Chapter 5 – Sedimentation and Erosion Control

5.1 Introduction

The Sediment Pollution Control Act (SPCA) of 1973 is a performance-oriented law. It was created to prevent pollution by sedimentation while still allowing development within our state. The SPCA is the enabling legislation that gives authority to the Sedimentation Control Commission (SCC) and the Land Quality Section (LQS) - Erosion and Sediment Control (E&SC) Program.

The NC Sedimentation Control Commission may delegate authority to implement the Sedimentation Pollution Control Act (SPCA) to cities and counties that adopt a local qualifying erosion and sediment control ordinance in compliance with North Carolina state requirements. The staff of the delegated Local Programs perform plan reviews and enforce compliance of the SPCA within their jurisdictions.

Per Wake County Unified Development Ordinance Article 10, land-disturbing activities within the County's jurisdiction must control accelerated erosion and sedimentation to prevent the pollution of water and other damage to lakes, watercourses, and other public and private property by sedimentation. Sedimentation and erosion control devices must be installed and maintained to prevent any offsite sedimentation for any development regardless of the size of the land disturbance.

Unless exempted by our UDO, Article 10, new development shall submit an application for land disturbance permit including plans, maps and calculations. All erosion and sediment control plans and measures must conform to the minimum applicable standards specified in both North Carolina's *Erosion and Sediment Control Planning and Design Manual* and this manual. In the case of any conflict, the more stringent criteria shall apply.

5.1.1 Land Disturbances Requiring an Approved Plan and Permit

Unless it meets one of the listed exemptions of UDO 10-13-2, land disturbance requires both an approved erosion and sedimentation control plan and an issued land disturbance permit when:

- the disturbed area for the project will equal or exceed 1 acre
- the disturbed area for the project is less than 1 acre but is part of a larger common plan of development which will have a total cumulative disturbance that will equal or exceed 1 acre
- sediment control measures are needed to protect against offsite damage (this may be required by the County, per UDO 10-30-1(B) when determined to be necessary)

When calculating the area of proposed land disturbance, it should be noted that associated activities including access and haul roads, borrow and waste areas (if conducted by the same person), roadside shoulders and ditches for individual lots, septic fields, and utility construction must be included within the limits of disturbance unless they are covered under another approved erosion and sedimentation control plan and permit. Reference UDO 10-13-1(A) for more details. If any of these areas are covered under another SEC permit, the project name(s) and permit number(s) shall be identified on the erosion control plan sheets.

No land disturbing activities (including clearing, logging, or timbering) may begin on a site which requires a land disturbance permit until the required erosion and sedimentation control plan is approved and the required land disturbance permit has been issued by the County. The County does not allow "early grading" or logging/clearing/grading of a site for projects within its jurisdiction prior to County approval of construction drawings and issuance of associated permits.

5.1.2 Land Disturbances Not Requiring an Approved Plan and Permit

Per UDO 10-20-5(B), projects which are not required to obtain an approved erosion control plan and permit are still required to provide and maintain sufficient measures to retain sediment onsite, in order to protect all public and private property from sedimentation and erosion damage caused by the land disturbing activities. Failure to do so may result in enforcement actions, including civil penalties, if an inspection identifies that the sedimentation has left the site.

Minimum required measures include:

- Construction entrance(s), 10 feet wide and 30 feet long, or equivalent, at all points where construction vehicles will enter or exit the project.
- Silt fences on the low sides of the lot/disturbance. For all projects that require a building permit, this silt fence must be installed prior to the initial footing inspection conducted by the County Building Inspections Division.
- Measures shall conform to Wake County standard details

Note that additional measures may be necessary and required to be installed and maintained in order to retain sediment generated by the disturbance on the property/tract. It is the property owner's responsibility to ensure that sufficient stabilization/groundcover or protective measures have been installed to restrain accelerated erosion and to prevent offsite sedimentation.

Prior to any Certificate of Occupancy (CO) being issued, all areas within 25 feet of the edge of pavement or gravel of the road must be permanently stabilized.

5.2 Financial Responsibility/Ownership (FRO) Form and Landowner Consent

The Wake County Financial Responsibility/Ownership Form is required to be included with any application for a sedimentation and erosion control (SEC) permit. A plan submittal is not complete if this form is missing or incomplete. The form must be fully and accurately completed, signed, and notarized in order to be reviewed and accepted by the County. Items on the FRO Form which are not applicable should not be left blank, but should be indicated as "N/A."

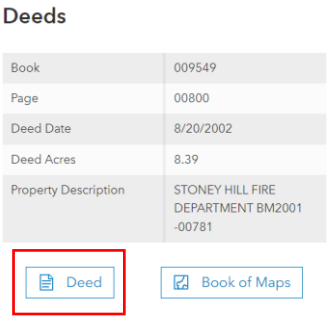
Common mistakes on FRO forms which cause them to be rejected include:

- Project name on the FRO form does not match other submitted paperwork, including the plans and application. Note that it is requested that the following naming convention be used for individual lot construction within a larger subdivision – *Subdivision Name Lot X* or *Subdivision Name Lots X-Z.*

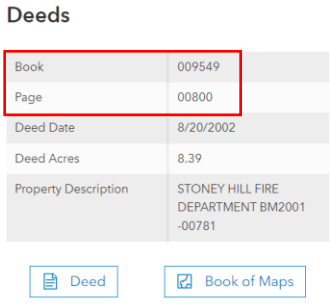
- Latitude and longitude are not provided in decimal degrees.

- Total disturbed acreage on the FRO form does not match other submitted paperwork, including the plans and application.

- Copies of the current deed(s) of all property covered under the plans and permit application have not been provided. A copy of the deed(s) can be downloaded from the iMaps property record.



- Deed book and page number of deeds have not been listed on the FRO form. The Deed book and Page number can be found from a copy of the deed, or from iMaps. From iMaps, under "Deeds":



- Landowner(s) of record on the FRO form does not match County tax records (refer to iMaps) and/or does not use the correct, legal names listed as the property owner(s).

- An individual's name is listed as the financially responsible party, but that person is signing the form on behalf of a company which is actually intended to be the financially responsible party.
    - For example, "John Smith" is listed as the financially responsible party under Part B1 of the form, but he has signed the FRO form as "Manager" of ABC Builders, LLC. In this case, "ABC Builders, LLC" should be listed as the financially responsible party in Part B1.

- The company listed as the financially responsible party does not match the legal name of the company as registered with the NC Secretary of State.
    - For example, "ABC Builders" was listed on the FRO form when the legal company name is "ABC Builders, LLC."

- The person signing the form on behalf of the financially responsible party (FRP) is not listed as a company officer or registered agent with the NC Secretary of State.
    - The form must be signed by the Financially Responsible Party if an individual (or his attorney-in-fact).
    - If the FRP is a company, then the form must be signed by a company officer, director, partner, or registered agent with the authority to execute instruments for the Financially Responsible Party. Alternatively, a company officer may give authority for another person to sign on behalf of the company via a signed and notarized signature authority form or other documentation. The County has developed a sample form which may be used. If used, this sample form should be printed on company letterhead.

- The financially responsible party is not a resident of Wake County but has not provided a designated Wake County agent to receive notices, etc.
    - Companies and corporations are legally required to provide a registered agent to the NC Secretary of State as part of business registration. A registered agent is a person or company that is designated to receive legal correspondence on behalf of and relay important messages to the Financial Responsible Party in a timely manner. Part B.2(b) of the FRO must be completed with the information provided to the NC Secretary of State when applicable.
    - If the financially responsible party is not the same person or entity as the property owner(s), then a signed and notarized statement of landowner consent is required to be submitted with the FRO form. This statement must be signed by all owners of the property and must clearly provide consent for the financially responsible party to submit the draft erosion control plan and to conduct the anticipated land disturbing activity on their property. Landowner consent is a requirement of the North Carolina Sedimentation Pollution Control Act of 1973 G.S. 113A+54.1(a) and the Wake County UDO Article 10-30-2(B)(2)(c). A sample landowner consent form may be found here.

5.3 Basic Control Objectives

Erosion and sedimentation control plans shall be designed to address the following objectives, as required by 15A NCAC 04B .0106 and UDO 10-30-4. Plans which fail to adequately address these objectives shall be disapproved.

5.3.1 Identify Critical Areas

> Onsite areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation, must be identified and receive special attention.
> UDO 10-30-4(A)(1)

When developing an erosion and sedimentation control plan, it is recommended that the designer walk the site to be developed. This site visit can help to check for potential drainage features; note existing vegetation and cover; note any lakes, potential streams or wetlands; and check for existing erosion or drainage problems onsite. It is important to look downstream for potential impacts from development so that a plan can be made to prevent or mitigate these impacts.

To meet this basic control objective, it is necessary to:

- Identify any jurisdictional streams, buffers (County or State), or wetlands on or adjacent to the property(ies) being developed. Excavation below the water table for the installation of measures should not occur.
- Identify any proposed impacts to any of these features.
- Ensure that adequate erosion and sedimentation control measures are proposed to protect these features.
- Consider downstream receiving waters or ponds. Turbidity curtains or other measures may need to be specified for protection of these waters.

The erosion and sedimentation control plan should include:

- Pre- and post-development contours and drainage patterns
- Identification of sensitive or critical areas (streams, buffers, wetlands, etc.) and approvals for any proposed impacts provided. Buffers should be labeled with their type and width specified.
- Identification of areas of steep slope
- Soils data
- 401/404 permitting information and corresponding Stream and Wetland Impact Maps
- Adequate erosion and sedimentation control measures and/or stabilization techniques to protect these critical areas
- Plans for adequate access throughout the site, especially as related to temporary stream crossings and additional erosion and sediment control measures, details and/or construction sequences needed during construction around these sensitive areas

5.3.2 Limit Time of Exposure

All land disturbing activities must be planned and conducted to limit exposure to the shortest feasible time. UDO 10-30-4(A)(2)

Limiting the time that a disturbed area remains unstabilized and subject to accelerated erosion is an important factor in developing an adequate erosion and sedimentation control plan. Temporary or permanent stabilization is the key to limiting the time of exposure of bare areas subject to accelerated erosion.

Erosion and sedimentation control devices like basins and diversions should be stabilized immediately upon construction to avoid interior erosion of the measures which will require maintenance/rework and otherwise contribute to sedimentation. Steep slopes or areas which are difficult to reach may need special techniques specified to achieve stabilization.

To meet this basic control objective, it is necessary to:

- Plan work so that exposure of disturbed areas is kept to the shortest feasible time.
- Stabilize certain measures and areas below them immediately upon construction, and other areas within minimum specified timeframes.
- Utilize both temporary and permanent groundcover effectively to minimize the time that disturbed areas are exposed.
- Provide proper seed bed preparation and amendments to ensure adequate vegetative stabilization. Rolled erosion control products may be specified to assist with stabilization. Special care should be given to areas of steep slopes, which may benefit from more specific techniques like hydroseeding/mulching.
- Maximize work area efficiency through a detailed construction sequence.

The erosion and sedimentation control plan should include:

- Stabilization timeframes to meet County (UDO 10-20-10(B)) and State NCG01 requirements
- Annotation of slopes to facilitate implementation of stabilization timeframes
- A detailed construction sequence that includes any special vegetative considerations or techniques
- Requirements that sediment basins and diversion channels and the areas downgradient of these devices be stabilized immediately upon construction (rolled erosion control products should be specified as needed)
- Access road, parking and material laydown area proposed locations and stabilization
- Location(s) where mulch grindings from clearing and topsoil stockpiling will be located onsite and the plan for sediment control and groundcover for these stockpiles
- Method of seed bed preparation
- Seeding specifications, including seed type and rates (both temporary and permanent) and special provisions for any special areas, including steep slopes or riparian buffers, as needed.
- Amendment types and rates (lime, fertilizer, etc.)

- Mulch type and rates (including method of anchoring)
- Detailed sequencing and specifications for special stabilization methods such as hydroseeding, hydromulching, chemical soil stabilization, and use of native warm season grasses
- Specifications for temporary/permanent liners or rolled erosion control products as needed

5.3.3 Limit Exposed Areas

All land disturbing activities must be planned and conducted to minimize the size of area to be exposed at any one time. UDO 10-30-4(A)(3)

When designing a plan to protect against erosion and sedimentation, care should be taken to limit the size of area exposed and subject to accelerated erosion at any given time. A project should have a site-specific construction sequence and adequate phasing to address erosion and sedimentation control needs as the site is changing during development. Larger graded projects will benefit from phasing construction to limit the extent and duration of disturbed area open at one time to no more than 20 (in high quality water zones) to 50 acres. Linear projects should be planned to stabilize the disturbed area at the end of each workday or after a specified length of work (linear feet). Temporary stabilization is the key to limiting the exposed bare areas subject to accelerated erosion during active grading.

To meet this basic control objective, it is necessary to:

- Develop a site-specific construction sequence.
- Limit initial clearing and/or land disturbance to only the area necessary to install the initial permitted perimeter measures for the site (construction entrances, silt fence/silt fence outlets, sediment basins, diversion channels, etc.).
- Phase construction activities to limit the amount of area disturbed and unstabilized at any given time.
- Consider the minimum disturbance needed to balance cut and fill onsite.
- Consider preserving the topsoil onsite in a stockpile to facilitate better vegetation establishment.
- Consider selective clearing and specify that areas will not be cleared until ready to grade. If clearing onsite, it is strongly recommended to grind the material onsite and retain it for mulch to be used as groundcover.

The erosion and sedimentation control plan should include:

- A detailed, site-specific construction sequence, as described in Section 5.4 of this manual
- Phasing of larger projects which will limit the maximum amount of acreage disturbed at any one time without stabilization. This can be done with a flexible or “rolling” limit to specify a maximum area disturbed and unstabilized at any given time during the project. For example, a larger project may propose to limit disturbed areas to no more than 50 acres at any given time during construction.
    - Note: Uncovered areas in High Quality Water (HQW) zones must be limited at any time to a maximum total area of 20 acres within the boundaries of the tract. Reference UDO 10-20-11. Only the portion of the land disturbing activity with an HQW zone is governed by this rule.
- For stage seeding, provide temporary stabilization along project perimeter to allow for additional area within the limits of disturbance to be graded.

5.3.4 Control Surface Water

Surface runoff originating upgrade of exposed areas must be controlled to reduce erosion and sediment loss during the period of exposure. UDO 10-30-4(A)(4)

Plans should be designed to control surface water and provide for its stable conveyance in both the temporary and permanent (final) condition.

To meet this basic control objective, it is necessary to:

- Divert offsite water around land disturbance via clean water diversions where possible.
- Ensure positive drainage to measures through all phases of construction.
- Consider early installation of culverts and storm drainage onsite.
- Specify stable conveyances of runoff for channels, slopes, and at transitions into basins.

The erosion and sedimentation control plan should include:

- Clean water diversions to divert clean water around areas of disturbance where possible, addressing immediate groundcover upon installation through use of rolled erosion control products, and non-erosive discharge for the outlets
- Positive drainage to treatment measures through all phases of construction
- Stable conveyance of runoff in channels and over slopes
- Stable conveyance of runoff to sedimentation control measures through temporary and permanent diversions or slope drains
- Stable transitions into basins (impermeable liners, riprap, slopes drains, etc.)
- Check dams as a velocity check in diversions
- Slope breaks as needed
- Permanent stormwater drainage facilities, including channels, swales, pipes, and culverts
- Berms located at top of slopes with slope drains for slopes greater than 10 ft in height

5.3.5 Control Sedimentation

All land disturbing activity must be planned and conducted to prevent offsite sedimentation damage. UDO 10-30-4(A)(5)

The primary objective of the County and State erosion and sedimentation control regulations is to prevent offsite sedimentation damage to streams, other environmental features, and adjacent properties.

To meet this basic control objective, it is necessary to:

- Provide a site-specific construction sequence to guide work onsite, with particular attention given to onsite stream crossings and downstream lakes or natural watercourses, etc.
- Provide for adequate perimeter control measures and equipment access for their maintenance, repair, or replacement.
- Provide for treatment of silt-laden runoff as close to the source as practical.
- Select and locate measures as needed to provide treatment through all phases of construction based on drainage areas, soil types, slopes, etc.
- Minimize exposure and subsequent erosion.
- Install stable outlets to prevent erosive discharge from the site.
- Provide for decommissioning and dewatering of basins upon completion of construction.

The erosion and sedimentation control plan should include:

- Existing and proposed elevation contours, with major measures (including basins) shown tying into these contours
- Stable construction entrances/exits at all points where construction traffic will enter or exit the project
- Stable material laydown, staging and stockpile areas within the limits of disturbance. Plan should include notes for the Wake County Stockpile (Wake County Stockpile Requirements)
- Properly designed erosion and sedimentation control measures to provide stable conveyance or runoff and treatment/storage through all phases of construction, with supporting calculations and drainage area maps. Design of measures shall conform to the standards specified in the NC Erosion and Sedimentation Control Planning and Design Manual or this manual, whichever is more stringent.
- Outlet protection to ensure non-erosive discharges
- Stable road shoulders and swales. Silt fence installation behind back of curb or anchored RECP adjacent this area. Stable lots if not active.
- Summaries of basic dimensions for erosion control measures (length, width, depth, side slopes, etc.) provided in tabular form on the plans
- Tables with basin measurements (required and proposed basin length, width, and depth, spillway length and depth, side slopes, Skimmer size and orifice dimensions,) and diversion channels (Bottom

width, depth, side slopes, shear stress, groundcover proposed)Clear, consistent labels for all measures (ex: SB-1, TD-1, etc.)

- Additional measures (not just silt fence) below graded slopes that are more than 10 feet high
- Berms and slope drains to collect and convey runoff down slopes greater than 10 feet high
- Berms to route runoff to inlets (note that asphalt berms may be used in later phases of construction when roads have been installed).
    - Rolled earthen berms shall be provided and maintained immediately down gradient of the protected inlet until the roadway is stoned.
    - A road subbase berm shall be maintained until the road is paved.
    - A six-inch minimum height asphalt berm shall be maintained until the roadway surface receives its final coat.
- Inlet protection with excavated storage when treatment is still needed for an area
- Appropriate construction and maintenance details for all proposed measures. Wake County details should be used if available.
- A site-specific construction sequence addressing all phases of construction
- A multi-phased erosion and sediment control plan to address existing conditions, changes to the site during construction, and final grading conditions. More information on phasing requirements can be found in Section 5.4 of this manual. At a minimum, at least three phases will generally be required for an adequate erosion and sedimentation control plan:
    - The initial phase is for the installation of initial/perimeter ESC measures only, as well as the limited clearing/grubbing/disturbance associated with that installation.
    - The intermediate phase(s) will include measures for mass grading, infrastructure, roads, etc.
    - The final phase will be final grading conditions for development and stormwater management.
- Special sequencing and appropriate measures at stream crossings or other sensitive areas to include additional erosion and sediment control measures, details and/or construction sequences. Rock Ford crossings for temporary stream crossings are not allowed.
- Basin dewatering/decommissioning sequence to be used prior to removal or conversion to post-construction measures
- The use of flocculants and/or turbidity curtains when soil conditions warrant to reduce the amount of suspended sediments from the construction activity and impacts to adjacent freshwater bodies
- Detailed construction sequence for conversion of basins from temporary to permanent stormwater devices. Details shall include a landscape/planting plan for each device.

As previously noted, design and specification of all erosion and sedimentation control measures shall conform to the standards specified in the NC Erosion and Sedimentation Control Planning and Design Manual or this manual, whichever is more stringent. Listed below are some important requirements for proper design of certain commonly used measures that are often overlooked or missing from initial plan submittals.

Construction Entrances

Construction entrances are often the most visible areas of a construction site to the public. Construction entrances provide an area where mud can be removed from tires prior to entering the public roadway. A well-maintained construction entrance reduces the amount of mud tracked off site, keeps roadways looking neat, improves public perception and complies with State and Wake County requirements.

- Construction entrances must be installed at every point where construction traffic leaves the site.
- When possible, the entrance should be located on level ground and at locations with appropriate sight distance.
- All surface water flowing off the construction entrance should be directed to a sediment control measure (ex: check dam within a roadside ditch) or directed away from the right of way.
- If the construction entrance crosses a depression (ex: a roadside ditch) a culvert pipe should be installed.
- Construction entrances within the NCDOT Right of Way require a temporary driveway permit from NCDOT.
- Construction entrances shall be installed in accordance with the Wake County construction details, including installation of geotextile fabric underlayment.
- Construction entrances should not be used for parking of vehicles or employees. Separate stabilized areas for equipment or vehicular parking should be provided within the limits of disturbance.
- The sides of the construction entrance may need to be blocked off onsite to prevent vehicles from cutting across the entrance.

Silt Fence

Silt fence is one of the most often used measures on a site, but there are several limitations to its use.

To function properly, silt fence should be:

- Placed along contours to capture sheet flow, with the ends of the fence tying into higher ground to prevent flow around the ends of the fence.
- Installed in accordance with the Wake County construction detail.
- Provided with excavated storage as needed for deposition and to prevent failure of the fencing.
- Provided with silt fence outlets as needed to provide relief and to prevent failure of the fencing.
- Located at least 5-10 feet beyond the toe of the slope to provide adequate storage area for sedimentation and to facilitate maintenance of the measure.
- Used below small, disturbed areas based on the slope and slope length in accordance with the specifications in the NC Erosion and Sedimentation Control Planning and Design Manual below:

Slope	Slope Length (ft)	Maximum Area (ft^2)
<2%	100	10,000
2 to 5%	75	7,500
5 to 10%	50	5,000
10 to 20%	25	2,500
>20%	15	1,500

Note that installation of a double row of silt fence does not allow for additional drainage area to be captured by the fence. Super silt fence may be used as needed at the toe of slope to prevent sediment loss to buffers or water features.

Silt fence should never be specified or installed across streams, ditches, waterways, or other areas of concentrated flow. Silt fence may not be used alone below graded slopes greater than 10 feet in height.

Sediment Basin Design

Wake County sediment basin design and construction requirements are unique and County specific. The County requirements are more stringent and differ from the EPA, NCDEQ, and other municipalities. Federal guidelines require all sediment basins with 1 acre or more of drainage area to drain (dewater) from the top of the water column. Below are Wake County's minimum requirements for sizing the sediment basin and the associated weir (if utilized).

- The required volume of the sediment basin shall be calculated by 1,800 cf/acre of drainage area.
- The required surface area (sf) shall be calculated as 435 x Q_{10} for all types of sediment basins. A minimum c-value of 0.5 shall be used for areas draining to the basin.
    - Note that a 25-year design storm must be used for measures located in High Quality Waters and Falls Lake. Refer to section 5.3.5.1 of this manual, below, for specific design requirements for measures in these areas.
- The maximum depth allowed is 4 feet from the bottom of the basin to the weir.
- The minimum depth required is 2 feet from the bottom of the basin to the weir.
- The floor of all basins should be roughly level.
- Basins should be designed to dewater the required (not provided) volume in 3-5 days.
- The required (not provided) sediment basin volume shall be used to size the skimmer and orifice diameter.
- The minimum weir length is 10 feet.
- When using the weir equation, $Q= C*L*H^{(3/2)}$
    - The maximum C shall be 3.0.
    - H for Q is not to exceed 0.5 feet.
    - An additional 1 foot of weir capacity is required for conveyance of larger storm events; therefore, the total weir depth will be 1.5 feet.

Use the Wake County Hybrid Sediment Basin Design Spreadsheet available on the web site. Calculations must be provided for skimmer sizing and drawdown, as well as for the sizing of the anti-flotation block of the permanent riser. Materials for the permanent riser shall be specified on the construction plan. Additional requirements for the sequencing of dewatering, decommissioning or conversion of sediment basins may be found in Section 5.7 of this manual.

Diversion Channels

Diversion channels, both temporary and permanent, should be stabilized immediately upon construction to prevent interior erosion and sedimentation from the measures themselves. It is strongly recommended that rolled erosion control products be used as part of this stabilization. A temporary diversion shall be designed to convey no more than 5 acres of drainage area and its length shall be no longer than 3,000 linear feet. Care should be given to provide positive drainage and to show contours for diversions that cross drainageways.

Calculations for all diversions should be done for two conditions:

- "Temporary" bare earth condition: Both velocity and shear stress should be calculated for the peak flow from a 2-year storm event in a bare earth condition to determine whether a temporary liner is required. If this temporary condition results in a velocity over 2 ft/s, a temporary liner shall be specified.
- "Proposed" condition: Both velocity and shear stress should be calculated based on the proposed stabilization for the channel (grass, riprap, etc.) and the peak flow from a 10-year storm event (25-year storm event in High Quality Waters and Falls Lake Watershed). The plan designer must confirm that the proposed stabilization is adequate for both the velocity and shear stress.

Temporary Stream Crossings

Stream crossings should be specified and given particular consideration when developing an adequate erosion control plan so that the stream or waterway is protected from sedimentation damage. The sequencing and details for stream crossings are critical elements to the success of a plan.

A few key considerations for stream crossings on the plan include:

- Crossings should be perpendicular to the stream.
- Prior to conducting work, ensure that all necessary materials for temporary stream crossing installation (including pipes, headwalls, etc.) are located onsite and ready for installation.
- A site-specific construction sequence should be shown on the plans with details to allow for successful completion of the activities at the stream crossings. At minimum it should address: erosion and sediment control device installation upstream of stream crossing area, damming of stream, 24-hr stream bypass, work area in dry conditions, temporary equipment crossings, and immediate groundcover of slopes.
- A coffer dam or other proposed dam should be installed upstream and downstream of the work area. Details should be included to allow for consistent installation.
- A method of stream bypass should be specified to divert stream flow around the work area and supporting calculations submitted. Supporting details and construction sequence of the stream bypass should be included in the plans, such as: good housekeeping to keep operation clean, dimensions, and rolled erosion control products.
- The work area should be addressed to allow for construction in dry conditions. Pumping of the work area to a stable discharge downstream of the crossing is typical.
- Adequate sediment storage and containment measures should be provided, i.e., the “Four Corners defense” which specifies sediment traps or basins at the corners of the crossing. Stable conveyance of runoff shall be provided to these containment measures.
- Silt fence should be specified over and around the top of any pipe(s)/culverts for the crossing and along the top of streambanks.
- Groundcover/stabilization should be provided immediately on the embankment. Rolled erosion control products should be specified for the slopes.
- If timber mats are specified for a stream crossing the plans should provide a detail that notes no gaps between boards, provides side rails, geotextile underlayment, and includes gravel approaches on both sides of the crossing.
- Rock fords are not allowed for a temporary equipment crossing of the stream.

Inlet Protection

- Inlet protection alone does not provide adequate treatment of sediment laden runoff. To be used as an effective treatment or containment device, excavated storage must be specified with the proposed inlet protection. This is often necessary when a project still has larger disturbed areas that are draining to inlets onsite in later phases of construction.
- A rolled earthen berm shall be provided and maintained immediately down gradient of the protected inlet until the roadway is stoned.
- A road subbase berm shall be maintained until the roadway is paved.
- A six-inch minimum height asphalt berm shall be maintained until the roadway surface receives its final coat.

Excavated storage at these inlet protections may be beneficial even if the inlets drain to a sediment basin. Additional benefits of excavated storage include reduced clogging and/or maintenance of the inlet protection, reduced maintenance for any sediment basins, and less sediment to flush from pipe systems before conversion of basins to final stormwater measures.

Excavated storage provided with inlet protection should be sized for a minimum of 1,800 cf/acre of drainage area.

5.3.5.1 Specific Requirements for High Quality Water Zones and Falls Lake

Measures for land-disturbing activities to be conducted in High Quality Water Zones and Falls Lake Watershed must be designed as follows:

- Uncovered areas in High Quality Water (HQW) zones must be limited at any time to a maximum total area of 20 acres within the boundaries of the tract.

- Erosion and sedimentation control measures, structures, and devices must be planned, designed, and constructed to provide protection from the runoff of the 25-year storm.

- Sediment basins within HQW zones must be designed and constructed so that the basin will have a settling efficiency of at least 70% for the 40-micron (0.04mm) size soil particle transported into the basin which produces the maximum peak rate of runoff. For the basins in HQW zones and Water Supply Watersheds, use the runoff of a 25-year storm.

- The angle for side slopes must be sufficient to restrain accelerated erosion. Side slopes shall be no steeper than two (2) horizontal to one (1) vertical if a vegetative cover is used for stabilization unless soil conditions permit a steeper slope or where the slopes are stabilized by using mechanical devices, structural devices, or other acceptable ditch liners.

5.3.6 Manage Stormwater Runoff

> When the increase in the velocity of stormwater runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving watercourse, plans must include measures to control the velocity at the point of discharge to minimize accelerated erosion of the site and increased sedimentation of the stream. UDO 10-30-4(A)(6)

Plans shall be designed so that any increase in velocity of stormwater runoff resulting from the land disturbing activity will not result in accelerated erosion at the point of discharge from the site or in any receiving stormwater conveyance. Plans shall include measures to prevent accelerated erosion within the project boundary and at the point of discharge.

To meet this basic control objective, it is necessary to:

- Identify and evaluate all points of discharge from the project, including discharges to any environmental features which may be present within the site such as streams.
- If a permanent stormwater controls exceed management of the ten year storm, the corresponding erosion control plan should meet the same design requirement. For example, if the 25 year storm or greater is required for stormwater design, then the erosion control plan shall be designed for a 25 year storm or greater. Management of the 25-year storm for temporary erosion and sediment control measures is required for developments in the Falls Lake Watershed, Swift Creek Watershed and areas of High-Quality Waters.

The erosion and sedimentation control plan should include:

- Identification of all points of discharge from the project
- Calculations to demonstrate that discharges from the project are non-erosive for the 10-year storm event (or 25-year storm event in landfills, High Quality Waters and Wake County Water Supply Watersheds)
- Adequately designed measures (temporary or permanent) as needed to prevent erosive velocities from the project, including discharges to any streams or other environmental features internal to the site.
- A Table with dimensions for energy dissipators (length, width, depth, NCDOT stone size and stone depth

5.4 Construction Sequence and Phasing

All land disturbing activities shall be planned and conducted to prevent erosion, which may result in sedimentation damage to streams, waterways, buffers, or adjacent properties. To accomplish this, erosion and sedimentation control plans must address the changing nature of construction activities and identify the necessary measures throughout multiple phases of construction. The number of phases required for a project will be site-specific and based on the complexity and/or sequencing of the site development.

Each project shall also have a site-specific construction sequence, with specific sequences tied to each phase and its plan sheet(s).

5.4.1 Certificate of Compliance Phase

The first phase of any erosion and sedimentation control plan shall be the installation of perimeter measures required to obtain a Certificate of Compliance from the Wake County field consultant. Clearing and land disturbance shall be limited only to those areas necessary to install these initial measures. Examples of initial perimeter measures include, but are not limited to, silt fence, silt fence outlets, construction entrance(s), basins, diversion ditches, and check dams.

The limits of disturbance shown in this first phase of construction shall be limited to the area necessary for installation of these measures and any upgradient areas of the site that will need to bypass site E&SC measures.

The construction sequence for this first phase of construction shall include, but is not limited to:

- Obtain NCG01 (Construction Stormwater) coverage from NCDEQ and upload a copy of the Certificate of Coverage to the land disturbance permit on Wake County's Permit Portal.
- Schedule a preconstruction meeting with the Environmental Consultant.
- Ensure that all necessary materials for initial measure installation (including risers, skimmers, etc.) are available and ready for installation onsite.
- Pay any outstanding land disturbing permit fees and obtain the land disturbing permit.
- Install construction entrance(s), silt fence, sediment basins, temporary diversions, or other measures shown on the Certificate of Compliance (initial) phase of the approved plan. Clear only as necessary to install these measures. Stabilize all temporary diversions, berms, and basins, and the bare areas downstream of these devices immediately upon construction.
- Call the Environmental Consultant for an onsite inspection to obtain a Certificate of Compliance. This step should be the last item on the construction sequence for this initial phase of the erosion control plan.

The dimensions and stabilization requirements for these erosion and sediment control devices should be shown on the same drawing as the construction sequence for this initial phase.

This Certificate of Compliance Inspection is required to ensure that the initial erosion and sedimentation control measures have been installed per the plans prior to larger disturbances (or mass grading) on the project.

5.4.2 Intermediate Phases

Projects must provide adequate intermediate phasing to address evolving construction activities. When developing the phases of an erosion control plan, the design engineer shall consider and address changes to the site during the construction process, both in topography and development/construction activities. Some of these intermediate phasing activities include, but are not limited to, bypass of off-site and on-site water, stream crossings, rough grading of the site, installation of infrastructure, fine grading, and installation of pavement and buildings.

Intermediate phasing and the associated construction sequencing may also need to address the relocation or resizing of specific erosion control measures. Additional as-needed E&SC measures may be added to the plans during intermediate phasing, including but not limited to, inlet protection, slope drains, basins, silt fence, silt fence outlets, etc.

The construction sequence for intermediate phases of the erosion control plan will be highly site specific. At a minimum, the following items must be addressed:

- Begin clearing and grubbing the site. Provide and maintain positive drainage to erosion and sedimentation control measures.
- Rough grade site.
- Relocate or resize specific erosion control measures as needed.
- Install storm sewer (if applicable) and protect inlets with inlet protection, with or without excavated storage, or other approved measures as shown on the plan.
- Begin vertical construction, building, etc.
- Stabilize site as areas are brought up to final grade with vegetation, paving, ditch linings, etc. Seed and mulch denuded areas per required ground stabilization time frames. The County recommends temporary stabilization of at least the first 30 feet interior to the exterior silt fence.
- Excess soil to be exported offsite shall be taken to a site with an approved sediment and erosion control plan and be a permitted facility. Provide name and address of the permitted facility to the Environmental Consultant and Watershed Manager at least 2 weeks prior to beginning the export operation.

If the erosion control plan for a residential subdivision is intended to cover all individual lot construction (not just roads and common elements), then one phase of construction should be the individual lot development with appropriate lot details provided to contain sediment on individual lots.

5.4.3 Final Phase

The final phase of an erosion and sedimentation control plan should include conversion of any temporary measures into post-construction stormwater control measures (SCMs) as well as permanent stabilization of the site.

No conversion or removal of erosion control measures to SCMs shall occur without the approval of the Wake County field consultant. E&SC plans shall address conversion of devices within the construction sequence - refer to the required conversion sequence in Section 5.7 of this manual.

The construction sequence for the final phase of construction shall include conversion of any measures onsite to their permanent forms, provision of any information or certifications required prior to final close out of permits and/or Certificate of Occupancy, and final stabilization of the site.

Steps in the final phase of the erosion control plan sequence include but are not limited to:

- When construction is complete and all areas are permanently stabilized, the Environmental Consultant should be called to perform a site inspection.
    - Where grass is used to meet stabilization requirements, permanent groundcover must be applied over 100% of the disturbed area. Permanent stabilization will be considered achieved when 80% density of the permanent groundcover is established with no evidence of large bare patches or erosion.
- If the Environmental Consultant provides approval, remove all temporary erosion control measures, and permanently stabilize any resulting bare areas. Include the basin removal/conversion sequence from Section 5.7 of this manual.
- All remaining permanent erosion control devices, such as velocity dissipators, should now be installed. Submit required certifications and documentation to satisfy conditions of any stormwater or flood permit approval, including:
    - as-built certifications for all post-construction proposed stormwater control measures
    - as-built impervious surveys (if required to verify that development is within its maximum impervious limitation)
    - as-built drawings and certification for any work requiring a flood study (ex: road or driveway crossings)
    - elevation certificates, if required by a flood certification permit
    - floodproofing certification, if required by a flood certification permit
- Once permanent vegetation has been established and all conditions of approval for any stormwater or flood permits have been met, the Environmental Consultant should be called to perform a final site inspection and issue the Certificate of Completion.

5.5 Stockpile Requirements

Proposed stockpile footprints must be shown on the erosion and sediment control plan with a 25-foot maintenance and access area surrounding them. Silt fence with silt fence outlets or other perimeter erosion and sediment control measures should be placed downslope of the stockpile on the erosion and sediment control plan and in the field. The following sets of notes should be included in the erosion and sediment control plan:

Design Criteria

1. A 25-foot temporary maintenance and access area shall be shown around all proposed stockpiles (erosion control measures surrounding the stockpile shall be shown at the outer limit of this area).

2. Stockpile footprints shall be setback a minimum of 25' from adjacent property lines.

3. A note shall be provided on the approved plan that stockpile height shall not exceed 35 feet.

4. Stockpile slopes shall be 2:1 or flatter.

5. Approved BMPs shall be shown on a plan to control any potential sediment loss from a stockpile.

6. Stockpiling materials adjacent to a ditch, drainageway, watercourse, wetland, stream buffer, or other body of water shall be avoided unless an alternative location is demonstrated to be unavailable.

7. Any concentrated flow likely to affect the stockpile shall be diverted to an approved BMP.

8. Off-site spoil or borrow areas must be in compliance with the Wake County UDO and State Regulations. All spoil areas over an acre are required to have an approved sediment control plan. Developer/Contractor shall notify Wake County of any offsite disposal of soil, prior to disposal. Fill of FEMA Floodways and Non-encroachment Areas are prohibited except as otherwise provided by subsection 14-19-2 of the Wake County Unified Development Ordinance (certifications and permits required).

Maintenance Requirements to be Noted on the Erosion and Sediment Control Plan

1. Seeding or covering stockpiles with tarps or mulch is required and will reduce erosion problems. Tarps should be keyed in at the top of the slope to keep water from running underneath the plastic.

2. If a stockpile is to remain for future use after the project is complete (builders, etc.), the financial responsible party must notify Wake County of a new responsible party for that stockpile.

3. The approved plan shall provide for the use of staged seeding and mulching on a continual basis while the stockpile is in use.

4. Establish and maintain a vegetative buffer at the toe of the slope (where practical).

5.6 Seeding Specifications

Temporary and permanent seeding specifications should be included in the erosion and sediment control plan. Proper seedbed preparation is the key to establishing temporary and permanent ground cover. The following seedbed preparation and temporary and permanent seeding schedule, or equivalent alternative, should be included in the erosion and sediment control plan.

Seedbed Preparation

1. Chisel compacted areas and spread topsoil three inches deep over adverse soil conditions, if available.

2. Rip the entire area to six inches deep.

3. Provide site topsoil from stockpile retained earlier in construction.

4. Remove all loose rock, roots, and other obstructions, leaving surface reasonably smooth and uniform.

5. Apply agricultural lime, fertilizer, and superphosphate uniformly and mix with soil (see mixture below).

6. Continue tillage until a well-pulverized, firm, reasonably uniform seedbed is prepared four to six inches deep.

7. Seed on a freshly prepared seedbed and cover seed lightly with seeding equipment or cultipack after seeding.

8. Mulch area uniformly at a 2 ton/acre rate of small grain straw or 3 ton/acre rate of hay immediately after seeding. Anchor mulch per rate specified in plan or North Carolina Erosion & Sediment Control Planning & Design Manual.

9. The use of anchored rolled erosion control products (RECPs) or matting is acceptable. Note that RECPs that have little to no straw or mulch material should be removed and not utilized onsite. The RECPs used should be consistent with a 2 ton/acre rate of small grain straw. In HQWs, asphalt is not recommended as a binding agent, use an approved hydraulically applied binding agent (NCDOT 4.9.2).

10. Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand should be more than 60% damaged, reestablish following the original lime, fertilizer and seeding rates.

11. Management of the stand of vegetation based on soil conditions and weather will allow for quicker and denser establishment. Note that grasses or legumes may need to be mowed to facilitate a stand of permanent vegetation.

12. Consult Wake County Soil & Water Conservation District or NC State Cooperative Extension on maintenance treatment and fertilization after permanent cover is established.

Amendment Mixture

Agricultural Limestone: 2 tons/acre (3 tons/acre in clay soils)
Fertilizer: 1,000 lbs/acre – 10-10-10
Superphosphate 500 lbs/acre – 20% analysis
Mulch: 2 tons/acre – small grain straw
Anchor: Asphalt emulsion at 400 gals/acre

Seeding Schedule - For Shoulders, Side Ditches, Slopes (Max 3:1):

Date	Type	Planting Rate
August 15 – November 1	Tall Fescue	300 lbs/acre
November 1 – March 1	Tall Fescue & Abruzzi Rye	300 lbs/acre
March 1 – April 15	Tall Fescue	300 lbs/acre
April 15 – June 30	Hulled Common Bermudagrass	25 lbs/acre
July 1 – August 15	Tall Fescue and Browntop Millet or Sorghum-Sudan Hybrids***	125 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Millet); 30 lbs/acre (Sorghum-Sudan Hybrids)

Seeding Schedule - For Shoulders, Side Ditches, Slopes (3:1 to 2:1):

Date	Type	Planting Rate
March 1– June 1	Sericea Lespedeza (scarified) and use the following combinations:	50 lbs/acre (Sericea Lespedeza)
March 1 – April 15	Add Tall Fescue	120 lbs/acre
March 1– June 30	Or add Weeping Love Grass	10 lbs/acre
March 1– June 30	Or add Hulled Common Bermudagrass	25 lbs/acre
June 1– September 1	Tall Fescue and Browntop Mullet or Sorghum-Sudan Hybrids***	120 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Mullet); 30 lbs/acre (Sorghum-Sudan Hybrids)
September 1 – March 1	Sericea Lespedeza (unhulled – unscarified) and Tall Fescue	70 lbs/acre (Sericea Lespedeza); 120 lbs/acre (Tall Fescue)
November 1 – March 1	and Abruzzi Rye	25 lbs/acre

Consult the Wake County Soil & Water Conservation District or the NC State Cooperative Extension for additional information concerning other alternatives for vegetation of denuded areas. The above vegetation rates are those that do well under local conditions; other seeding rate combinations are possible.

Temporary Seeding Schedule: Reseed according to optimum season for desired permanent vegetation. Do not allow temporary cover to grow more than 12" in height before mowing; otherwise, fescue may be shaded out.

Permanent stabilization of disturbed areas shall be required prior to close out of any land disturbance permit, and may be achieved by one or more of the following methods:

Grass

- Where grass is used to meet stabilization requirements, permanent groundcover must be applied over 100% of the disturbed area.
- Permanent stabilization will be considered achieved when 80% density of the permanent groundcover is established with no evidence of large bare patches or erosion. Annual rye is NOT a permanent groundcover.

Sod

- Sod should be laid across the slope working from the bottom to the top of a slope
- Sod strips should be placed so that there are snug, even joints. Joints should be staggered to prevent gaps or voids which may allow roots to dry out or be more susceptible to erosion.
- Roll or tamp sod immediately after placement to ensure that there is solid contact between the sod and the ground.
- On steep slopes, sod may need to be stapled to the surface of the soil.
- Sod should be watered immediately once secured, and regularly as needed to ensure sod grows.
- Sod should not be applied to compacted soil. Till the soil below sod placement.

Mulch

- Triple shredded hardwood mulch may be applied at a minimum depth of 6 inches to achieve permanent stabilization on level areas.

Impervious surface

- Impervious surface such as gravel, rip rap, asphalt, etc. may be used for permanentstabilization. All such impervious surfaces must be permitted appropriately.

5.7 Basin Removal Sequence

The following Sediment Basin Removal and Conversion Sequence should be included in the erosion and sediment control plan:

1. Schedule a site meeting with the Environmental Consultant to determine if a basin can be removed. Install silt fencing or other temporary erosion control measures as needed prior to removal of the basin.

2. Contact the NCDEQ – Raleigh Regional Office at (919) 791-4200 to determine the Division of Energy, Mineral and Land Resources contact person to receive dewatering notifications. At least 10 days prior to beginning dewatering activity, send an email to the NCDEQ-DEMLR contact person and copy the Environmental Consultant that met you onsite. The email should include: E&SC Jurisdiction: Wake County, Wake County Project: Name, Number, and Location (city/town), Environmental Consultant Name, and address the following: a) Reason for conversion, b) Basin #, c) Dewatering method, and d) all other necessary info from Part II, Section G, Item 4 of the NCG01. Keep a copy of this email for your NPDES monitoring documentation.

3. After receiving positive confirmation from NCDEQ-DEMLR, you may remove the basin OR on ≥ Day 11, whichever is sooner. Look for a forecasted pattern of dry weather of 3 - 5 days before beginning basin removal. Using a floating intake, begin pumping operation and take into account any additional requirements per NCDEQ email notification. Remove Basin(s) and associated temporary diversion ditches. If pipes need to be extended, perform this operation at this time. Fine grade the area in preparation for seeding.

4. Perform seedbed preparation, then seed, mulch, and anchor any resulting bare areas immediately.

5. Install velocity dissipators and/or level spreaders as required on the Erosion Control Plan.

6. When the site is fully stabilized, call the Environmental Consultant for approval to remove the remaining temporary erosion control measures and advice on when the site can be issued a Certificate of Completion. Note: A meeting should also be scheduled with the Environmental Consultant to determine when a basin may be converted for stormwater use. Some municipalities may also require this.

5.8 Standard Details

Wake County has developed a set of standard drawings for commonly specified sedimentation and erosion control measures which may be downloaded from County's web site here.

If there is no Wake County standard detail for a particular measure being proposed, details from the following may be used with County approval:

- NCDOT construction and maintenance details
- NCDEQ Division of Energy, Mineral and Land Resources (DEMLR) construction and maintenance details
- Construction and maintenance details from another local delegated erosion and sedimentation control program within North Carolina.

Customized, site-specific details may also be necessary depending on the features (i.e., environmental features, topography, etc.) of the development site and could be allowed with County approval.