STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA
SECRETARY

April 16, 2013

Memorandum To: Division Engineers

From: Terry Gibson, PE
Chief Engineer

Subject: Revision to Trout Waters Construction Guidelines

In March of 2007, a document entitled "2007 Guidelines for Construction of Highway Improvements Adjacent to or Crossing Trout Waters in North Carolina" was distributed to your offices to include when requesting a trout buffer variance from the Land Quality Section of NCDENR. The guidelines have been updated to current design and construction standards and in compliance with the NCG-010000 construction permit. The updates and revisions are now the following:

(1) Updating the ground cover requirement in No. 3 of the "General Erosion Control Notes for NCDOT Projects in Trout Waters" to 7 calendar days.
(2) Adding language to utilize flocculants during construction in the general notes.
(3) Replacing Kentucky Bluegrass with Creeping Red Fescue in the Native Grass Seed Mix.

It is vital to the operations of the Department of Transportation that we comply with the most recent regulations and mandates when requesting a trout variance to work within the 25-foot trout buffer zone. All subsequent highway construction activities that require a trout variance request should be submitted to the regional Division of Land Resource office with the 2013 guidelines included with each request. In the event that you or your staff should have any questions about the new procedures that are outlined in this document please contact the Roadside Environmental Unit.

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2013 GUIDELINES FOR CONSTRUCTION OF HIGHWAY IMPROVEMENTS ADJACENT TO OR CROSSING TROUT WATERS IN NORTH CAROLINA

The Division of Highways in western North Carolina has the responsibility for construction and maintenance of state system roads, many of which are adjacent to trout streams and other high quality waters. Highway improvements and maintenance will always be needed and it is incumbent upon the Division of Highways to make every effort to perform this construction and maintenance work without doing harm to the public waters. General Statute 113A-57(1) describes mandatory standards for land disturbing activities and specifically requires that a buffer zone be either provided or retained along any lake or natural water course to confine visible siltation within the 25 percent of the buffer zone nearest the land disturbing activity whichever is greater. The law also provides, however, that the Sedimentation Control Commission may approve plans which include the land disturbing activity along trout waters when the duration of said disturbance would be temporary and the extent of such disturbance would be minimal. Under this provision of the law, the Department of Environment and Natural resources (DENR) has established procedures for granting approval of temporary disturbance in the buffer zone. The North Carolina Administrative Code under Section **15A NCAC 04B .0125**, buffer zone Requirements, spells out the general rules that the DENR has established for granting approval to encroach on the trout water buffer zone.

The purpose of these guidelines is to establish a procedure for districts and divisions to follow in obtaining approval from the Director of the Division of Land Resources of DENR for construction within the buffer zone of a trout stream.

In planning construction and maintenance activities adjacent to trout streams, the first consideration should be to avoid any encroachment on the trout stream buffer zone. When construction in the trout stream buffer zone cannot be avoided, approval from the Director of DENR Land Resources is required before construction can proceed. The following guidelines should be utilized to request approval from DENR for a variance to **§ 113A-57 (1) and 15A NCAC 04B .0125** Buffer Zone Requirements.

The Approval Process

I. **SUPPORTIVE INFORMATION:** The NCDOT Engineer will need several tools to begin the process.
   - A. A set of United States Department of the Interior Quad Maps or other approved maps locating streams classified as Trout waters by the Environmental Management Commission. These maps will be necessary for the determination of drainage areas for the computation of fill in protection elevations.
   - B. DENR classification schedule to identify trout waters.
   - C. Maps provided by DENR or ArcGIS with trout waters marked, along with an alphabetical listing of all streams.
   - D. Flood stage determination procedures accompanying these guidelines.
   - E. General Erosion Control Notes for NCDOT Projects in Trout Waters.

F. Stream Bank Reforestation Special Provision.
G. Native Grass seed mix.

II. **PROPOSAL PREPARATION:** When the project has been identified as encroaching upon the buffer zone of a trout stream, certain information must be provided to DENR for consideration of approval to work in the buffer zone. Highway construction work that involves secondary road improvements should be submitted to the Regional Land Quality Office for approval. Highway construction work that is performed as a T.I.P. project or involves extensive grading operations in the buffer zone should be submitted to the Central Land Quality Office for approval.

A. Procedures

1. STEP ONE

A plan view of the project showing erosion control measures with dimensions and location of the stream relative to the right of way will be prepared. The plan can be a straight-line diagram type plan; however, additional information will be required in the buffer zone encroachment area of the project. This additional information will include cross sections within the buffer zone showing both before and after conditions for the road construction and the stream. Ordinarily, two or three cross sections will be all that is required within an area with some narrative description of the remainder of the areas. It is important that the NCDOT Engineer communicates with the Land Quality Engineer at this point to determine the amount of cross section information required.

The plan view and the cross section should indicate the measures to be taken to prevent erosion of fill slopes and temporary and permanent erosion and sediment control devices required to limit siltation of the trout stream.

A description of the slope protection treatment is required and generally would include a reference to the most current Standard Specifications for Roads and Structures. If slope protection is constructed then identify the materials to be used and the construction method to install the slope protection.

The District Engineer will make a hydraulic analysis to determine the stream bank protection level required, using the procedure outlined in the Flood Stage Determination procedures.

Details showing the construction of culverts and relocated streams should be included on the plan and cross sections. A narrative description of construction methods for installing culverts and stream relocations should be provided: for pipe culverts 36 inches in diameter and greater, a sequence of operations should be submitted with an emphasis on minimizing stream disturbances. All culverts and relocated streams should be accomplished in non-flowing streams.

2. STEP TWO

The Roadside Environmental Field Operations Engineer will be requested to review the proposed work in the trout water buffer zone and a written statement from the Roadside Environmental Field Operations Engineer is required. The

Roadside Environmental Field Operations Engineer will respond with an Erosion Control Plan Evaluation Form indicating on the transmittal sheet that they have reviewed the trout water buffer zone submittal and that adequate erosion and sediment control methods are planned for protection of the stream. In either case, the comments of the Roadside Environmental Field Operations Engineer must be submitted along with the package to the Land Quality Engineer.

3. **STEP THREE**
   The NCDOT Engineer will solicit and receive comments from the District Wildlife Resources Commission Fisheries Biologist. The letter of request must be specific and request a review for a trout water buffer zone approval by DENR. The comments received from the District Wildlife Resource Commission Fisheries Biologist must be submitted along with the package to the Land Quality Engineer.

4. **STEP FOUR**
   Every approval request should contain a narrative statement describing the project and discussing alternatives considered for the project to avoid encroaching on the trout water buffer zone. Justification for encroachment on the trout water buffer zone should be provided in this narrative statement including photographs.

5. **STEP FIVE**
   The entire package of information is to be forwarded to the appropriate Land Quality Engineer, DENR. The Land Quality Section has committed to prompt review of variance requests from the NCDOT.

B. Procedures for High Quality Waters (HQW)

Trout water buffer zone encroachments along high quality water (HQW) trout streams will require the same process as outlined in the five steps above. The hydraulic analysis, however, must be done for a Q-25 flow and all temporary and permanent erosion and sediment control devices must be designed for a Q-25 flow level if it is necessary to encroach on the trout water buffer zone of a high quality water stream. Not all-high quality waters are trout streams and no buffer zone approvals are required if a trout stream is not involved.

C. General Considerations

These guidelines have dealt with the problem of construction in trout water buffer zones generally along or parallel to a trout stream. According to G.S. 113A-57(1), the buffer zone requirement does not apply to a land disturbing activity in connection with the construction of facilities to be located on, over or under a lake or natural water course. The Sedimentation Control Commission has previously considered "facilities" to include culverts and bridges. Disturbance of less than 100 linear feet of buffer within 1000 linear feet of stream does not require written approval from Land Quality. The practical implication is that no approval by Land Quality Section Engineers to work in the buffer zone is necessary for culverts and bridges as long as the alignment is perpendicular or only slightly skewed to the

stream as opposed to paralleling the stream. It is necessary that the Land Quality Engineer be notified when crossings of trout water or high quality waters are planned. This notification shall be in the form of a notation on the erosion control plan submitted to the Regional Engineer. Erosion and sediment control plans prepared by the NCDOT Engineer for near perpendicular crossing of trout waters must include measures to minimize the amount of sediment lost downstream during construction and must be completely implemented on the project. This must include, but not necessarily be limited to, sediment basins or pits in the roadside ditches ahead of the stream, sediment fence below the toe of earth fills, earthen berms with slope drains at the top of earth fills, and diversions across the roadway prior to final grading and base course.

Temporary stream crossings should be avoided whenever possible. Where stream crossings are necessary, they must conform to the practice referenced in the Best Management Practice Manual.

FLOOD STAGE DETERMINATION FOR TROUT STREAM BUFFER ZONE

1. Determine location(s) where project construction limits will encroach upon 25' buffer zone.
2. Determine drainage area size from USGS quad map (1:24000 maps – 1 sq. inch = 0.1435 sq. miles)
3. If drainage area is:
   A) Greater than 0.8 square miles calculate 10 year discharge Q(10) = 334 (Area)^0.665
      NOTE: Area in Square Miles
      Q(10) in cubic feet/ second cfs

   B) Less than 0.8 square miles contact Hydraulics Unit with specific location for assistance.

4. Determine stream slope to be used:
   A) Field survey slope
   B) From quad map contour crossings
   C) Use flatter of two slopes
5. Select typical stream cross section in area of encroachment for analysis.
6. Select initial Q(10) water surface elevation (Rule of Thumb – Use one foot above top of bank for each 1 sq. mile of drainage area).
7. Calculate waterway area beneath initial Q(10) water surface (square feet).
8. Measure "wetted perimeter" of Channel and floodplain beneath initial Q(10) water surface (linear feet)
9. Calculate discharge using Manning's equation and roughness coefficient of n= 0.055

   $Q=1.49/n\ (A)\ (R)^{0.667}\ (S)^{0.5}$

   A= Area, sq. feet
   R= Area/Wetted Perimeter (Sq. Ft/ Ft)
   S= Slope (Ft/Ft)

10. If Manning's discharge is
    A) Less than Q (10), increase water surface elevation one foot.
    B) More than Q (10) decrease water surface elevation one foot.

    Then repeat steps 7,8,9,10 until Manning's discharge is within 5% of Q(10)
    NOTE: Elevation change alters area and wetted perimeter.

Appendix

These items shall be included in the Erosion Control Plan package.

A. General Erosion Control Notes for NCDOT Projects in Trout Waters
B. Streambank Reforestation
C. Native Grass Seed Mix

General Erosion Control Notes for NCDOT Projects in Trout Waters

1. The project must minimize the duration and extent of disturbance within the stream buffer zone. Staging areas and stockpiles must be located outside of the buffer zone whenever possible. Work within the buffer zone should be sequenced to minimize the length of time that disturbed areas are exposed. All materials should be on hand before work is commenced. Stream bank stabilization, which includes the area from the edge of water to the top of bank, should be phased so that each day's work is a completed work, including provision of adequate ground cover.

2. Installation of culverts and relocation of stream channels should be accomplished in non-flowing streams. The stream flow should be diverted around the work area of the pipe culvert or new stream channel. New channels should be stabilized before stream flow is diverted into them. Stream diversion should be accomplished according to NCDOT BMPs for Construction and Maintenance Activities Section 5.0

3. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. In any event, slopes left exposed will, within 7 calendar days of completion of any phase of grading, be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

4. Graded slopes and fills within the trout buffer zone (excluding road shoulders) shall be protected with rolled erosion control product, bonded fiber matrix, or flexible growth medium after seeding.

5. Silt fence backed by woven wire, with a post spacing of 6 feet, shall be used instead of standard silt fence in trout buffer zone. Special sediment control fence shall be used in areas where bedrock is encountered which prohibits the proper anchoring of fabric, and in low points of the silt fence in 3-foot sections to allow for concentrated flows.

6. The disturbed areas within the stream buffer shall be restored to native vegetation characteristic of an undisturbed buffer to the extent practical upon completion of construction.

7. Flyrock protection such as blast mats should be provided for blasting in close proximity to streams.

8. Erosion and sedimentation control measures will include the use of flocculants in appropriate areas to improve the settling of sediment particles and reduce turbidity levels in construction runoff. Flocculants will not be applied to perimeter erosion control measures at drainage outlets. The use of flocculants will conform to Division of Water Quality approved product list.

Streambank Reforestation:

Description:

Streambank Reforestation will be planted in areas designated on the plans and as directed by the engineer. See the Streambank Reforestation Detail Sheets.

The entire *Streambank Reforestation* operation shall comply with the requirements of Section 1670 of the *Standard Specifications.*

Materials

Live Stakes:

Type I Streambank Reforestation shall be live stakes, planted along both streambanks. Live stakes shall be ½"- 2" in diameter. Stakes shall also be 2 ft. - 3 ft. in length.

Live staking plant material shall consist of a random mix made up of 50% Black Willow (*Salix nigra*) and 50% Silky Dogwood (*Cornus amomum*). Other species may be substituted upon approval of the Engineer. All plant material shall be harvested locally (within the same physiographic ecoregion and plant hardiness zone) or purchased from a local nursery, with the approval of the Engineer. All live stakes shall be dormant at time of acquisition and planting.

Coir Fiber Matting:

Provide matting that meets the following requirements:

100% coconut fiber (coir) twine woven into high strength matrix
Thickness - 0.30 in. minimum
Tensile Strength 1348 x 626 lb/ft minimum
Elongation 34% - 38% maximum
Flexibility (mg-cm) 65030 x 29590
Flow Velocity Observed 11 ft/sec
Weight 20 oz/SY
Size 6.6 x 164 ft (120 SY)
"C" Factor 0.002
Open Area (measured) 50%

Staples, stakes, or reinforcement bars shall be used as anchors and shall meet the following requirements:

Wooden Stakes:

Provide hardwood stakes 12"- 24" long with a 2" x 2" nominal square cross section. One end of the stake must be sharpened or beveled to facilitate driving through the coir fiber mat and down into the underlying soil. The other end of the stake needs to have a 1"- 2" long head at the top with a 1"- 2" notch following to catch and secure the coir fiber mat.

Steel Reinforcement Bars:

Provide uncoated #10 steel reinforcement bars 24" nominal length. The bars shall have a 4" diameter bend at one end with a 4" straight section at the tip to catch and secure the coir fiber mat.

Staples:

Provide staples made of 0.125" diameter new steel wire formed into a *u* shape not less than 12" in length with a throat of 1" in width.

Bare Root Seedlings:

Type II Streambank Reforestation shall be bare root seedlings 12"-18" tall.

Construction Methods

Coir fiber matting shall be installed on the streambanks where live staking is to be planted as shown on the Streambank Reforestation Detail Sheets and in locations as directed. Work includes providing all materials, excavating and backfilling, and placing and securing coir fiber mat.

Provide a smooth soil surface free from stones, clods, or debris that will prevent the contact of the matting with the soil. Place the matting immediately upon final grading and permanent seeding. Take care to preserve the required line, grade, and cross section of the area covered.

Unroll the matting and apply without stretching such that it will lie smoothly but loosely on the soil surface. Bury the top slope end of each piece of matting in a narrow trench at least 6" deep and tamp firmly. Where one roll of matting ends and a second roll begins, overlap the end of the upper roll over the buried end of the second roll so there is a 6" overlap. Construct check trenches at least 12" deep every 50-ft. longitudinally along the edges of the matting, or as directed. Fold over and bury matting to the full depth of the trench, close and tamp firmly. Overlap matting at least 6" where 2 or more widths of matting are installed side be side.

Wooden stakes, reinforcement bars, or staples may be used as anchors in accordance with the Streambank Reforestation Detail Sheets and as directed. Place anchors across the matting at ends, junctions, and check trenches approximately 1 ft. apart. Place anchors down the center of each strip of matting 3 ft. apart. Place anchors along all lapped edges 1 ft. apart. Refer to the Streambank Reforestation Detail Sheets for anchoring pattern.

The Engineer may require adjustments in the trenching or anchoring requirements to fit individual site conditions.

During preparation of the live stakes, the basal ends shall be cleanly cut at an angle to facilitate easy insertion into the soil, while the tops shall be cut square or blunt for tamping. All limbs shall be removed from the sides of the live cutting prior to installation.

Live stakes shall be installed within 48 hours of cutting. Outside storage locations should be continually shaded and protected from wind and direct sunlight. Live cut plant material shall remain moist at all times before planting.

Stakes shall be spaced approximately 4 ft. on center. Live stakes shall be installed according to the configuration presented on the Streambank Reforestation Detail Sheets.

Tamp live stakes perpendicularly into the finished bank slope with a dead blow hammer, with buds oriented in an upward direction. Stakes should be tamped until approximately ¾ of the stake length is within the ground. The area around each live stake shall be compacted by foot after the live stake has been installed.

1"- 2" shall be cut cleanly off the top of each live stake with loppers at an angle of approximately 15 degrees following installation. Any stakes that are split or damaged during installation shall be removed and replaced.

The bare root seedlings shall be planted as soon as practical following permanent *Seeding and Mulching*. The seedlings shall be planted from top of bank out, along both sides of the stream, as designated on the plans.

Root dip: The roots of reforestation seedlings shall be coated with a slurry of water, and either a fine clay (kaolin) or a superabsorbent that is designated as a bare root dip. The type, mixture ratio, method of application, and the time of application shall be submitted to the Engineer for approval.

With the approval of the Engineer, seedlings may be coated before delivery to the job or at the time of planting, but at no time shall the roots of the seedlings be allowed to dry out. The roots shall be moistened immediately prior to planting.

Seasonal Limitations: Streambank reforestation shall be planted from November 15 through March 15.

Native Grass Seed Mix:

Native Grass Seeding and Mulching shall be performed on the disturbed areas of wetlands, and adjacent to Stream Relocation and/or trout stream construction within a 50 foot zone on both sides of the stream or depression, measured from top of stream bank or center of depression. The stream bank of the stream relocation shall be seeded by a method that does not alter the typical cross section of the stream bank. Native Grass Seeding and Mulching shall also be performed in the permanent soil reinforcement mat section of preformed scour holes, and in other areas as directed. The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined. All rates are in pounds per acre.

August 1 - June 1
18# Creeping Red Fescue
8# Big Bluestem
6# Indiangrass
4# Switchgrass
35# Rye Grain
500# Fertilizer
4000# Limestone

May 1 – September 1
18# Creeping Red Fescue
8# Big Bluestem
6# Indiangrass
4# Switchgrass
25# German or Browntop Millet
500# Fertilizer
4000# Limestone

Approved Creeping Red Fescue Cultivars:

Aberdeen	Boreal	Epic	Cindy Lou

Fertilizer shall be 10-20-20 analysis. Upon written approval of the Engineer, a different analysis of fertilizer may be used provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis.

Temporary Seeding
Fertilizer shall be the same analysis as specified for *Seeding and Mulching* and applied at the rate of 400 pounds and seeded at the rate of 50 pounds per acre. German Millet or Browntop Millet shall be used in summer months and rye grain during the remainder of the year. The Engineer will determine the exact dates for using each kind of seed.

Fertilizer Topdressing
Fertilizer used for topdressing shall be 16-8-8 grade and shall be applied at the rate of 500 pounds per acre. A different analysis of fertilizer may be used provided the 2-1-1 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as 16-8-8 analysis and as directed.

Supplemental Seeding
The kinds of seed and proportions shall be the same as specified for *Seeding and Mulching*, and the rate of application may vary from 25# to 75# per acre. The actual rate per acre will be determined prior to the time of topdressing and the Contractor will be notified in writing of the rate per acre, total quantity needed, and areas on which to apply the supplemental seed. Minimum tillage equipment, consisting of a sod seeder shall be used for incorporating seed into the soil as to prevent disturbance of existing vegetation. A clodbuster (ball and chain) may be used where degree of slope prevents the use of a sod seeder.

Mowing
The minimum mowing height shall be 6 inches.

Measurement and Payment
Native Grass *Seeding and Mulching* will be measured and paid for in accordance with Article 1660-8 of the *Standard Specifications*.

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES
LAND QUALITY SECTION

NC DOT Trout Buffer Waivers Issued by Regional Engineers for Maintenance Projects

From 2/1/2013 to 5/2/2013

County	DOT Division	Issue Date	Project	Stream	Linear Feet	River Basin
Ashe	11	02/22/2013	484	Big Horse Creek	2,280	New
Madison	13	04/24/2013	485	Unnamed Tributary Meadow Fork Creek	400	French Broad
Mitchell	13	04/24/2013	486	Unnamed Tributary Soapstone Creek	1,185	French Broad

Count of Waivers: 3 **Sum of Linear Feet: 3,865**

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES

Report of Immediate Corrective Actions Issued by DOT

From 3/1/2013 to 5/2/2013

County	Issue Date	Project Number	Location	DOT Division	Project Type	Length	Compliance	NOV Issue Date	Evaluator
Forsyth	04/11/2013	9C.034089	SR 2095 Emorywood Road	Winston-Salem Regional Office	Maintenance	0.30	No		Phil Suggs
	04/19/2013	9C.034089	SR 2095 Emorywood Road		Maintenance	0.30	Yes		Phil Suggs