheet), drainage areas, etc.
- Plans shall address any environmental issues raised during the permitting process.
- The E&SC design engineer shall comply with the *North Carolina Administrative Code Title 15A Department of Environment and Natural Resources Chapter 4, Sediment Control*.
- All E&SC measures with stone extending beyond the construction limits shall be considered temporary fill. If impacted wetland areas are permitted as "Hand Clearing," then the aforementioned temporary fill shall be permitted as "Temporary Fill in Hand Cleared Areas for Erosion and Sediment Control."

Administrative Requirements

Consider the following administrative details while drafting the E&SC plan and throughout the life of the project:

- A sample set of E&SC plans (including any special details or special provisions used by the NCDOT REU) and the MicroStation Erosion Control Workspace is available upon request from the NCDOT REU.
- Sufficient time shall be allowed for the E&SC design engineer to make any changes to the E&SC plans deemed necessary by the NCDOT REU.
- All E&SC plans, including any red-line revisions, shall be maintained by the District or Resident Engineer and kept on site at all times throughout the duration of the project.

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3.2 Design Build Projects Section

Developing the E&SC Plan for Design Build Projects

Design Build (DB) projects utilize a team for design and construction services and all work is performed under one contract. Utilizing one main point of contact for large transportation projects provides for efficiencies in cost and scheduling. The DB team also maintains responsibility for accurate design plans, including E&SC plans. The DB team must also abide by NCDOT's REU E&SC guidelines.

Prior to development of the E&SC plans, the steps in Figure 3.3 should be addressed:

Environmental Document Review

- Review the Green Sheets for E&SC commitments made during permit negotiations.
- Scan permit conditions for any unique E&SC items that may not be captured on the Green Sheets.

Base Plans

- Lead Designer furnishes contours, vertical and horizontal alignment with hydraulic design, cross sections and profile.
- Identify areas where easements are needed to allow the basins to be placed outside of fill slopes and remain functional for up gradient disturbances.

Water Quality Review

- Ask if there are any applicable:
  - HQWs? (HQW, ORW, WS-I, WS-II, SA, PNA)
  - Trout (Tr) streams? Riparian Buffer rules?
  - Critical Area? (CA)
  - 303(d) streams listed for Turbidity impairment?
  - T&E species sensitive to sediment present?
- If yes to any, all jurisdictional streams require a 50 ft. ESA on both sides of stream.

Other Environmental Considerations

- Identify adjacent wetland boundaries and surface waters as high risk, including impoundments downstream of the right of way (ROW).

E&SC Design Standards

- Calculate Q_p for the 25-year storm for five water quality items listed above or other commitments made for design standards in sensitive watersheds.
- Calculate Q_p for the 10-year storm on all other sites.

E&SC Design Discussion

- Hold a pre-design meeting between the NCDOT REU S&W Engineering Section, the DB team, and any other pertinent NCDOT personnel before any E&SC designs are submitted to NCDOT REU.

Figure 3.3 Steps to follow before developing the E&SC plans

DB Work Flow for E&SC Plans

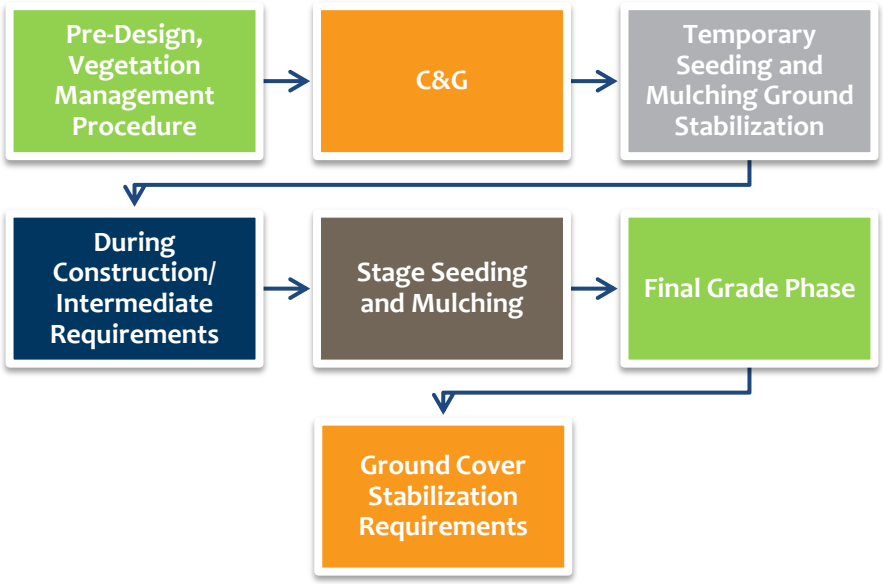


Figure 3.4 The major work flow steps of a DB transportation project

The DB work flow in Figure 3.4 outlines the process for developing the E&SC Plans. The NCDOT REU shall review and accept all E&SC plans. C&G and final grade released for construction (RFC) E&SC plans shall be submitted to all NCDOT personnel listed in the DB submittal guidelines (see Appendix D) before any land-disturbing activities, including C&G can commence. If the DB team chooses to perform the work in discrete sections, then a complete set of C&G and final grade RFC E&SC plans shall be submitted, accepted and distributed prior to land-disturbing activities (including C&G) commencing in that section.

E&SC plans must be submitted and accepted by REU before any land-disturbing activity begins. Review the DB Submittal Guidelines.

Reference Appendix D

The typical schedule the E&SC design engineer will follow for DB projects is demonstrated in Figure 3.5. No land-disturbing activities, including C&G, shall occur in any location that does not have accepted C&G and final grade RFC E&SC plans. Note that E&SC plans shall, at a minimum, address the requirements presented in this section.

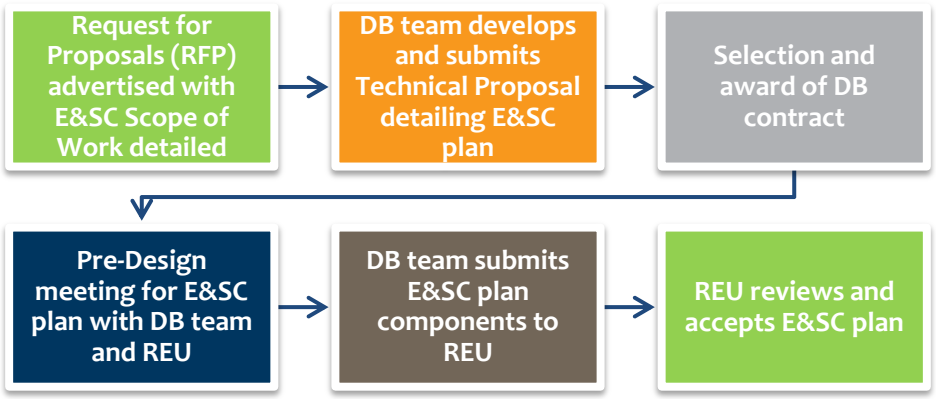


Figure 3.5. Typical schedule for E&SC design engineer on a DB project.

Vegetation Management Procedure

To conform to the vegetative components of the NCG01 permit, the DB team shall formally submit a project-wide vegetation management procedure for the REU's review and acceptance prior to any land-disturbing activities. All versions of the vegetation management procedure shall include, but not be limited to:

- Provisions for the early establishment of grasses/vegetation
  - Outline plans for ground stabilization during and after C&G.
  - Outline plans for stabilization during phased work at or near jurisdictional water bodies.
  - Outline plans for staged construction and staged stabilization as cuts and fills are developed.
  - Outline plans for the stabilization of roadway subgrade if pavement operation is not a continuous operation.
  - Outline plans for winterization during periods of freezing temperatures or conditions are too wet to work.

- Procedure and schedule details for fertilizer topdressing, supplemental seeding, mowing and repair seeding.
    - Fertilizer topdressing
        - Analyses
        - Rates
        - Frequency
        - Application method
        - Target dates
    - Supplemental seeding
        - Threshold for need
        - Species mix
        - Rate
        - Application method
        - Target dates
    - Mowing
        - Threshold for need
        - Target height
        - Frequency
        - Slope limitations
    - Repair seeding
        - Threshold for need
        - Species mix
        - Rate
        - Application method
        - Target dates

DB projects progress rapidly during the construction phase resulting in a need for a well-planned and implemented vegetation management procedure.

The vegetation management procedure shall be closely coordinated with the grading and hauling operations. The DB team shall provide a narrative overview of the vegetation management procedure in the technical proposal

when they respond to the RFP. After the Department's initial review, the DB team shall concurrently provide updated versions of the vegetation management procedure to the District or Resident Engineer and REU on a monthly basis. These updated versions will not require formal submittal to the Transportation Program Management Office, but will be subject to review comments by the aforementioned field personnel.

The DB team shall maintain comprehensive "red-line" as-built plans that detail when and where permanent, temporary and repair seeding and topdressing have been performed.

C&G Phase Design

Good planning is essential to designing and executing an effective E&SC plan. Recall the ten key concepts of E&SC planning and design (presented in Chapter 2) as the first phase of E&SC plans are developed and implement the NCDOT-required guidelines below:

General

Adhere to the following general guidelines when developing the C&G plan:

- Submit these plans and the vegetation management procedure for approval prior to any land-disturbing operations.
- Use correct NCDOT symbology.
- Obtain adequate easement for design of E&SC outside of the slope stake limits to prevent controls from being impacted by roadway or embankment footprint as construction progresses.
- Account for existing topography and include contours for the C&G phase only.
- Determine drainage areas and disturbed areas.
- Consider clean water diversions to route run-on water around disturbed areas.
- Protect existing streams and wetlands; do not place E&SC devices in live streams unless done through Section 401 and 404 permits.

- If needed, include 50-foot ESAs on C&G plans only.
- Do not place E&SC devices that require excavation (e.g., basins, silt ditches) in wetlands or buffer zones.
- Provide disturbed and undisturbed drainage areas for the entire project limits in MicroStation format.
- Immediately after the clearing and grubbing E&SC measures have been installed for the entire project, or for individual sections (if the DB team has divided the project into construction segments), the DB team's E&SC designer shall field-verify constructed dimensions and installation of all E&SC devices.

Access and Haul Roads

Temporary access and haul roads, other than public roads, constructed or used in connection with the project shall be considered a part of the project and addressed in the E&SC plans.

- Note that construction access is normally the first land-disturbing activity and should be carefully planned.
- Refer to the gravel construction entrance for construction details.
- Include access and haul road details and quantities.

Inlet and Perimeter Controls

Inlet protection at this stage involves protecting existing inlet structures while perimeter controls provide the outer boundary of protection.

- Protect all existing drainage structure inlets that may receive stormwater with Rock Inlet Sediment Traps - Type A, Type B and Type C (RIST-A, RIST-B, and RIST-C), and Rock Pipe Inlet Sediment Traps – Type A and Type B (PIST-A, PIST-B).
- Provide inlet protection that can handle the volume of water from the respective drainage area.
- Maintain natural areas to the maximum extent possible.
- Utilize adequate perimeter runoff controls (e.g., temporary silt ditches, temporary sediment fence)
- Supplement natural vegetation with silt fences and wattles around the perimeter, focusing on the down gradient areas.
    - Use these barriers to protect stream buffers, riparian areas and waterways where sheet flow occurs.

Runoff Management Conveyances

Install stormwater conveyances with inlet and outlet protection devices early in the project to avoid the development of gullies and washes (NCDENR, 2008).

- Provide velocity control in conveyances and include all calculations.
- Utilize Temporary Rock Silt Checks - Type B (TRSC-B) to reduce velocity in existing and proposed roadway ditches. Spacing between the silt checks should be so that the elevation at the top of the lower check is the same as the toe elevation of the upped check. In other words, the silt checks should be installed so that runoff flows in ditch in a "stair" step pattern. Also utilize TRSC-Bs in proposed temporary silt ditches, temporary diversions, and clean water diversions.
- Incorporate devices with flocculant in ditches that drain directly to jurisdictional streams and wetlands.
- Where approved by the REU, utilize wattles with flocculant and/or Temporary Rock Silt Check - Type A (TRSC-A) with matting and flocculant in temporary and permanent, existing and proposed ditches at a spacing of 50 feet in areas where:
    - Sediment basins are not feasible at drainage outlets; and
    - Sediment and silt basins at drainage outlets cannot be properly sized to surface area and/or sediment storage requirements due to safety concerns, right-of-way restrictions, utility conflicts or other construction limitations exist.

Sediment Basins, Skimmer Basins and Barriers

Install principal sediment basins and barriers as soon as access to the site is gained. Additional basins will likely be needed when grading begins.

- Utilize skimmer basins and rock measures with sediment control stone (Temporary Rock Sediment Dam - Type B [TRSD-B], TRSC-A, etc.) at drainage outlets and include calculations.
- Provide adequate sediment storage for 3,600 cubic feet per disturbed acre and basins shall be sized with the surface area equal to 435 square feet per cfs of the peak inflow rate, Q_p, using the 10 or 25-year peak rainfall data (NCDENR - *Erosion and Sediment Control Planning and Design Manual* or NOAA's National Weather Service website [http://dipper.nws.noaa.gov/hdsc/pfds/] for ARI time series type).

Sediment basins that drain directly into jurisdictional water or have a total drainage area of 1 acre or more shall be designed and constructed with outlet structures that only withdraw water from the surface.

Skimmer basins shall provide adequate silt storage for 1,800 cubic feet per disturbed acre with the surface area equal to 325 square feet per cfs of the peak inflow rate, Q_p, using the 10 or 25-year peak rainfall data (see link/reference in preceding bullet).

- Request sediment and/or skimmer basin designer spreadsheets as needed from the NCDOT REU.
- The minimum and maximum length to width ratio of all sediment basins shall be 2:1 and 6:1, respectively. With REU approval, basins may be of different l:w ratios due to topography, ROW or other constraints.
- Install coir fiber baffles in all silt basins and sediment dams at drainage outlets.
    - For silt basins with a 20-foot or longer length, three coir fiber baffles shall be installed with a spacing of 1/4 the basin length.
    - For silt basins with a length less than 20 feet, a minimum of two coir fiber baffles shall be installed, with a spacing of 1/3 the basin length.
    - The DB team will not be required to show the individual baffles on the E&SC plans.
- Provide a written explanation for all drainage outlets where the runoff cannot be treated with a sediment basin and/or the sediment basin cannot be constructed to the required sediment storage or surface area requirements.
- Place all perimeter sediment basins outside of fill slopes.
- Sediment basins that drain directly into jurisdictional waters or have a total drainage area of 1 acre or more shall be designed and constructed with outlet structures that only withdraw water from the surface; otherwise, stone outlets may be provided.

Incorporate and transition temporary basins into permanent stormwater devices, as applicable. See Chapter 2 for more guidance on transitioning E&SCs to permanent controls.

For sediment basins that do not drain directly into jurisdictional water or have less than 1 acre of total drainage area, surface dewatering outlets and stone outlets may be provided.

Culvert and Pipe Construction

Provide a pipe and culvert phasing plan or note in accordance with NCDOT's *Best Management Practices for Construction and Maintenance Activities*. Include any culvert and/or pipe construction sequence plan sheets in the C&G plans including BMP and construction narrative, for all box culverts and any pipes 48 inches or larger, or any combination of pipes that total 48 inches or more.

Prior to the installation of pipes smaller than 48 inches in jurisdictional areas, the DB team shall submit a phasing plan for managing the watercourse to the District or Resident Engineer for review and acceptance.

Provide E&SC sequence phasing, including BMP and construction narrative, for all box culverts and any pipes, or combination of pipes, less than or equal to 48 inches.

During Construction

The E&SC design engineer is responsible for obtaining approval for E&SC plan revisions and maintaining accurate E&SC plans for the life of the construction project. This is an iterative process and will coincide with monthly field verifications and monthly vegetation management procedure updates. Figure 3.6 represents this ongoing process.

- After the initial E&SC device inspection(s) during C&G, the designer shall review the project conditions a minimum of every 30 days during the heavy grading operations, or as directed by the Engineer, to verify:

  - Field conditions of disturbed areas are draining to E&SC devices, and
  - Sediment control devices provide the current field condition requirements for sediment storage and surface area.
- The DB team shall provide written documentation of all field verifications/inspections performed to NCDOT REU, S&W Engineering and Field Operations Sections, and the District or Resident Engineer.
  - At a minimum, this documentation shall detail what was observed during the field verification/inspection and all resulting required actions with a timeframe for implementation.
- During construction, any E&SC design revisions must be submitted to NCDOT REU by the 15th of the month via the Transportation Program Management Director. Updated versions of E&SC plans may be requested by the Engineer or REU at any time during the process.
- Prior to installation of any E&SC devices, the DB team shall verify boundaries of jurisdictional areas in the field and delineate with safety fence or flagging.
  - For guidance on safety fence and flagging in jurisdictional areas, see Section 4.2.2 in Chapter 4.
- Whenever the Engineer determines that significant erosion and sedimentation continues despite the installation of approved protective practices, the DB team is required to take additional protective action.

Redesign for any Major Deviation on Selected Measures

The DB team's E&SC designer shall submit design calculations, for the Department's review and acceptance, for all modifications to the E&SC plan that result in dimension modifications and/or relocations (other than minor shifts to accurately place) of the devices noted below:

- Riser basin
- Skimmer basin and all devices with skimmers
- TRSD-A
- TRSD-B
- TRSC-A
- Culvert construction sequences
- Temporary and permanent stream channel relocations

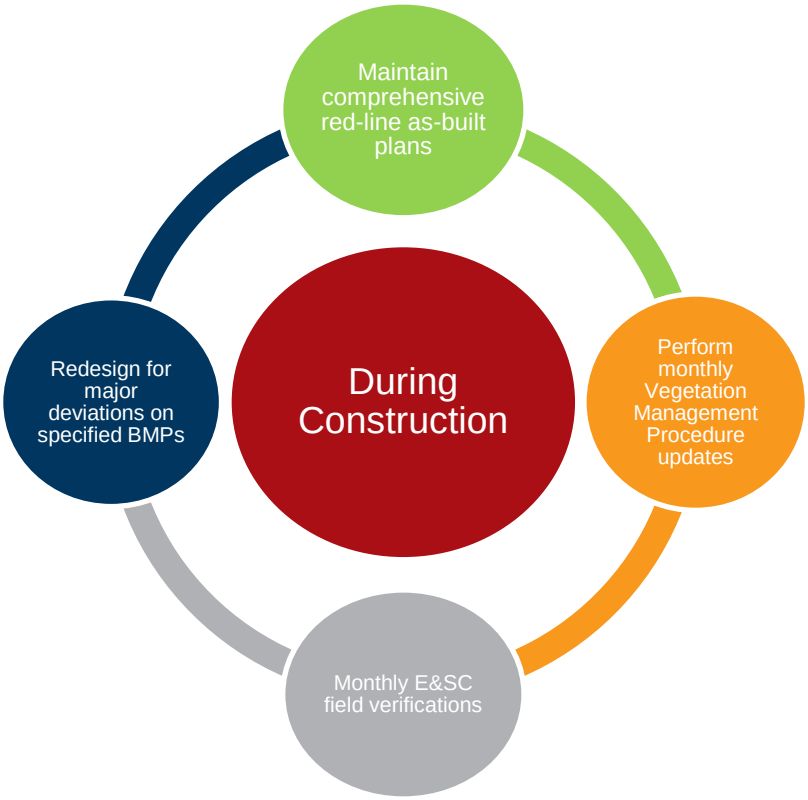


Figure 3.6 Process for E&SC Plan revisions during construction.

Intermediate Phase Design

Intermediate E&SC plans may only be required if design modifications and/or site conditions require additional E&SC design or design revisions to the RFC C&G and/or RFC final grade E&SC plans. Intermediate plans shall be submitted for review and shall be accepted prior to construction of any aspect impacted by the revised E&SC design. For any intermediate phase, comply with the section on Final Grade Phase Design.

- Provide for phases not adequately addressed in C&G or final phase plans.
- Determine if detours require intermediate phase design plans.
- Determine if utility construction and bridge phasing operations require intermediate phase design plans.

Minor changes such as relocating silt fence, adding velocity controls in ditches or adjusting slope drains shall be reviewed by the Engineer in the field.

Utility Construction

Utility-related construction is one of greatest challenges the E&SC design engineer encounters. When utilities have to be relocated or new facilities installed, this work typically is done ahead of the proposed construction and grading activities. In many cases, the following utilities require land disturbances at watercourses near bridges, box culverts and pipes, including:

- Water
- Sewer
- Electric
- Gas
- Communication lines

Occasionally, underground utilities are scheduled to be relocated within project limits during the construction timeframe and additional E&SC measures can be designed and shown on the E&SC plans to help prevent offsite sediment from this work.

Bridge Phasing Operations

Construction activities occurring at bridges may also warrant intermediate phase design plans. E&SC should be considered for the following operations:

- Bridge demolition
- Bridge construction operations (jetting, dredging, shaft/caisson drilling)
- Temporary bridges
- Temporary causeways
- Temporary equipment work pads
- Temporary stockpiles
- Managing the watercourse

Final Grade Phase Design

It is important to establish seeding and mulching as early as possible on graded surfaces as grading progresses rather than waiting until the entire slope reaches final grade.

The most effective E&SC practice available is proper establishment of a good vegetative cover.

General

Observe applicable design components listed for C&G as well as:

- Protect existing and proposed drainage structure inlets and utilize adequate perimeter controls – refer to the Inlet and Perimeter Controls section under the C&G section.
- Refer to the Sediment Basins, Skimmer Basins and Barriers section within the C&G section if additional basins or barriers need to be constructed at this stage.

Slope Protection

Slope protection is a critical step in the E&SC process and the grading plan forms the basis of the E&SC plan (NCDENR, 2008). All practices necessary for controlling erosion on the graded surface must be included in the final grade phase plan and steps utilized in the C&G phase may be repeated.

- Utilize temporary slope drains and earth berms at the top of fill slopes and where there are super elevations on tall fill slopes. For slope drain design and location guidance, refer to Section 4.4.1 on page 4-51. Maximum spacing between slope drains should be 200 feet.
- Utilize a rock energy dissipater at the outlet of the slope drain.
- For DB projects, unless otherwise approved by the REU Field Operations Engineer, provide matting for erosion control on all slopes (cut and fill) that are 2:1] or steeper and a height of 8 feet or greater.
- Refer to Appendix C for regional seed mixes that provide stabilization of graded areas, including specific seed species for slopes.

Runoff Management Conveyances

As median and roadway ditch lines reach final grade, install E&SCs that sufficiently manage the stormwater runoff velocity and sediment loss as there is great potential for soil erosion in this phase.

- Utilize TRSC-B's to reduce velocity in existing and proposed roadway ditches with a spacing between the silt checks so that the elevation at the top of the lower check is the same as the toe elevation of the upped check. Also utilize TRSC-Bs in proposed temporary silt ditches, temporary diversions, and clean water diversions.
- Provide matting for erosion control in all ditch lines, including but not limited to temporary ditch lines utilized to divert off-site runoff around construction areas, where the velocity is greater than 2.0 feet/sec, and the shear stress is 1.55 psf or less.
    - For ditch lines with a shear stress above 1.55 psf, permanent soil reinforcement mat or riprap shall be utilized.

Storm Drainage Network

As the storm drain drop inlets and catch basins are being finalized, inlet protection is critical to keep the new pipe network free of sediment where runoff is contacting unpaved areas.

- Utilize infiltration, skimmers or sediment control stone devices (TRSD-B, TRSC-A, etc.) and a spillway with an adequately designed base length to distribute outflow for devices at all drainage turnouts.
- Protect all new drainage inlets within the final storm drain network until pavement is in place (RIST-A, B, C and PIST-A, B).

Ground Cover Stabilization Requirements

Ground cover stabilization shall comply with the timeframe guidelines specified in NCG01. Excluding the slopes noted below, temporary and permanent ground cover stabilization shall be provided within seven calendar days from the last land-disturbing activity. The DB team shall label all slopes subject to the 7-day ground cover stabilization requirements on all E&SC plans submitted to the Department for review and acceptance.

- For the slopes noted below, temporary and/or permanent ground cover stabilization shall be provided within 14 calendar days from the last land-disturbing activity:
  - Slopes between 2:1 and 3:1, with a slope length of 10 ft. or less
  - Slopes 3:1 or flatter, with a slope length of 50 ft. or less
  - Slopes 4:1 or flatter
- Temporary and/or permanent ground cover stabilization shall be provided in accordance with the provisions in each project's contract, the DB team's vegetation management procedure and NCG01.

Additional Stabilization Requirements

Due to delays and unforeseen conditions, it is often the case during construction that areas originally scheduled to meet the stability requirements are delayed and require additional stabilization. Once the DB team identifies these areas for stabilization due to inactivity, the DB team shall obtain concurrence from the Engineer and adhere to NCDOT special provisions as well as the following options based on the estimated amount of time the area will remain inactive. Special provisions often reference NCDOT's standard specifications that must be followed. Review REU seeding and mulching special provisions as needed at the following NCDOT web page link: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/special_provisions/.

If the area stabilized exceeds the estimated timeframe, the DB team shall implement the next level of stabilization as directed by the Engineer.

Short-term Stabilization

Short-term stabilization is for areas that will remain inactive for up to 21 days. Implement the following:

- Erodible areas shall be stabilized utilizing non-vegetative cover.
  - Non-vegetative cover options include straw mulch, hydraulic applied E&SC products or RECP.
  - If straw mulch is used, it shall provide 100% groundcover and be tacked sufficiently to hold the mulch in place for the duration of the inactive period.
  - All other methods shall be installed according to the manufacturer's directions.

Mid-term Stabilization

- Mid-term stabilization is for areas that will remain inactive for up to 90 days. Implement the applicable stabilization protocol (rates in pounds/acre) as detailed in the appropriate special provisions. At the Engineer's sole discretion, the use of limestone on sandy soils that require topsoil for stabilization may be eliminated. The DB team shall consult with, and obtain approval from, the REU prior to eliminating limestone.
- Upon obtaining approval from the Engineer, the DB team may use wood mulch and/or ground C&G debris as an option for mid-term stabilization. If approved, the aforementioned mulch and/or debris shall be installed at a thickness that prevents erosion.

Long-term Stabilization

Erodible areas shall be stabilized utilizing the region-specific seed and mulching stabilization protocols available at the special provisions link provided under *Additional Stabilization Requirements*.

Soil Analysis

If vegetation establishment indicates a deficiency in soil nutrients or an incorrect pH level is present, the DB team shall take soil samples and apply additional soil amendments to the affected area per soil sampling analysis results and as directed.

Fertilizer Topdressing

In accordance with the requirements noted below, the DB team shall apply fertilizer topdressing to all permanently-seeded areas to promote vegetative growth.

- Prior to completion of the project and once during every growing season from April 1st through September 31st, the DB team shall apply a minimum of one fertilizer topdressing application, in accordance with the requirements noted in the special provisions.

Supplemental Seeding

For all supplemental seeding, the type of seed and proportions shall be the same as specified above for long-term stabilization. The rate of application for supplemental seeding shall be between 25 to 75 pounds per acre. Prior to

topdressing, the DB team shall determine the actual rate per acre for supplemental seeding and submit the supplemental seeding rate and areas to the Department for review and acceptance.

- To prevent disturbance of existing vegetation, minimum tillage equipment, consisting of a sod seeder, shall be used to incorporate seed into the soil where degree of slope allows. Where degree of slope prevents the use of a sod seeder, a "clodbuster" (ball and chain) may be used.

Mowing

The minimum mowing height shall be 4 inches for warm-season turf species and 6 inches for cool-season species.

Reclamation Plans for any Off-site Borrow or Waste Pits

Borrow or waste areas that are part of the project shall require a separate reclamation plan, unless the borrow or waste activity is regulated under the Mining Act of 1971, or is a landfill regulated by the NCDENR DSWM. For newly-created borrow pits that require dewatering, borrow pit dewatering basins shall be required and shall be in accordance with the applicable special provision available at the website noted in the NCDOT Special Provisions section below. The DB team shall submit the location and permit number for waste/borrow sites covered by the Mining Act or regulated by DSWM (NCDENR) concurrently to the Transportation Program Management Director and the District or Resident Engineer. For reclamation procedures, refer to Section 3.7 in Chapter 3 of this manual and the guidance at the following link:

http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/fieldops/downloads/.

Special Provisions

NCDOT has developed a wide range of special provisions to provide guidance for E&SC designers. Chapter 2 focuses on the watershed/regulatory guidelines while Chapter 4 discusses those provisions that provide guidance on installation and placement of E&SC BMPs. Special provisions often reference NCDOT's standard specifications that must be followed. Review special provisions as needed at the following link:

http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/special_provisions/.

- Review Seeding and Mulching special provisions for specific regional requirements
- Disregard references in the E&SC special provisions from the aforementioned website to "method of measurement," "basis of payment," or any other statement regarding direct payment for E&SC measures.

Title Sheet

DB projects shall include a title sheet for the proposed E&SC plans. The title sheet shall include the following information:

- Correct notes: NCG01, HQW, ESA, C&G, etc.
- Correct standards for project
- List of standard NCDOT symbology
- Name and certification number of Level III-certified individual responsible for designing and/or reviewing E&SC plans

Detail and Summary Sheets

DB projects shall include detail sheets and notes for the proposed E&SC plans. The detail sheet and notes shall include the following information:

- E&SC device detail drawing sheets
- Matting quantity summary sheets
- Ground Cover Stabilization Timeframe sheet

Reforestation

Reforestation should be provided when ESAs are applied to jurisdctional streams on the project during the C&G phase. Streambank Reforestation is applied to stream relocation and mitigation sites. Reforestation is also included when there is significant pavement removal for onsite detours, road closings, etc. and on large projects with interchanges and wide ROW corridors.

- Reforestation sheets
- Streambank Reforestation sheets

Additional Plan Requirements

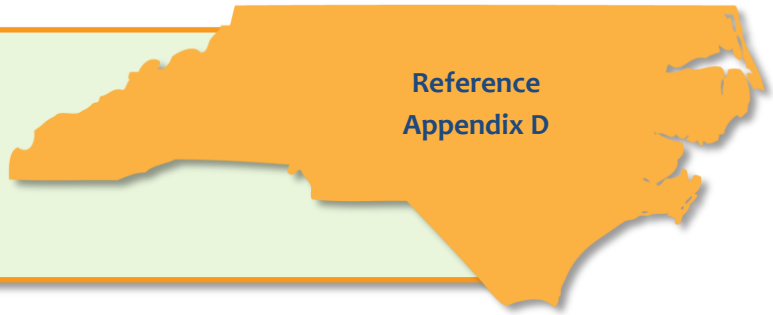
In addition to the guidelines presented throughout this section, NCDOT REU requires the following conditions be addressed by the DB team:

- Plan submittals shall include all pertinent design information required for review, such as design calculations (furnished on REU design calculation spreadsheet), drainage areas, etc.
- At minimum, the DB team shall bring one E&SC plan sheet with a C&G E&SC design to the E&SC plan pre-design meeting.
- Plans shall address any environmental issues raised during the permitting process.
- The DB team shall comply with the *North Carolina Administrative Code Title 15 A Department of Environment and Natural Resources Chapter 4, Sediment Control*.
- All E&SC measures with stone extending beyond the construction limits shall be considered temporary fill. If impacted wetland areas are permitted as "Hand Clearing," then the aforementioned temporary fill shall be permitted as "Temporary Fill in Hand Cleared Areas for Erosion and Sediment Control."

Administrative Requirements

Consider the following administrative details while drafting the E&SC plan and throughout the life of the project:

Review the DB submittal guidelines prior to development.



Reference Appendix D

- A sample set of E&SC plans (including any special details or special provisions used by the NCDOT REU) and the MicroStation Erosion Control Workspace is available upon request from the NCDOT REU.
- Sufficient time shall be allowed for the DB team to make any changes to the E&SC plans deemed necessary by the NCDOT REU.

3.3 Low Impact Bridge Projects Section

Developing the E&SC Plan for Low Impact Bridge Projects

The low impact bridge program was developed to expedite bridge replacement. Low Impact Bridge (LIB) projects are intended to be limited in scope. The design phase, construction phase and delivery of the bridge itself are completed within 12 months. The E&SC plan design should allow for minimal disturbance and appropriate protection at low impact bridge stream crossings.

Prior to development of the E&SC plans, the steps in Figure 3.7 should be addressed:

Environmental Document Review

- Review the Green Sheets for E&SC commitments made during permit negotiations.
- Scan permit conditions for any unique E&SC items that may not be captured on the Green Sheets.

Base Plans

- Lead Designer furnishes contours, vertical and horizontal alignment with hydraulic design, cross sections, and profile
- Identify areas where easements are needed to allow the basins to be placed outside of fill slopes and remain functional for up gradient disturbances.

Water Quality Review

- HQWs? (HQW, ORW, WS-I, WS-II, SA, PNA)
- Trout (Tr) streams? Riparian Buffer rules?
- Critical Area? (CA)
- 303(d) streams listed for Turbidity impairment?
- T&E species sensitive to sediment present?
- If yes to any, all jurisdictional streams require 50 ft. ESA on both sides of stream.

Other Environmental Considerations

- Identify adjacent wetland boundaries and surface waters as high risk, including impoundments downstream of right of way (ROW).

E&SC Design Standards

- Calculate peak flow, Q_p for 25-year storm for five water quality items listed above or other commitments made for design standards in sensitive watersheds.
- Calculate Q_p for 10-year storm on all other sites.

Figure 3.7 Steps to follow before developing the E&SC plans.

Low Impact Bridge Work Flow for E&SC Plans

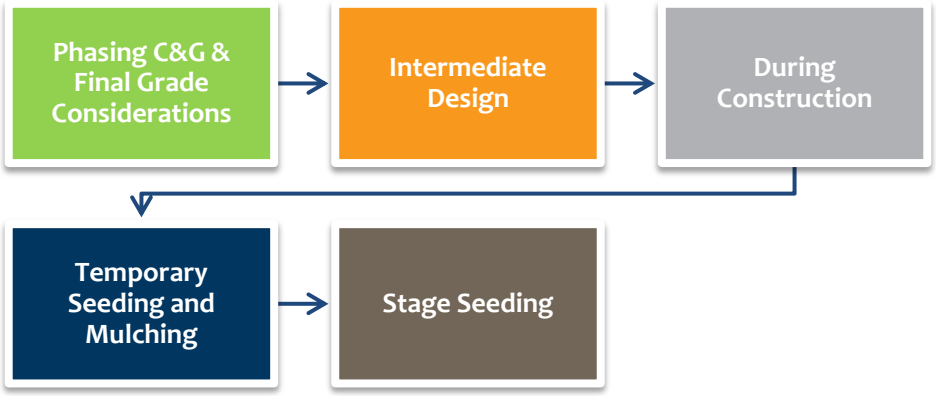


Figure 3.8 Major work flow phases for low impact bridge projects.

The low impact bridge work flow in Figure 3.8 outlines the process for developing the E&SC Plans. The NCDOT REU shall review and accept all E&SC plans. No land-disturbing activities shall occur in any location that does not have accepted and approved E&SC plans.

Phasing

As previously noted, LIB projects are intended to be limited in scope. As such, disturbance associated with these projects should be minimal. Nonetheless, E&SC plans are required per NCDOT policy and typically include C&G and Final Grade designs. Single phase E&SC designs are considered on a case by case basis if C&G and Final Grade designs are similar. From the beginning through the end of construction, the Contractor shall maintain comprehensive "red-line" as-built plans that detail E&SC plan implementation, any and all field revisions, and when and where stabilization has been performed.

Incorporate E&SC devices with flocculant on LIB projects to the greatest extent practical.

General

The following guidelines should be considered for E&SC design:

- Perimeter protection between stream and approach fill
- TRSC-A placed at outlet of existing and proposed ditches
- Devices with flocculant utilized within existing and proposed ditches and spaced every 50 feet and as appropriate for project conditions
- TRSC-A in ditches with greater than 2.5% grade incorporating flocculant
- Drainage breaks in silt fences (Stone or Wattle)
- Velocity control at the beginning and end of project ditch lines
- Include 50-foot ESAs and riparian buffer zones if needed
- Consider clean water diversions to route run-on water around disturbed areas

Construction Entrances

Construction entrances shall be considered part of the project and addressed in the E&SC plans.

- Note that construction access is normally the first land-disturbing activity and should be carefully planned.
- Refer to the gravel construction entrance in Chapter 4, Section 4.2.1 for construction details.

Inlet and Perimeter Controls

Inlet protection at this stage involves protecting existing inlet structures while perimeter controls provide the outer boundary of protection.

- Protect all existing drainage structure inlets that may receive stormwater with RIST-A, B, or C, PIST-A, B, etc.
- Provide inlet protection that can handle the volume of water from the respective drainage area.
- Maintain natural areas to the maximum extent possible.
- Utilize adequate perimeter runoff controls (e.g., temporary silt ditches and temporary silt fencing).
- Supplement natural vegetation with silt fences and wattles around the perimeter, focusing on down gradient areas.
    - Use these barriers to protect stream buffers, riparian areas and waterways where sheet flow occurs.

Runoff Management Conveyances

Install stormwater conveyances with inlet and outlet protection devices early in the project to avoid the development of gullies and washes (NCDENR, 2008).

- Provide velocity control in conveyances and include all calculations.
- Incorporate flocculant on wattles.
    - Utilize wattles with flocculant within ditch lines that have a grade of 2.5% or less. TRSC-As with matting and flocculant should be designed within ditch lines that are greater than 2.5% grade. Spacing of these measures is required every 50 feet within temporary, permanent, existing and proposed ditch lines.

Sediment Basins, Skimmer Basins and Barriers

Due to the size and nature of LIB projects, sediment traps and skimmer basins are not usually included within the E&SC plan design. However, certain projects may involve a large enough drainage area or unique site conditions that may require a sediment trap or basin. In such cases, the following guidelines provide instruction for the design of these measures.

- Utilize skimmer basins and rock measures with sediment control stone (TRSD-B, TRSC-A, etc.) at drainage outlets and include calculations.
- Provide adequate sediment storage for 3,600 cubic feet per disturbed acre and size basins such that surface area equals 435 square feet per cfs of the peak inflow rate, Q_p, using 10 or 25-year peak rainfall data (NCDENR - *Erosion and Sediment Control Planning and Design Manual* or NOAA's National Weather Service web site http://dipper.nws.noaa.gov/hdsc/pfds/ for ARI time series type).
- Skimmer basins shall provide adequate silt storage for 1,800 cubic feet per disturbed acre with surface area equal to 325 square feet per cfs of the peak inflow rate, Q_p, using the 10 or 25-year peak rainfall data (see link/reference in preceding bullet).
- Request sediment and/or skimmer basin designer spreadsheets from the NCDOT REU as needed.
- The minimum and maximum length-to-width ratio of all sediment basins shall be 2:1 and 6:1, respectively. With REU approval, basins may be of different l:w ratios due to topography, ROW or other constraints.

  - Coir fiber baffles shall be installed in all silt basins and sediment dams at drainage outlets.
  - For silt basins with a 20-foot or longer length, three coir fiber baffles shall be installed with a spacing of 1/4 the basin length.
  - For silt basins with a length less than 20 feet, a minimum of two coir fiber baffles shall be installed, with a spacing of 1/3 the basin length.
  - The E&SC designer is not required to show the individual baffles on the E&SC plans, but shall incorporate the coir fiber baffle detail on the E&SC plans.
- The E&SC Designer may be requested to provide a written explanation for all drainage outlets where the runoff cannot be treated with a sediment basin and/or the sediment basin cannot be constructed to the required sediment storage or surface area requirements.
- Place all perimeter sediment basins outside of fill slopes.
- Avoid excavation for sediment control devices in wetlands or buffer zones.
- Submit any major sediment basin design change, addition, deletion, relocation or any change that involves calculations, to the NCDOT REU for review and acceptance once E&SC plans are issued.
- Incorporate and transition temporary basins into permanent stormwater devices, as applicable. See Chapter 2 for more guidance on transitioning E&SC devices to permanent controls.
- Sediment basins that drain directly into jurisdictional waters or have a total drainage area of 1 acre or more shall be designed and constructed with outlet structures that only withdraw water from the surface.
  - For sediment basins that do not drain directly into jurisdictional water and have less than 1 acre of total drainage area, surface dewatering outlets and stone outlets may be provided.

Culvert and Pipe Construction

Work involving culvert and pipe construction or replacement should be shown on the E&SC plans.

- Include any culvert and/or pipe construction sequence plan sheets in the plans including BMP and construction narrative, for all box culverts and any pipes 48 inches or larger, or any combination of pipes that total 48 inches or more.

During Construction

- Planning considerations for work area and watercourse management over jurisdictional areas during operations such as the demolition of existing bridge, jetting, dredging and shaft/caisson drilling include the use of turbidity curtains and temporary silt fences around bridge approaches.

Redesign for any Major Deviation on Selected Measures

The E&SC designer shall submit design calculations, for the REU's review and acceptance, for all modifications to the E&SC plan that result in dimension modifications and/or relocations, other than minor shifts for accurate placement, to the devices noted below:

- Riser basin
- Skimmer basin and all devices with skimmers
- TRSD-A
- TRSC-A
- Culvert construction sequences
- Temporary and permanent stream channel relocations

Intermediate Phase Design

Intermediate E&SC plans may be required if design modifications and/or site conditions require additional E&SC design or design revisions to the plans. Intermediate plans shall be submitted for review and shall be accepted prior to construction of any aspect impacted by the revised E&SC design. For any intermediate phase, comply with the section on Final Grade Phase Design. Utilities and bridge phasing operations may require such design modifications.

Utility Construction

Utility relocation associated with LIB projects is usually minor and may include overhead or underground utilities. Perimeter protection, to prevent off-site sediment, such as silt fence with wattle breaks, should be designed in areas between the disturbance and jurisdictional areas. Include E&SC design for any underground utility work included in the proposed project.

Bridge Phasing Operations

There are activities associated with construction of the bridge structure that require consideration in the E&SC plan design. Such activities may require

instream work. In designated trout streams, planning should allow for these projects to be active only during the 6 months outside of October 15-April 15 due to the spawning seasons of trout species. The designer should also be aware of and plan for any anadromous fish moratoria that may be associated with instream pile driving, drilling or jetting operations. E&SC measures to consider for these types of instream construction activities include coffer dams and turbidity curtains. Silt fence or SSCF provides protection around bridge approaches.

Final Grade Phase Design

It is important to establish seeding and mulching as early as possible on graded surfaces and embankments around bridge approaches as grading progresses rather than waiting until the entire area reaches final grade.

The most effective erosion control practice available is proper establishment of a good vegetative cover

Slope Protection

Slope protection is a critical step in the E&SC process and the grading plan forms the basis of the E&SC Plan (NCDENR, 2008). All practices necessary for controlling erosion on the graded surface must be included in the plan.

- Utilize temporary slope drains and earth berms at the top of fill slopes and where there are super elevations on tall fill slopes. For slope drain design and location guidance, refer to Section 4.4.1 on page 4-51. Maximum spacing between slope drains should be 200 feet.
- Utilize a rock energy dissipater at the outlet of the slope drain.
- Unless otherwise approved by the REU Field Operations Engineer, provide matting/permanent soil reinforcement mat (PSRM) for erosion control on all slopes (cut and fill) that are 2:1 or steeper and a height of 8 feet or greater. In trout waters, the designer should plan for biodegradable matting only.

Conveyances

As roadway ditch lines reach final grade, install E&SCs that sufficiently manage the stormwater runoff velocity and sediment loss as there is great potential for soil erosion in this phase. The measures outlined in the initial conveyance section should be utilized.

Storm Drainage Network

Inlet protection of all existing and proposed funnel drain inlets and drop inlets is critical to keep the new pipe network sediment free where runoff is contacting unpaved areas.

- Devices at all drainage turnouts shall utilize infiltration, skimmer, or sediment control stone (TRSD-B, TRSC-A, etc.) and a spillway with an adequately designed base length to distribute outflow.
- Protect all new funnel drain inlets and drop inlets within the final storm drain network using (RIST-A, B, C and PIST-A, B).

Ground Cover Stabilization Requirements

Ground cover stabilization shall comply with the timeframe guidelines specified in NCG01. Excluding the slopes noted below, temporary and permanent ground cover stabilization shall be provided within seven calendar days from the last land-disturbing activity. The Engineer shall label all slopes subject to the 7-day ground cover stabilization requirements on all E&SC plans submitted to the Department for review and acceptance.

- For the slopes noted below, temporary and/or permanent ground cover stabilization shall be provided within 14 calendar days from the last land-disturbing activity:
    - Slopes between 2:1 and 3:1, with a slope length of 10 feet or less
    - Slopes 3:1 or flatter, with a slope length of 50 feet or less
    - Slopes 4:1 or flatter
- Temporary and/or permanent ground cover stabilization shall be provided in accordance with the provisions in this contract and NCG01.

Reclamation Plans for any Off-site Borrow or Waste Pits

Borrow or waste areas that are part of the project shall require a separate reclamation plan, unless the borrow or waste activity is regulated under the

Mining Act of 1971, or is a landfill regulated by the NCDENR DSWM. For newly-created borrow pits that require dewatering, borrow pit dewatering basins shall be required and shall be in accordance with the applicable special provision available at the website noted in the Special Provisions section below. The E&SC designer shall submit the location and permit number for waste/borrow sites covered by the Mining Act or regulated by DSWM (NCDENR) concurrently to the Transportation Program Management Director and the Resident Engineer. For reclamation procedures, refer to Section 3.7 in Chapter 3 of this manual.

Special Provisions

NCDOT has developed special provisions to provide guidance for E&SC designers. Chapter 2 focuses on the watershed/regulatory guidelines while Chapter 4 focuses on E&SC BMPs and discusses those provisions that provide guidance on installation and placement of structural BMPs. Special provisions often reference NCDOT's standard specifications that must be followed. Review special provisions as needed at the following link: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/special_provisions/.

Title Sheet

The title sheet shall include the following information:

- Correct notes: NCG01, HQW, ESA, C&G, etc.
- Correct standards for project
- List of standard NCDOT symbology
- Name and certification number of Level III-certified individual responsible for designing and/or reviewing E&SC plans

Detail and Summary Sheets

The detail sheets and notes shall include the following information:

- E&SC device detail drawing sheets
- Matting quantity summary sheets
- Ground Cover Stabilization Timeframe sheet

Reforestation

Reforestation should be provided when ESAs are applied to jurisdictional streams on the project during the C&G phase. Streambank Reforestation is applied to stream relocation and mitigation sites.

- Reforestation Sheets
- Streambank Reforestation Sheets

Additional Plan Requirements

In addition to the guidelines presented throughout this section, NCDOT REU requires the following conditions be addressed by the E&SC designer:

- Plan submittals shall include all pertinent design information required for review, such as design calculations (furnished on REU design calculation spreadsheet), drainage areas, etc.
- Plans shall address any environmental issues raised during the permitting process.
- The E&SC designer shall comply with the *North Carolina Administrative Code Title 15 A Department of Environment and Natural Resources Chapter 4, Sediment Control*.
- All E&SC measures with stone extending beyond the construction limits shall be considered temporary fill. If impacted wetland areas are permitted as "Hand Clearing," then the aforementioned temporary fill shall be permitted as "Temporary Fill in Hand Cleared Areas for Erosion and Sediment Control."

Administrative Requirements

Consider the following administrative details while drafting the E&SC plan and throughout the life of the project:

- A sample set of E&SC plans (including any special details or special provisions used by the NCDOT REU) and the MicroStation Erosion Control Workspace are available upon request from the NCDOT REU.
- Sufficient time shall be allowed for the E&SC designer to make any changes to the E&SC plans deemed necessary by the NCDOT REU.
- All RFC E&SC plans, including any red-line revisions, shall be kept on site at all times throughout the duration of the project.

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3.4 Operations Projects Section

Developing the E&SC Plan for Operations Projects

Operations projects, also referred to as state forces projects, refer to the construction work the Department performs on secondary and primary roadway projects. Bridge management projects are included as part of the operations projects category and are covered in a separate section within this chapter. The construction activities are completed using Department forces and resources, unless the project is contracted.

Prior to development of the E&SC Plans, the steps in Figure 3.9 should be addressed:

Environmental Document Review

- The Division Environmental Officer (DEO) performs minimum criteria checklist as part of the State Environmental Policy Act, SEPA.
- The DEO defines wetland and jurisdictional boundaries and provides assessments to the Design Engineer.

Base Plans

- Division Design Construct Offices develop the E&SC plan.
- The E&SC plan and plan checklist are sent to the NCDOT REU for review.
- All plans developed should use the EroDes spreadsheet.
- Typically, base plans are CADD drawings that may include horizontal and vertical alignments. Cross-section profile data is typically limited or not included on base plans.
- Hydraulic information for the proposed pipes and culverts are included on base plans.

Water Quality Review

- Ask if there are any applicable:
  - HQWs? (HQW, ORW, WS-I, WS-II, SA, PNA)
  - Trout (Tr) streams? Riparian Buffer rules?
  - Critical Area? (CA)
  - 303(d) streams listed for Turbidity impairments?
  - T&E species sensitive to sediment present?
- If yes to any, all jurisdictional streams require 50-ft. ESA on both sides of stream.

Other Environmental Considerations

- ESAs are assessed for the proposed pipe or culvert operation.
- Managing the watercourse and work zone is key to operations construction projects.
- The ability to obtain easements is limited.

Phasing

- Operations projects do not include C&G phase plans.
- Typically, disturbance is minimal, construction is completed and the area is stabilized in a short timeframe.
- Intermediate phase design elements are included in operations jobs.
- Projects are given a 30- or 60-day stabilization timeframe from start of grading operations.

Figure 3.9 Steps to follow before developing the E&SC plans.

Phasing is key to operations projects. Typically, they include a 30- or 60-day stabilization timeframe from the initial ground disturbance to groundcover establishment.

Operations Projects Work Flow for E&SC Plans

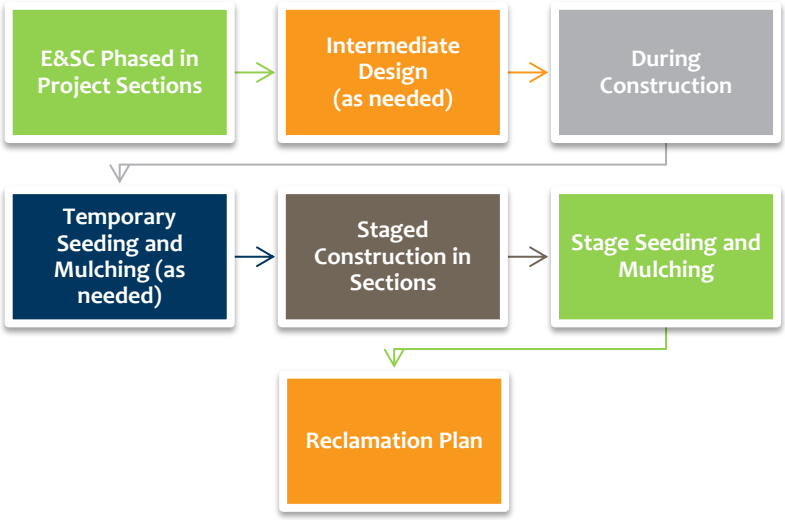

Figure 3.10 The major work flow steps of an Operations Transportation Project.

The operations project work flow in Figure 3.10 outlines the process for developing the E&SC Plans. The NCDOT REU shall review and accept all E&SC plans. E&SC plans shall be accepted by NCDOT REU before any land-disturbing activities commence, including C&G.

Note that E&SC plans shall, at a minimum, address the requirements presented in this section.

Phasing

Typically, operations projects are phased, or worked within discrete sections to minimize disturbance, stabilize the area and complete the project within a 30-

to 60-day timeframe. Some projects may deviate from the typical timeframe, but the projects are constructed similarly to those with the 30- to 60-day limits. Operations projects have no separate C&G phase. Intermediate phase design elements are included on these types of projects.

Because secondary and primary road construction activities have shorter construction schedules / time periods than conventional contracted and constructed projects, there is not typically a distinction between initial C&G operations of the site and final phase design. Rather, projects are given a 30- and 60-day stabilization timeframe once areas have been disturbed.

Phases of E&SC Design for Operations Projects

Because of the nature of operations projects, they usually do not warrant separate C&G and final grade phases. However, the following guidelines should be considered and implemented in the design of the E&SC plans as C&G and final grade activities are proposed for the site.

Good planning is essential to designing and executing an effective E&SC plan. Recall the ten key concepts of E&SC planning and design (presented in Chapter 2) as the E&SC plans are developed and implement the NCDOT-required guidelines. Specifically, for operations projects, EroDes should be used to design and develop the E&SC plan for all projects.

EroDes Design Spreadsheet

All operations projects should be designed using the EroDes design spreadsheet developed and provided by NCDOT at:

http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.

EroDes utilizes the Revised Universal Soil Loss Equation, Version 2 (RUSLE2) to calculate required storage volumes. There is a Help tab within the EroDes file that provides specific step-by-step guidance. The E&SC Design Engineer should then use the EroDes data to develop the E&SC plan.

- Use one worksheet for each project. Rename the Required Storage tab for the first drainage length. Each drainage length should be named by station left or right. Then, copy the first drainage length tab and rename it for the next drainage length.
- When the worksheet is completed for a drainage section:

  - If Option 4 can be used and is chosen, the storage for the drainage length will be obtained from TRSC-As or wattles.
  - If Option 5 can be used and is chosen, the storage for the drainage length will be obtained from TRSD-Bs.
  - If Option 6 can be used and is chosen, the storage for the drainage length will be obtained from Temporary Silt Basins, Type B.
- **Option 4 is the recommended option for bridge management projects with minimal disturbance on the approaches and some secondary and primary road projects**. Use of Option 4 will likely require diversion of off-site water through or around the project. This recommendation is made due to lack of available right-of-way (ROW) for basin installation.
- **Option 5 is <u>not</u> recommended for either secondary or primary road projects.** The storage obtained using this method requires basins too large to be installed on these types of projects.
- **Option 6 is the recommended option for secondary and primary road projects**.
- When the calculations for a project have been completed and the E&SC plan has been finalized, the EroDes spreadsheet for the project should be delivered to the NCDOT REU Field Operations Office. A hard copy should be included with the set of plans that is to remain on site during construction. The calculations are considered part of the E&SC plan.
- For more specific guidelines on using the EroDes spreadsheet, refer to NCDOT REU's website: http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.

C&G Guidelines

Operations projects do not have a separate C&G plan. However, C&G may be proposed for operations projects. When developing the E&SC plan for operations projects, adhere to the following general guidelines when considering C&G for the site:

- Submit the E&SC plans for approval prior to any land-disturbing operations.
- Furnish calculations on REU calculation tool spreadsheets.
- Use correct NCDOT symbology (Section 4.1 of Chapter 4).
- Account for existing topography.
- Determine drainage areas and disturbed areas.

- Consider clean water diversions to route run-on water around disturbed areas.
- Protect existing streams and wetlands; do not place E&SC devices in live streams unless authorized through Section 401 and 404 permits.
- Do not place sediment control devices that require excavation (e.g., basins, silt ditches) in wetlands or buffer zones.

The Designer should reference regulatory information regarding trout variances and riparian buffers. For specific environmental questions, refer to Chapter 2.

Construction Entrances

Construction entrances shall be considered part of the project and addressed in the E&SC plans.

- Note that construction access is normally the first land-disturbing activity and should be carefully planned.
- Refer to the gravel construction entrance in Chapter 4, Section 4.2.1 for construction details.

Inlet and Perimeter Controls

Inlet protection involves protecting existing inlet structures while perimeter controls provide the outer boundary of protection.

- Protect all existing drainage structure inlets that may receive stormwater with RIST-A, B, or C, PIST-A, B, etc.
- Provide inlet protection that can handle the volume of water from the respective drainage area.
- Maintain natural areas to the maximum extent possible.
- Utilize adequate perimeter controls (temporary silt ditch, temporary silt fence, etc.).
- Use perimeter erosion control below fill slopes 3-feet high or taller and between the project and any water body within 25 feet of the project.

- Show TRSC-As, 3-foot sections of special sediment fence or silt fence breaks on the plan at the low points of both the temporary silt fence and the temporary silt ditch.
- Use either silt fence backed by woven wire, with a post spacing of 6 feet or SSCF instead of standard silt fence in trout buffer zones and in ESAs that are at Trout water crossings.
- Supplement natural vegetation with silt fences and wattles around the perimeter, focusing on down gradient areas.
    - Use these barriers to protect stream buffers, riparian areas and waterways where sheet flow occurs.

Runoff Management Conveyances

Install stormwater conveyances with inlet and outlet protection devices early in the project to avoid the development of gullies and washes (NCDENR, 2008).

- Provide velocity control in conveyances and include all calculations.
- Utilize TRSC-Bs to reduce velocity in existing ditches with spacing as provided in EroDes. Also utilize TRSC-Bs in proposed temporary silt ditches and temporary diversions.
- Incorporate flocculant on wattles.
- Where approved by the REU Field Operations Engineer, utilize wattles with flocculant and/or TRSC-As with matting and flocculant in temporary and permanent, existing and proposed ditches at a spacing as provided in EroDes in areas where:
    - Sediment basins are not feasible at drainage outlets; and
    - Sediment and silt basins at drainage outlets cannot be properly sized to surface area and/or sediment storage requirements due to safety concerns, right-of-way restrictions, utility conflicts or other construction limitations exist.
- Ensure every ditch line on a project has a ditch treatment/ditch liner.

The recommendations from EroDes (Ditch Liner tab) should be followed unless there is a reason the ditch liner cannot be installed (i.e., an existing solid rock ditch line). Install velocity controls as soon as access to the site is gained. Additional velocity controls will likely be needed when grading begins. The Design Engineer will use EroDes to develop velocity controls for the project.

- Either wattles with flocculant, TRSC-Bs or TRSC-As with matting and flocculant must be used in the ditch lines as velocity controls.

Wattles (Excelsior or Coir Fiber)

- Wattle use with flocculant is required on projects in ditches that do not have riprap and which have water quality classifications of HQW or Trout. The HQW classification includes HQW, ORW, WS-I and WS-II. Wattles can be used on Non-Trout water and Non-HQW projects if the designers choose to use them. At least one wattle with flocculant must be used in drainage lengths that are designed using any method other than Option 5 in EroDes.
- Wattles with flocculant are used in place of check dams in the ditch line. The turnout measure of a drainage length will still have a rock weir, not a wattle and **without** flocculant.
- The flocculant powder should be replaced on the wattles after each 0.5-inch rain event. It is recommended that the technician conducting the NPDES inspections after the rain events also replaces the flocculant.
- The EroDes spreadsheet for plan design includes recommendations on the wattle number and spacing.
- Wattles are not needed in riprapped ditch lines unless there will be a delay between pulling the ditch line and riprap installation.
- 'Wattle Installation Guide' and a 'Materials Needed for Wattle Installation' documents are available for download from the REU Field Operations webpage under Important Downloads. These will give installation guidance and a list of materials needed for wattle installation and the information needed for ordering the materials: http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.
- The wattles are 12 or 18 inches in diameter. NCDOT recommends use of the 12-inch wattles for typical foothill and mountain ditch lines. During installation, the installer should verify the water flows over the low point of the wattle and not around it. The wattles are malleable and can be compressed in the middle and pinned down to ensure the water flow is over the middle of the wattle. Another alternative to obtain a low point involves excavating a perpendicular trench in the ditch line to bury part of the wattle to achieve the height needed.
- For projects that take less than a year, excelsior wattles are used. For projects greater than 1 year, coir fiber wattles are used. Typically, operations projects use excelsior wattles.
- Chapter 4, Section 4.5.1 discusses specific information about wattles.

Typically, operations projects use excelsior wattles due to short duration projects and to provide velocity control and flocculant delivery.

TRSC-Bs

- TRSC-Bs are not needed in riprapped ditch lines unless there will be a delay between constructing the ditch line and installing the riprap.
- If the storage requirement from EroDes is obtained from TRSC-As, then these should be substituted for the TRSC-Bs.
- Chapter 4, Section 4.5.3 discusses specific information about TRSC-Bs.

TRSC-As with Matting and Flocculant

- TRSC-As with matting and flocculant are used in place of wattles on projects which have water quality classifications of HQW or Trout when wattles cannot be installed. Wattles are the preferred ditch check on HQW and Trout projects. TRSC-As can be used on Non-Trout water and Non-HQW projects if the designers choose to use them. At least one wattle or TRSC-A with matting and flocculant must be used in drainage lengths that are designed using any method other than Option 5 in EroDes.
- TRSC-As with matting and flocculant are used in place of check dams in the ditch line. The turnout measure of a drainage length should still have a rock weir not a wattle, and **without** flocculant.
- The flocculant powder should be replaced on the TRSC-A after each 0.5-inch rain event. The technician conducting the NPDES inspections after the rain events should also be responsible for replacing the flocculant powder.
- The EroDes spreadsheet for plan design includes recommendations on the TRSC-A number and spacing.
- TRSC-As are not needed in riprapped ditch lines unless there is a delay between constructing the ditch line and installing the riprap.
- Chapter 4, Section 4.5.2 discusses specific information about TRSC-As.

Coir Fiber Baffles

- Coir fiber baffles shall be installed in every TRSD-B and every Silt Basin Type B installed at the turnouts (including cross pipe outlets). Implement the following coir fiber baffle requirements:
  - Basins 10 feet in length or less require one baffle.
  - Basins greater than 10 feet in length up to 20 feet in length require two baffles.
  - Basins greater than 20 feet in length require three baffles.
- A 'Materials Needed for Coir Fiber Baffles' guide is available for download from the REU Field Operations webpage under Important Downloads. The guide provides a list of materials needed for coir fiber baffle installation. (Note: 9-gauge single strand wire can be substituted for the 8-gauge wire.) http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/
- Chapter 4, Section 4.7.7 discusses specific information about coir fiber baffles.

Sediment Storage Requirements

Sediment storage requirements are addressed in the EroDes spreadsheet. Storage for the project will be obtained from TRSC-As, wattles, TRSD-Bs or Silt Basins Type B.

There is limited ROW for sediment storage in operations projects.

Culvert and Pipe Construction

For operations projects, E&SC phasing for pipe and culvert construction shall be included and provided for review. Installation of these items shall be in accordance with NCDOT's *Best Management Practices for Construction and Maintenance Activities*. Prior to the installation of pipes smaller than 48 inches in jurisdictional areas, the E&SC Design Engineer shall submit a phasing plan for

managing the watercourse to NCDOT REU Field Operations for review and acceptance.

During Construction

The E&SC Design Engineer is responsible for obtaining approval for E&SC plan revisions and maintaining accurate E&SC plans for the life of the construction project.

- During construction, any major deviations from the E&SC plan must be submitted to NCDOT REU Field Operations.
- Prior to installation of any E&SC devices, the DEO shall verify boundaries of jurisdictional areas in the field and delineate them with safety fence or flagging.
    - For guidance on safety fence and flagging in jurisdictional areas, refer to Chapter 4, Section 4.2.2.
- Whenever the Engineer determines that significant erosion and sedimentation continues despite the installation of approved protective practices, additional protective action should be taken.

Intermediate Phase Design

Intermediate erosion control plans may be required if design modifications and/or site conditions require additional E&SC design or design revisions to the E&SC plans. Intermediate plans shall be submitted for review and shall be accepted prior to construction of any aspect impacted by the revised erosion control design. Specifically, for operations projects, some examples of elements to include in the intermediate phase design might involve managing the work zone and watercourse for construction activities with roadway cross line pipes.

Utility Construction

Utility relocation work on operations projects is typically handled by owners of the utility prior to construction. E&SC plans are generally not required for such work activities as moving utility poles and telecommunication pedestals or relocating underground communication cables.

Final Grade Phase

The most effective erosion control practice available is proper establishment of a good vegetative cover. It is important to establish seeding and mulching as

early as possible on graded surfaces as grading progresses rather than waiting until the entire slope reaches final grade.

The most effective erosion control practice available is proper establishment of a good vegetative cover.

General

Observe applicable design components listed previously and protect existing and proposed drainage structure inlets. Utilize adequate perimeter controls; refer to the Inlet and Perimeter Controls section as needed.

Slope Protection

Slope protection is a critical step in the E&SC process and the grading plan forms the basis of the E&SC plan (NCDENR, 2008). All practices necessary for controlling erosion on the graded surface must be included in the plan and steps utilized in previous phases may be repeated.

- Utilize temporary slope drains and earth berms at the top of fill slopes and where there are super elevations on tall fill slopes. For slope drain design and location guidance, refer to Section 4.4.1 on page 4-51. Maximum spacing between slope drains should be 200 feet.
- Utilize a rock energy dissipater at the outlet of the slope drain.
- Unless otherwise approved by the REU Field Operations Engineer, provide matting for erosion control on all slopes (cut and fill) that are 2:1 or steeper and a height of 8 feet or greater. In Trout waters, the E&SC designer should plan for biodegradable matting only.

Storm Drainage Network

As the storm drainage network is finalized, inlet protection is critical to keep the new network free of sediment where runoff is contacting unpaved areas. Devices at all drainage turnouts shall utilize infiltration or sediment control stone devices (TRSD-B, TRSC-A, etc.) and a spillway with an adequately designed base length to distribute outflow.

Cover Stabilization Requirements

Ground cover stabilization shall comply with the timeframe guidelines specified in NCG01. Excluding the slopes noted below, temporary and permanent ground cover stabilization shall be provided within seven calendar days from the last land-disturbing activity. The designer shall label all slopes subject to the 7-day ground cover stabilization requirements on all E&SC plans submitted to the Department for review and acceptance.

- For the slopes noted below, temporary and/or permanent ground cover stabilization shall be provided within 14 calendar days from the last land-disturbing activity:
    - Slopes between 2:1 and 3:1, with a slope length of 10 feet or less
    - Slopes 3:1 or flatter, with a slope length of 50 feet or less
    - Slopes 4:1 or flatter

There may be cases where EroDes yields an excessive number of TRSC-A (TRSC-A that is wrapped with coir fiber, excelsior or straw matting to aide in the introduction of flocculant) to achieve storage requirements, and site constraints disallow skimmer and infiltration basin installation. Therefore, it will be necessary to utilize the option below that best fits the situation:

- 30-day option - Under these circumstances, it will be necessary to provide a minimum of 23% of the storage calculated using the RUSLE2 analysis during the initial project phase. This section must then be permanently stabilized within 30 days from the time C&G begins. This is derived from Table 2-1 of the Level III Reference Manual which indicates that for any given 30-day period in NC, the maximum amount of rainfall energy that can be expected is 23% of the annual total.
- 60-day option - Under these circumstances, it will be necessary to provide a minimum of 43% of the storage calculated using the RUSLE2 analysis during the initial project phase. This section must then be permanently stabilized within 60 days from the time C&G begins. This is derived from Table 2-1 of the Level III Reference Manual which indicates that for any given 60-day period in NC, the maximum amount of rainfall energy that can be expected is 43% of the annual total. Note that this option is not available for projects involving HQW or Trout waters.

Additional Stabilization Requirements

Seeding & Mulching

Trout buffer zones require additional ground stabilization measures.

- Graded slopes and fills within the trout buffer zone will be planted or otherwise provided with temporary or permanent ground cover (native plant and tree species), devices or structures sufficient to restrain erosion within seven calendar days of completion of any phase of grading. The stabilization timeline applies to contract and operations projects.
- Graded slopes and fills within the trout buffer zone (excluding road shoulders) shall be protected with RECP, bonded fiber matrix or flexible growth medium after seeding.

Reclamation Plans for Any Off-site Borrow or Waste Pits

Borrow or waste areas that are part of the project shall require a separate reclamation plan, unless the borrow or waste activity is regulated under the Mining Act of 1971, or is a landfill regulated by the NCDENR's Division of Solid Waste Management (DSWM). For newly-created borrow pits that require dewatering, borrow pit dewatering basins shall be required. The Engineer shall record the location and permit number for waste/borrow sites covered by the Mining Act or regulated by DSWM (NCDENR) on the E&SC title sheet. For reclamation procedures, refer to Section 3.7 in Chapter 3 of this manual.

Detail Sheets and Notes

Operations projects generally do not include detail sheets. Quantity sheets are not included, and reforestation sheets, if any, are minimal. Project-specific notes for E&SC measures should be provided as applicable to the project.

Title Sheet

Operations projects shall include a title sheet for the proposed E&SC plans. The title sheet shall include the following information:

- Correct notes: NCG01, HQW, ESA, C&G, etc.
- List of standard NCDOT symbology in Section 4.1 of Chapter 4.

- Name and certification number of Level III-certified individual responsible for designing and/or reviewing E&SC plans.

3.5 Section

Bridge Management Construction Projects

Developing the E&SC Plan for Bridge Management Construction Projects

Bridge management construction projects involve the installation and replacement of culvert structures that are primarily greater than 48 inches in diameter. These construction activities are generally conducted on secondary and primary roads and are completed within a few days or weeks. C&G activities associated with bridge management construction projects are minimal. Thus, E&SC planning can be limited to design considerations for the existing ditch lines, stockpile containment and watercourse management.

Prior to development of the E&SC plans, the steps in the diagram below should be addressed:

Environmental Document Review

- The DEO performs the minimum criteria checklist as part of the State Environmental Policy Act, SEPA.
- The DEO defines wetland and jurisdictional boundaries and provides assessments to the Design Engineer.

Base Plans

- The Bridge Management Office develops the E&SC plan.
- The E&SC plan and plan checklist are sent to the NCDOT REU for review.
- All plans developed should use EroDes.
- Typically, base plans are a straight line diagram that may include horizontal and vertical alignments. Cross-section profile data is typically limited or not included on base plans.
- Hydraulic information for the proposed pipes and culverts are included on base plans.

Water Quality Review

- Ask if there are any applicable:
  - HQWs? (HQW, ORW, WS-I, WS-II, SA, PNA)
  - Trout (Tr) streams? Riparian Buffer rules?
  - Critical Area? (CA)
  - 303(d) streams listed for Turbidity impairments?
  - T&E species sensitive to sediment present?
- If yes to any, all jurisdictional streams require a 50-ft. ESA on both sides of stream.

Other Environmental Considerations

- ESAs are assessed for the proposed pipe or culvert operation.
- Managing the watercourse and work zone is key to bridge management construction projects.
- The ability to obtain easements is limited.

Phasing

- Bridge management construction projects have no C&G phase.
- Typically, disturbance is minimal, construction is completed and the area is stabilized in a short timeframe.
- Intermediate phase design elements are included in bridge management jobs.
- Projects are given a 30- or 60-day stabilization timeframe.

Figure 3.11 Steps to follow before developing the E&SC plans.

Managing the watercourse and work zone is key to bridge management construction projects.

Bridge Management Construction Operations Work Flow for E&SC Plans

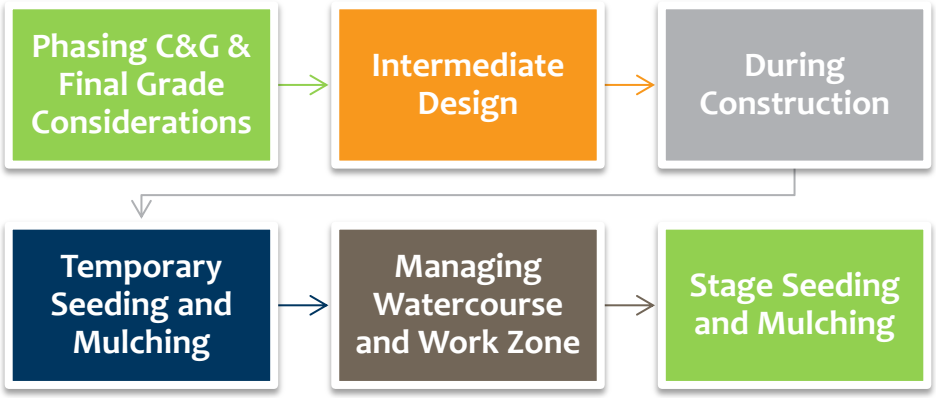

Figure 3.12 Operations flow for E&SC plans.

The bridge management construction operations work flow in Figure 3.12 outlines the process for developing the E&SC Plans. The NCDOT REU shall review and accept all E&SC plans. No land-disturbing activities shall occur in any location that does not have accepted and approved E&SC plans. Note that E&SC plans shall, at a minimum, address the requirements presented in this section.

Phasing

Typically, bridge management projects are limited to a single stream crossing and have minimal ground disturbance but involve construction activities in and around the watercourse. The construction period is limited to a few days or a few weeks and infrequently exceeds 30 days. Bridge management projects

have no separate C&G phase. Intermediate phase design elements are included on these types of projects.

Because bridge management construction activities have shorter construction schedules / time periods than conventional contracted and constructed projects, there is not typically a distinction between initial C&G operations of the site and final phase design. Rather, projects are constructed and stabilized with a 30-day timeframe once areas have been disturbed. Refer to the bridge E&SC plan design checklist available through the REU ERCON (i.e., the erosion control system from the REU Field Operations Office).

Phases of E&SC Design for Bridge Management Projects

Because of the nature of bridge management projects, they usually do not warrant separate C&G and final grade phases. The following guidelines, however, should be considered and implemented in the design of the E&SC plans as C&G and final grade activities are proposed for the site.

Good planning is essential to designing and executing an effective E&SC plan. Recall the ten key concepts of E&SC planning and design (presented in Chapter 2) as the E&SC plans are developed and implement the NCDOT-required guidelines. Specifically, for bridge management projects, the EroDes spreadsheet should be used to design and develop the E&SC plan for all projects.

EroDes Design Spreadsheet

While not all projects require the use of EroDes, all bridge management projects should be designed using the EroDes design spreadsheet developed and provided by NCDOT at:

http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.
EroDes utilizes RUSLE2 to calculate required storage volumes. There is a Help tab within the EroDes file that provides specific step-by-step guidance. The E&SC Design Engineer should then use the EroDes data to develop the E&SC plan.

- Use one worksheet for each project. Rename the Required Storage tab for the first drainage length. Each drainage length should be named by

station left or right. Then, copy the first drainage length tab and rename it for the next drainage length.

- When the worksheet is completed for a drainage section:
  - If Option 4 can be used and is chosen, the storage for the drainage length will be obtained from TRSC-As or wattles.
  - If Option 5 can be used and is chosen, the storage for the drainage length will be obtained from TRSD-B.
  - If Option 6 can be used and is chosen, the storage for the drainage length will be obtained from Silt Basin Type B.
- **Option 4 is the recommended option for bridge management projects with minimal disturbance on the approaches**. Use of Option 4 will require diversion of off-site water through or around the project. This recommendation is made due to lack of available right-of-way (ROW) for basin installation.
- **Option 5 is not recommended for bridge management projects.** The storage obtained using this method is too large to be installed on these types of projects.
- **Option 6 is the recommended option for bridge management projects with moderate disturbance on the approaches.**
- When the calculations for a project have been completed and the E&SC plan has been finalized, the EroDes spreadsheet for the project should be delivered to the NCDOT REU Field Operations Office. A hard copy should be included with the set of plans that is to remain on site during construction. The calculations are considered part of the E&SC plan.
- For more specific guidelines on using the EroDes spreadsheet, refer to NCDOT REU's website: http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.

C&G Guidelines

Bridge management projects do not have a separate C&G plan. However, C&G may be proposed for bridge management projects.

The designer should reference regulatory information regarding trout variances and riparian buffers.
For specific environmental questions, refer to Chapter 2.

When developing the E&SC plan for bridge management projects, adhere to the following general guidelines when considering C&G for the site:

- Submit the E&SC plans for approval prior to any land-disturbing operations.
- Use correct NCDOT symbology in Section 4.1 of Chapter 4.
- Account for existing topography.
- Determine drainage areas and disturbed areas.
- Consider clean water diversions to route run-on water around disturbed areas.
- Provide protection between stream and approach fill velocity control within the ditch lines using TRSC-Bs or wattles.

Construction Entrances

Construction entrances shall be considered part of the project and addressed in the E&SC plans.

- Note that construction access is normally the first land-disturbing activity and should be carefully planned.
- Refer to the gravel construction entrance in Chapter 4, Section 4.2.1 for construction details.

Inlet and Perimeter Controls

Inlet protection involves protecting existing inlet structures while perimeter controls provide the outer boundary of protection.

- Protect all existing drainage structure inlets, including bridge funnel drains that may receive stormwater with RIST-A, B, or C, PIST-A, B, etc.
- Provide inlet protection that can handle the volume of water from the respective drainage area.

- Maintain natural areas to the maximum extent possible.
- Utilize adequate perimeter controls (temporary silt ditch, temporary sediment fence, etc.).
- Supplement natural vegetation with silt fences and wattles around the perimeter, focusing on downslope areas.
    - For small drainage areas only, use these barriers to protect stream buffers, riparian areas and waterways.

Runoff Management Conveyances

Install stormwater conveyances with inlet and outlet protection devices early in the project to avoid the development of gullies and washes (NCDENR, 2008).

- Provide velocity control in conveyances and include all calculations.
- Utilize TRSC-Bs to reduce velocity in existing ditches with spacing as provided by EroDes. Also utilize TRSC-Bs in proposed temporary silt ditches and temporary diversions.
- Incorporate flocculant on wattles.
- Where approved by the REU Field Operations Engineer, utilize fiber wattles with flocculant and/or TRSC-As with matting and flocculant in temporary and permanent, existing and proposed ditches with spacing as provided by EroDes in areas where:
    - Sediment basins are not feasible at drainage outlets; and
    - Sediment and silt basins at drainage outlets cannot be properly sized to surface area and/or sediment storage requirements due to safety concerns, right-of-way restrictions, utility conflicts or other construction limitations exist.

Velocity Controls

Install velocity controls as soon as access to the site is gained. Additional velocity controls will likely be needed when grading begins. The E&SC Design Engineer will use EroDes to develop velocity controls for the project.

- Either wattles with flocculant, TRSC-Bs or TRSC-As with matting and flocculant must be used in the ditch lines as velocity controls.

Wattles (Excelsior and Coir Fiber)

- Wattle use with flocculant is required on projects in ditches that do not have riprap and which have water quality classifications of HQW or Trout. The HQW classification includes HQW, ORW, WS-I, WS-II, SA and

PNA. Wattles can be used on Non-Trout water and Non-HQW projects if the designers choose to use them. At least one wattle with flocculant must be used in drainage lengths that are designed using any method other than Option 5 in EroDes.

- Wattles with flocculant are used in place of check dams in the ditch line. The turnout measure of a drainage length will still have a rock weir, not a wattle and **without** flocculant.
- The flocculant powder should be replaced on the wattles after each 0.5-inch rain event. It is recommended that the technician conducting the NPDES inspections after the rain events also replaces the flocculant powder.
- The EroDes spreadsheet for plan design includes recommendations on the wattle number and spacing.
- Wattles are not needed in riprapped ditch lines unless there will be a delay between pulling the ditch line and riprap installation.
- A 'Wattle Installation Guide' and a 'Materials Needed for Wattle Installation' document are available for download from the REU Field Operations webpage under Important Downloads. These will give installation guidance and a list of materials needed for wattle installation and the information needed for ordering the materials: http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/.
- The wattles are 12 or 18 inches in diameter. NCDOT recommends use of the 12-inch wattles for typical foothill and mountain ditch lines. During installation the installers should verify the water flows over the low point of the wattle and not around it. The wattles are malleable and can be compressed in the middle and pinned down to ensure the water flow is over the middle of the wattle. Another alternative to obtain a low point involves excavating a perpendicular trench in the ditch line to bury part of the wattle to achieve the height needed.
- For projects that take less than a year, excelsior wattles are used. For projects greater than 1 year, coir fiber wattles are used. Typically, operations projects use excelsior wattles.
- Chapter 4, Section 4.5.1 discusses specific information about wattles.

TRSC-Bs

- TRSC-Bs are not needed in riprapped ditch lines unless there will be a delay between constructing the ditch line and installing the riprap.

- If the storage requirement from EroDes is obtained from TRSC-As, then these should be substituted for the TRSC-Bs.
- Chapter 4, Section 4.5.3 discusses specific information about TRSC-Bs.

TRSC-A with Matting and Flocculant

- TRSC-As with matting and flocculant are used in place of wattles on projects which have water quality classifications of HQW or Trout when wattles cannot be installed. Wattles are the preferred ditch check on HQW and Trout projects. TRSC-As can be used on Non-Trout water and Non-HQW projects if the designers choose to use them. At least one wattle or TRSC-As with matting and flocculant must be used in drainage lengths that are designed using any method other than Option 5 in EroDes.
- TRSC-As with matting and flocculant are used in place of check dams in the ditch line. The turnout measure of a drainage length should still have a rock weir, not a wattle and **without** flocculant .
- The flocculant powder should be replaced on the TRSC-A after each 0.5-inch rain event. The technician conducting the NPDES inspections after the rain events should also be responsible for replacing the flocculant powder.
- The EroDes spreadsheet for plan design includes recommendations on the TRSC-A number and spacing.
- TRSC-As are not needed in riprapped ditch lines unless there is a delay between constructing the ditch line and installing the riprap.
- Chapter 4, Section 4.5.2 discusses specific information about TRSC-As.

Coir Fiber Baffles

- Coir fiber baffles shall be installed in every TRSD-B and every Silt Basin Type B installed at the turnouts (including cross pipe outlets). Implement the following coir fiber baffle requirements:
    - Basins 10 feet in length or less require one baffle.
    - Basins greater than 10 feet in length and up to 20 feet in length require two baffles.
    - Basins greater than 20 feet in length require three baffles.
- A 'Materials Needed for Coir Fiber Baffles' guide is available for download from the REU Field Operations webpage under Important Downloads. The guide provides a list of materials needed for coir fiber

baffle installation. (Note: 9-gauge single strand wire can be substituted for the 8-gauge wire.) http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/

- Chapter 4, Section 4.7.7 discusses specific information about coir fiber baffles.

Sediment Storage Requirements

Sediment storage requirements are addressed in the EroDes spreadsheet. Storage for the project will be obtained from TRSC-As, wattles, TRSD-Bs or Silt Basins Type B. Bridge projects that do not disturb ditch lines will not need sediment storage calculations.

Bridge projects that do not disturb ditch lines will not need sediment storage calculations.

Culvert and Pipe Construction

For bridge management projects, E&SC phasing for pipe and culvert installation shall be included and provided for review. Installation of these items shall be in accordance with NCDOT's *Best Management Practices for Construction and Maintenance Activities*. Prior to the installation of proposed pipes and culverts, the E&SC design engineer shall submit a phasing plan for managing the watercourse to NCDOT REU Field Operations for review and acceptance.

Stockpile Management

One of the challenges of bridge management projects is the management of stockpiles. The replacement of culverts involves excavation that results in temporary stockpiles used for backfill once the new structures have been set into place. Stockpiled materials shall be contained within the work area and not placed within wetlands, protected riparian buffers or any other jurisdictional areas.

- Utilize silt fence or as a perimeter measure for stockpile locations.
- Apply straw mulch at a rate of 2 tons/acre or cover with impermeable materials, if necessary, prior to rainfall events.

- Refer to the NCDOT Construction Manual at: https://connect.ncdot.gov/projects/construction/Pages/Construction-Manual.aspx for stockpile management details.

During Construction

The E&SC Design Engineer is responsible for obtaining approval for E&SC plan revisions and maintaining accurate E&SC plans for the life of the construction project.

- During construction, any major deviations from the E&SC plan must be submitted to NCDOT REU Field Operations.
- Prior to installation of any E&SC devices, the DEO shall verify boundaries of jurisdictional areas in the field and delineate them with safety fence or flagging.
    - For guidance on safety fence and flagging in jurisdictional areas, refer to Chapter 4, Section 4.2.2.
- Whenever the Engineer determines that significant erosion and sedimentation continues despite the installation of approved protective practices, additional protective action should be taken.

Intermediate Phase Design

Intermediate erosion control plans may be required if design modifications and/or site conditions require additional E&SC design or design revisions to the E&SC plans. Intermediate plans shall be submitted for review and shall be accepted prior to construction of any aspect impacted by the revised erosion control design. Specifically, for operations projects, some examples of elements to include in the intermediate phase design might involve managing the work zone and watercourse for pipe and culvert construction activities.

Utility Construction

Utility relocation work on bridge management projects is typically handled by owners of the utility prior to construction. E&SC plans are generally not required for such work activities as moving utility poles and telecommunication pedestals or relocating underground communication cables.

Construction and Watercourse Management

Culvert replacement involves isolation of the work area from flow within the stream or watercourse. In such cases, the flow must be diverted. Steps taken

to minimize impacts to the watercourse when diverting flow either through or around the work area involve maintaining normal flow both upstream and downstream, as well as conducting activities within intermittent streams during times when there is no flow.

- Streamflow diversion is typically achieved by utilizing bypass pumping techniques or suspended bypass pipes.
- Work zone dewatering activities include effluent being pumped into a geotextile bag and treated prior to being released offsite at a non-erosive velocity through sheet flow.

Final Grade Phase

It is important to establish seeding and mulching as soon as backfilling is completed and the final typical section is established.

The most effective erosion control practice available is proper establishment of a good vegetative cover.

General

Observe applicable design components listed previously and protect existing and proposed drainage structure inlets. Utilize adequate perimeter controls; refer to the Inlet and Perimeter Controls section as needed.

Slope Protection

Slope protection is a critical step in the E&SC process and the grading plan forms the basis of the E&SC plan (NCDENR, 2008). All practices necessary for controlling erosion on the graded surface must be included in the plan and steps utilized in the previous phase may be repeated.

- Utilize temporary slope drains and earth berms at the top of fill slopes and where there are super elevations on tall fill slopes. For slope drain design and location guidance, refer to Section 4.4.1 on page 4-51. Maximum spacing between slope drains should be 200 feet.
- Utilize a rock energy dissipater at the outlet of the slope drain.
- Unless otherwise approved by the REU Field Operations Engineer, provide matting for erosion control on all slopes (cut and fill) that are 2:1 or steeper and a height of 8 feet or greater. In Trout waters, the designer should plan for biodegradable matting only.

Storm Drainage Network

- Inlet protection of all existing and proposed funnel drain inlets is critical to keep the new pipe network clean where runoff is contacting unpaved areas. Devices at all drainage turnouts shall utilize infiltration, skimmers or sediment control stone (TRSD-B, TRSC-A, etc.) and a spillway with an adequately designed base length to distribute outflow.
- Protect all funnel drain inlets within the final storm drain network (RIST-A, B, C and PIST-A, B).

Ground Cover Stabilization Requirements

Ground cover stabilization shall comply with the timeframe guidelines specified in NCG01. Excluding the slopes noted below, temporary and permanent ground cover stabilization shall be provided within seven calendar days from the last land-disturbing activity. The designer shall label all slopes subject to the 7-day ground cover stabilization requirements on all E&SC plans submitted to the Department for review and acceptance.

- For the slopes noted below, temporary and/or permanent ground cover stabilization shall be provided within 14 calendar days from the last land-disturbing activity:
  - Slopes between 2:1 and 3:1, with a slope length of 10 feet or less
  - Slopes 3:1 or flatter, with a slope length of 50 feet or less
  - Slopes 4:1 or flatter

Additional Stabilization Requirements

Seeding & Mulching

Trout buffer zones require additional ground stabilization measures.

- Graded slopes and fills within the trout buffer zone will be planted or otherwise provided with temporary or permanent ground cover (native plant and tree species), devices or structures sufficient to restrain erosion within ten calendar days of completion of any phase of grading.

Reclamation Plans for any Off-site Borrow or Waste Pits

Borrow or waste areas that are part of the project shall require a separate reclamation plan, unless the borrow or waste activity is regulated under the

Mining Act of 1971, or is a landfill regulated by the NCDENR DWSM. For newly-created borrow pits that require dewatering, borrow pit dewatering basins shall be required. The Engineer shall record the location and permit number for waste/borrow sites covered by the Mining Act or regulated by DSWM (NCDENR) on the E&SC title sheet. For reclamation procedures, refer to Section 3.7 in Chapter 3 of this manual.

Detail Sheets and Notes

Bridge management projects generally do not include detail sheets. Quantity sheets are not included, and reforestation sheets, if any, are minimal. Project-specific notes for E&SC measures should be provided as applicable to the project.

Title Sheet

Bridge management projects shall include a title sheet for the proposed E&SC plans. The title sheet shall include the following information:

- Correct notes: NCG01, HQW, ESA, C&G, etc.
- List of standard NCDOT symbology in Section 4.1 of Chapter 4
- Name and certification number of Level IIIA-certified individual responsible for designing and/or reviewing E&SC plans

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3.6 Section

Nonlinear Projects

E&SC Requirements for Nonlinear Projects

Nonlinear projects can originate from many different groups within NCDOT's organization. Examples of nonlinear projects for the Division of Highways may include site development for buildings at Division, District, Construction and Maintenance Facilities, equipment shops, rest areas and welcome centers. Nonlinear Division of Motor Vehicles projects may include weigh stations, Driver's License offices and Commercial Driver License Skill Testing sites. NCDOT's Facilities Management Division (FMD) serves to coordinate the design and construction of these facilities regardless of the source of the project.

NCDOT's FMD leads in overseeing nonlinear project development.

The E&SC design engineer for a nonlinear project shall develop the E&SC design in accordance with all applicable BB design requirements (see Section 3.1 of this chapter), including implementation of existing NCDOT E&SC design measures, Standard Specifications, Standard Special Provisions and Standard Drawings, and submit the E&SC plans to the NCDOT FMD. FMD forwards the plans to the REU S&W Engineering Section for review and FMD coordinates with the E&SC design engineer for incorporation of REU's comments. During the construction phase, the REU Field Operations office provides oversight and reviews the project for compliance with the plans.

The E&SC design engineer should reference and be guided by:

- Division 16 of the NCDOT Standard Specifications available at: https://connect.ncdot.gov/resources/Specifications/Pages/Specifications-and-Special-Provisions.aspx.
- Applicable NCDOT roadway standard drawings for E&SC BMPs available at: https://connect.ncdot.gov/resources/Specifications/Pages/2012-Roadway-Drawings.aspx.
- Applicable E&SC details which are available at: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/details/.
- An example set of E&SC plans for a nonlinear project are available at: http://www.ncdot.gov/DOH/operations/dp_chief_eng/roadside/soil_water/downloads/files/CherryPolo.pdf.

Levels I, II and III certifications are required for E&SC plans for nonlinear projects. For more information regarding training and certification, refer to Chapter 5.

Vegetation establishment shall meet the requirements of Division 16 of the Standard Specifications for Roads and Structures (current edition) as well as the regional Project Special Provisions for Seeding and Mulching which are available at the following link:

http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/soil_water/special_provisions/.

Since many of the nonlinear projects are open to the public and mowed on a more frequent basis than roadway medians and shoulders, include provisions to provide a lawn type appearance for all applicable maintained areas.

All facets of the Division of Highway's Borrow and Waste Site Reclamation Plan Procedures for contract projects will be followed including the Project Special Provisions for Contractor Borrow Source, Procedure for Monitoring Borrow Pit Discharge and Borrow Excavation and State Historic Preservation Office (SHPO) Documentation for Borrow/Waste Sites. Refer to Section 3.7 of this chapter for guidance on reclamation plan procedures.

Articles 105-16 of the Standard Specifications (current edition), Failure to Maintain the Project or Perform Erosion Control Work and 107-12 Control of Erosion, Siltation, and Pollution should also be included in any contract documentation.

In summary, for nonlinear NCDOT construction projects, the E&SC design engineer should adhere to the following guidelines:

- All applicable bid-build E&SC requirements;
- Division 16 of the Standard Specifications for Roads and Structures (current edition);
- Applicable regional special provisions for seeding and mulching;
- Applicable roadway standard drawings (current edition) for E&SC BMPs;
- Applicable NCDOT E&SC special details;
- NCDOT Reclamation Plan Procedures;
- Failure to Maintain the Project or Perform Erosion Control Work (Standard Specifications Article 105-16); and
- Control of Erosion, Siltation, and Pollution (Standard Specifications Article 107-12).

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3.7 Section

Reclamation Plans

E&SC Guidance for Reclamation Plans

Reclamation plans are required for construction projects where land-disturbing activities exceed the project limits. Construction activities that include waste and borrow pits, as well as applicable staging areas and haul roads require reclamation plans.

Applicability

NCDOT has developed and defined reclamation procedures for contracted projects and operations projects. Contracted projects are defined as those projects using a contractor (DB, BB, Low Impact Bridge, etc.) to perform construction activities. Operations projects are projects that utilize NCDOT forces to perform construction activities. If the project is contracted and is operations related, then the reclamation plan follows contracted procedures.

Borrow Sites

Borrow sites for construction activities involve the transportation of borrowed materials from outside of the project limits to locations within the project limits. When construction activities require the use of borrow materials outside of the project limits, NCDOT requires that a reclamation plan be developed for the project.

Waste Sites

Waste sites are locations associated with construction activities where waste material consists of all excavated material not used in the construction of the project. Permanent and temporary waste stockpiles beyond the project limits warrant development of a reclamation plan.

Staging Areas

Staging areas are temporary areas beyond the project limits that are used during the project to store equipment, supplies, materials or other activities related to the project.

Haul Roads

Haul roads provide access to reclamation sites. Typically, these are located on larger contracted projects, but can be needed on operations projects as accessibility issues arise. If a haul road is proposed to be developed and is associated with one of these sites, staging areas or waste or borrow locations, then it should be delineated on the reclamation plans.

Stockpiles

Stockpiles are permanent and temporary locations associated with construction activities where unused materials are stored. Stockpiles can be located within the project limits and outside of the projects limits. If stockpiles are located within the project limits, they can be included on the project E&SC plans. If the stockpiles are located outside of the project limits, then stockpiles become waste sites and warrant the development of a reclamation plan.

Reclamation Procedures

NCDOT has developed guidelines for reclamation procedures for construction activities. The reclamation procedures are applied to both contracted and operations projects where reclaimed sites exist. While there are some differences between the two types of projects (contracted and operation projects), the approach to the reclamation procedures is the same. The primary difference between the two types of projects is that in contracted projects, an environmental consultant is hired to perform the environmental evaluation. For operations projects, the DEO performs the environmental evaluation. For specific reclamation procedures for contracted and operations projects, refer to the NCDOT REU Field Operations website.

- Reclamation Procedures for Contracted Projects: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/fieldops/downloads/Files/ContractedReclamationProcedures.pdf.
- Reclamation Procedures for Operations Projects: http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/fieldops/downloads/Files/OperationsReclamationProcedures.pdf.

Checklist Overview

For both contracted projects and operations projects, Figure 3.13 outlines the process for developing the reclamation plans in the initial stages and carrying it through to the final completion and observation period for the proposed construction activities for the reclaimed site.

Initial Reclamation Plan Considerations

Several factors should be considered in the initial stages of reclamation plan development:

- Consider how the proposed construction activities (including the reclaimed sites) will environmentally impact the existing and adjacent areas.
- Consult with the Resident Engineer and obtain REU Field Operations Engineer approval.
- Verify setback and buffer requirements.
- Verify permitted uses for waste and borrow activities.

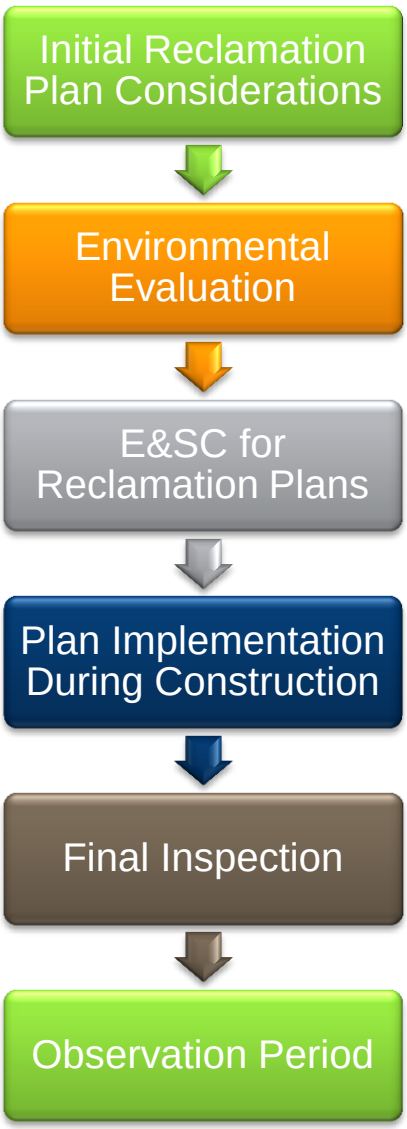

Figure 3.13 Considerations during the initial stages of the reclamation plan development.

Environmental Evaluations

For contracted projects, an environmental consultant employed by the contractor (DEO for operations projects) performs the environmental evaluation of the proposed activities. The Resident Engineer will evaluate the environmental evaluation, reclamation plans and associated checklist.

The environmental evaluation is a report that documents descriptions of the site and adjacent areas, location of jurisdictional areas and surface waters at the site and adjacent areas, and regulatory requirements. Table 3.1 outlines components of environmental evaluations. Regulatory agencies should be consulted for guidelines to address environmental impacts.

No reclaimed site activities can occur within HQWs Zones (WS-I, WS-II, ORW, Class SA and Primary Nursery Waters) unless authorized by an environmental permit.

Environmental Evaluations

Descriptions
- Existing topography
- Soil conditions
- Hydrologic conditions
- Vegetative communities
- Qualifications and experience of investigators and methodologies applied

Environmental Delineations
- Locate jurisdictional areas and surface waters
- Locate CCPCUA impacted counties
- Locate riparian buffers

Documentation
- Identify federally-protected species
- Include SHPO review
- Includes Skaggs Method and calculations, if applicable

Table 3.1 Environmental evaluations

Borrow Pits

Borrow pit activities require specific environmental and design considerations when developing the reclamation plan for construction activities. The location of the borrow sites with respect to the water table should be addressed and noted on the reclamation plans.

Water Table

The relationship of the borrow pit activities to the water table must be considered when evaluating environmental impacts. As part of the EA, the environmental consultant will consider borrow pit impacts on wetlands and surface waters within 400 feet of the site. If jurisdictional areas are identified within the proposed borrow pit location or within the 400-foot perimeter and

dewatering, wet mining or excavating below the seasonal water table or adjacent streambed elevation is planned, the contractor should maintain a 400-foot buffer between the land-disturbing activity or obtain concurrence for the proposed activities from the Corps.

As part of the concurrence process through the Corps, the contractor's Level III-certified individual must provide hydrologic analysis and calculations that demonstrate that the proposed borrow pit will not adversely affect the surrounding jurisdictional features.

Figure 3.14 gives an overview of the Corps approved method for determining the minimum buffer required between the borrow pit activities and adjacent jurisdictional features.

For specifics on using the Skaggs Method to determine borrow pit setbacks in Type 1 and 3 borrow pits, refer to the NCDOT REU Field Operations website:

http://www.ncdot.gov/doh/operations/dp_chief_eng/roadside/fieldops/downloads/.

Dewatering Within the Borrow Pit

If a borrow pit requires dewatering, the volume of the borrow pit dewatering basin will be based on a 2-hour retention time. Additional dewatering requirements for borrow pits are outlined in the Dewatering Borrow Pits section on the NCDOT REU Field Operations website. This section includes a turbidity reduction options sheet (Appendix A of this manual), information about the lateral effects of borrow pits, Skaggs Method information and software and pit dewatering basin design guidelines.

E&SC for Reclamation Plans

E&SC measures should be included on the reclamation plans. The reclamation plan procedures on the NCDOT REU Field Operations website provides specific guidelines for construction activities with drainage areas less than and greater than 1 acre in size.

Determine Borrow Pit Type

Type 1 Wetland Upgradient of the Pit
The ground surface of the wetland adjacent to a pit is higher than the water level in the pit.

Type 2 Wetland Downgradient of the Pit
The ground surface of the wetland is at an elevation lower than the average water level in the borrow pit.

Type 3 Wetlands Upgradient and Downgradient of the Pit
A combination of Types 1 and 2, the pit is adjacent to two wetlands with one wetland upgradient and the other downgradient of the pit.

Determine Setbacks

Type 1
Use Skaggs Method

Type 2
Maintain minimum 25' from wetland, 50' from stream

Type 3
Use Skaggs Method

Figure 3.14 Method for determining minimum buffer requirements for borrow pit activities adjacent to jurisdictional features.

Plan Implementation During Construction

The E&SC measures proposed for the project reclamation plans are installed during the construction phase. The measures are designed to be installed and operated throughout the duration of the construction activities and until stabilization requirements have been met for the reclaimed area.

Specifically for borrow pits, refer to the Procedures for Monitoring Borrow Pit Discharge Special Provision.

Final Inspection

Final inspection can occur when the construction activities are completed according to the reclamation plans. The property owners should be notified of the completion of construction activities and notified of the 1-year observation period.

Observation Period

Upon completion of the construction activities and final project inspection, the site will be monitored for 1 year or one growing season following the final inspection date for any repairs or modifications that need to be made. If repairs are needed, the contractor (Engineer for Operations projects) will perform the work to provide a stable site with groundcover suitable to restrain erosion.

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3.8 Section

Construction Site Pollutants

E&SC Plan Guidance for Managing Construction Site Pollutants

While sediment tends to be the primary focus when managing stormwater discharge from construction activities, there are several "good housekeeping" requirements necessary to prevent other pollutants from adversely affecting receiving waters that deserve discussion. Section II.B.1 of NCG01, Construction Site Pollutants, addresses these items by requiring site-specific management of construction activities in the following areas:

- Equipment operation and maintenance
- Material handling
- Building material waste handling
- Stockpile location and handling, and
- Concrete handling

Section II.B.1 of NCG01, Construction Site Pollutants, requires site-specific management of construction activities.

Implement the BMPs provided in Table 3.2 to prevent construction site pollutants from reaching state waters.

Table 3.2 BMPs for Construction Site Pollutants

Construction Activity	BMPs

Equipment Operation and Maintenance	▪ Maintain equipment to prevent leaks of potential contaminants.
	▪ Do not discharge fuels, lubricants, coolants, hydraulic fluids and all petroleum products onto the ground or surface waters.
	▪ Note that construction sites may be subject to 40 CFR Part 112 regulations that require the preparation and implementation of a Spill Prevention Control and Countermeasure (SPCC) Plan to prevent oil spills from aboveground and underground storage tanks. The site is subject to this rule if the project:
	  ▪ *Has a total storage capacity (count only containers >55 gal) greater than 1,320 gallons or a completely buried storage capacity greater than 42,000 gallons and*
	  ▪ *Could reasonably be expected to discharge oil in quantities that may be harmful to navigable waters of the United States and adjoining shorelines (EPA, 2007).*
	▪ Clean up all spent fluids and dispose of properly; refer to Appendix E for guidance on developing a spill response plan.
	▪ Conduct refueling operations in an area where leaks or spills will not discharge, flow or be washed into the stormwater drainage system.
	▪ Centralize refueling activities in one location equipped with containment features.
	▪ Minimize mobile refueling operations during times of heavy rainfall.
	▪ Position mobile refueling vehicles no more than 50 feet from the vehicle being refueled. Personnel should be instructed to avoid the topping off of fuel tanks. Topping off increases the risk of fuel being spilled on the ground.
	▪ Create an on-site fueling and maintenance area that is clean and dry. The on-site fueling area should have a spill kit, and staff should be trained on how to use it. If possible, conduct vehicle fueling and maintenance activities in a covered area; outdoor vehicle fueling and maintenance is a potentially significant source of stormwater pollution (EPA, 2007).

Material Handling	▪ Herbicide, pesticide and fertilizer usage during construction shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 and used in accordance with label restrictions. ▪ Store materials indoors and under a cover when possible. Secondary containment is required if materials are stored outdoors.

For further guidance refer to the Waste Handling and Disposal and Hazardous Materials Management chapters from NCDOT's *Industrial and Roadway Maintenance Manual* in Appendix F.

Table 3.2 BMPs for Construction Site Pollutants	
Construction Activity	**BMPs**
Building Material Waste Handling	▪ Dispose of all wastes composed of building materials in accordance with NC Administrative Code Section 15A NCAC 13B. ○ Approved disposal methods per 15A NCAC 13B include sanitary landfills, land clearing and inert debris landfills, incineration or other sanitary methods approved by the NC Division of Waste Management. ▪ Note that land clearing waste includes stumps, trees, limbs, brush, grass and other naturally occurring vegetation generated solely from land clearing activities. Land clearing waste is considered nonhazardous. ▪ Note that inert debris includes unpainted concrete, brick, concrete block, uncontaminated soil, untreated and unpainted wood, rock and gravel. Inert debris is considered non-hazardous waste. ▪ Create staging areas dedicated for management of land clearing and demolition debris, construction and domestic waste and hazardous waste. ▪ Inspect areas often and label all hazardous waste materials. NCDOT uses a wide range of hazardous materials including adhesives, antifreeze, asphalt mix and liquid asphalt, asphalt releasing agent, batteries, cleaners, deicing materials, fertilizer, filters, fuel, oil, paint, pesticides and solvents. ▪ Store paints, solvents, pesticides, fuels and oils, other hazardous materials or any building materials that have the potential to contaminate stormwater indoors or under cover when possible or in areas with secondary containment. ▪ Provide training on proper handling and storage practices within staging areas. ▪ Staging areas must be at least 50 feet away from storm drain inlets and surface waters. ▪ Provide storage in accordance with secondary containment regulations and provide cover for hazardous materials when necessary. Storage containers should be regularly inspected for leaks, corrosion, support or foundation failure or any other signs of deterioration and tested for soundness (EPA, 2007).

Table 3.2 BMPs for Construction Site Pollutants	
Construction Activity	**BMPs**
	▪ Dumping of paint and other liquid building material wastes in storm drains is strictly prohibited. ▪ Manage and dispose of litter and sanitary waste properly to prevent them from entering storm drains or waters of the state. ▪ Tie or stake-down portable toilets and provide secondary containment beneath them where possible.
Stockpile Location and Management	▪ Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. ▪ Protect stockpiles from stormwater runoff using a perimeter sediment barrier such as berms, dikes, silt fences or wattles. ▪ Install E&SC measures and stabilize them per an approved reclamation plan (see Section 3.7 for reclamation plan guidance).

The E&SC designer should include details and quantities for concrete washout structures for projects receiving commercial concrete mixes.

Concrete Handling	▪ Control and manage concrete materials onsite, including excess concrete, to avoid contact with surface waters, wetlands and buffers. ▪ Do not discharge any concrete or cement slurry from the site. ▪ Dispose of, or recycle, hardened concrete residue in accordance with local and state solid waste regulations. ▪ Establish washout areas and indicate their locations with signs. ▪ Provide adequate containment for the amount of wash water that will be used. Inspect washout structures daily to detect leaks or tears and to identify when materials need to be removed. Dispose of materials properly. The preferred method is to allow the water to evaporate and to recycle the hardened concrete. Full service companies may provide dewatering services and should dispose of wastewater properly. Concrete wash water can be highly polluted. It should not be discharged to any surface water, storm sewer system, or allowed to infiltrate into the ground. It should not be discharged to a sanitary sewer system without first receiving written permission from the system operator (EPA, 2007). ▪ Note that discharges from on-site concrete plants require coverage under a separate NPDES permit – NCG140000.