2006-2008 NC Forestry BMP Implementation Survey Procedure

Survey Introduction

The primary goals of this survey are to (1) determine what level of Best Management Practice (BMP) implementation is occurring on "active" logging sites throughout NC and (2) assess the implemented BMP practices for strengths and weaknesses with regard to water quality protection. Any BMP practice "problem areas" identified by the survey will be subsequently addressed in the near term through policy change (i.e., training, educational efforts) and site-specific technical recommendations; long-term resolution will be affected through periodic upland/wetland forestry BMP manual revisions. Additionally, we will utilize the survey to quantify the NC Division of Forest Resources (NCDFR) progress in implementing it's Forestry BMP Program and determine if BMP application inequities exist geographically. Secondary goals of the survey include benchmarking BMP implementation with respect to NCFA's ProLogger Program and NCDFR's District Water Quality Foresters (DWQFs) positioned in ten of the Division's thirteen Districts. Finally, the survey also contains a component to determine forest management (FM) practice compliance with the Randleman Lake Watershed Rule that had an effective date of April 1, 1999, the Neuse River Buffer that had a June 22, 1999 revised effective date, the Tar-Pamlico River Buffer Rule that had an August 1, 2000 effective date and the Catawba Mainstem Buffer Rule that had an effective date of June 30, 2001. The "buffer rules section" of this survey will be expanded to include additional Riverbasin Buffer Rules as they become effective. On a related note, the survey also contains an inquiry as to the presence of other local buffer rules or tree ordinances you may encounter during the course of performing a survey. The primary interest in these local rules is one of awareness only at this time. In summary, all survey output will be used to support future NCDFR decision-making on forestry water quality issues.

The 2006 NCDFR BMP Implementation Survey has been developed to support a one-year survey of "active" logging sites throughout North Carolina. The NCDFR's Forest Management staff's present goal is to survey a minimum of 215 ongoing harvest operations. We plan to survey all 100 counties of the State over a one-year period or in all counties that support viable forest harvest operations. The number of surveys performed in each county will be allocated in the following manner: Each county that has active forestry operations will be sampled at least once. The remaining samples will be divided among the counties according the volume of forestry activity in those counties. See Appendix 1 for a table of counties and number of samples to be taken in each county. The survey format and layout is based on a similar design previously used by state forestry agencies in Florida and Tennessee and conforms to the Silviculture Best Management Practices Implementation Monitoring Protocol established in 1997 for the Southern Group of State Foresters. The survey is designed to assess practices found in NCDFR's 1989 BMP manual that were originally developed to play an integral role in protecting water quality during timber harvesting operations. The survey also contains questions that align with BMPs that are anticipated to appear in future forestry BMP manual revisions. Survey questions are worded to yield a "yes" response if the BMP has been correctly implemented and a "no" response for failure or improper BMP implementation. <u>We believe this survey can provide an accurate picture of forestry BMP implementation in NC provided site selection criteria, survey completion instructions and training, and Quality Assurance/Quality Control (QA/QC) supporting this project are closely followed</u>. Your adherence to these critical project components will serve greatly to advance the overall accuracy and precision of this Federal 319 NPS Water Quality Grant initiative and yield information vital to the continued success and improvement of NCDFR's Forestry BMP program.

One final note -- this survey document is not a replacement or alternative product to NCDFR's Procedure 4808 or any associated records or forms thereof. Logging information entered on the BMP Implementation Survey Form that indicates a compliance concern exists with the Forest Practice Guidelines Related to Water Quality (FPG) Performance Standards (15 NCAC 1I.0101 - .0209) should continue to be addressed using Procedure 4808. FPG compliance issues "discovered" when performing this BMP survey should be pursued via normal NCDFR communication channels and protocol. More on this concern is included in the text that follows.

Survey Implementation

The following procedure sections will detail the site criteria and "steps to completing and processing" the survey. The words or statements that appear in **bold print** within these sections are viewed as critical components to the survey. Your attention to these survey details is appreciated! Any questions arising should be directed to the Forestry NPS Specialist, Will Summer.

Random Sampling

[Note: This random sampling method will be supplemented with one-on-one and group training. These sampling methods are flexible, provided alternative random sampling techniques are reported as discussed in survey training sessions.]

The BMP Implementation Survey will be completed for **"active" logging tracts five (5) acres in size or greater. "Active" is defined to be the ongoing operation of tree felling and/or transport/loading equipment at the time the survey is conducted; "active" also includes preharvest activities such as forest road/access road/skid trail construction and post-harvest site rehabilitation efforts. The tracts surveyed will have <u>either</u> intermittent or perennial streams <u>and/or</u> waterbodies located within the "cut zone" or within fifty (50) feet of the harvest operation boundaries.** Site selection will be conducted by the CO and designated field staff and will occur from the air and/or ground as follows, **using the DeLorme *North Carolina Atlas and Gazetteer, Topo Maps of the Entire State* (Third Edition, 1997) or an appropriate county or district map with a grid that can be used for the follow random site selection process.**

Using one of the above referenced maps, District Water Quality Foresters and designated District Service Foresters should select a map or grid for the area of interest. The selected grid should then be randomly sub-sampled for five (5) different quadrants. The five quadrants can be sub-sampled by simply numbering each quadrant on the grid or page that is applicable and randomly selecting the numbers. The quadrants selected should be "proofed" at this time for **road accessibility** and **timber harvest potential.** The quadrants that have no road access or harvest potential should be discarded and additional sub-sampling should occur to replace them. The process should be repeated until five quadrants are available for surveying in each county. **When a county is to be sampled again, the surveyor should not include any previously surveyed quadrants to maximize spatial distribution of the dataset.** Those individuals conducting the survey will maintain a map, which depicts the location of the tracts surveyed.

Alternatively, where time constraints and other Forest Management/Forest Protection obligations make the above "Gazetteer method" unworkable, you can query the DFR County office staff to locate where harvest operations are ongoing in a given county. Should a number of opportunities be presented at one time, randomly chose which ones to visit.

Where County staff are obligated to inspect "every active harvest operation" they observe, you should request that County staff provide you the location of the active harvest and a "window of opportunity" (e.g., 24-48 hour period) to assess the harvest for survey applicability and conduct the survey prior to a required County FPG inspection. If County staff conduct their inspection and then notify you of the active harvest location, you can still use the tract if it meets the site-selection criteria, provided you follow-up the survey by contacting the County staff to determine if a change in operation had resulted from the County inspection – this action will then be incorporated into your findings.

Site Selection Criteria

Aviation-Supported Site Selection

[Note: Aircraft support can be used provided conflicts do not arise with respect to District budget and personnel resources.]

The five selected quadrants can be flown to determine if logging operations are present that fit the site-selection criteria. It is recommended, however, that this activity be coupled with other forestry-related accountabilities requiring air support to minimize costs. **Based on comments received from field staff, we strongly recommend that sites identified from the aircraft as meeting the survey criteria be visited as quickly as possible to capture the "active" harvest operation.**

Ground-Supported Site Selection

The five selected quadrants should be reviewed via ground transportation to the extent practicable. Encountered sites that meet the site-selection requirements should be surveyed upon discovery. **In order to minimize bias, the "survey personnel" should not contact the landowners and/or loggers involved in advance of the survey.** However, if these individuals are present on the tract at the time of survey, they should be provided an opportunity to accompany the NCDFR staffer while the survey is conducted. Identification of the purpose of the visit will be facilitated by a survey flyer handout describing the purpose of the visit. **We encourage all "survey personnel" to disassociate the BMP Implementation Survey from a discussion on potential FPG non-compliance with the customer. Your best judgement under this circumstance is appreciated.**

Completing the Survey

The fifteen (15) page survey form consists of four (4) parts: Part I, General Information; Part II, Site Information and Characteristics; Part III, Forestry Operations; and Part IV, BMP Practices Applicable to Operations. All four parts were developed to minimize excessive writing in the field. With the exception of Part I, completing the survey will primarily require "checking" or "circling" the appropriate choice for each of the applicable questions. Comment lines provided within the BMP Practice and Overall Summary sections should only be used to clarify a BMP issue(s) that is not fully captured by a "yes-no" response. Based on previous field-testing, the survey document itself will likely require about fifteen to twenty minutes to complete. **We strongly recommend the active harvest site undergo a complete and thorough walkthrough prior to completing the survey.**

Part I (General Information) – Page 1 should be completed with the following points noted:

- The preferred method for site location is GPS instrument readout. However, Lat/Long estimates can also be made directly from the DeLorme maps.
- Enter the logger's full name, address, and telephone numbers; when requesting this information from the logger, you may want to briefly state that the survey is a research project and that their participation is appreciated. Distributing the research flyer prepared for this study should facilitate the customers' understanding of the visit.
- Indicate whether the logger is a graduate of the ProLogger Program (PLP); if this information is not available at the time of survey, the CO staff will provide an answer via a PLP records check after you have forwarded the survey to the CO.

Part II (Site Information and Characteristics) – Page 2 should be completed with the following points noted:

- Principle soil class selection should be based on the "Feel Method" and should be done in the field per previous training (see Appendix 2).
- Estimated slope should be determined by using previously learned practices or field instruments.
- Soil Erodibility class for this survey will be a subjective estimate taking into account the components of the "universal soil loss equation" of rainfall potential, soil erodibility slope length/gradient, ground cover, and BMP (i.e., erosion control practice) (see Appendix 2).
- Soil Erosion Type: **Sheet** – Soil is removed more or less uniformly form every part of the slope; **Rill** – Tiny gullies irregularly dispersed; **Gully** – Formation of large or small ravines by undermining and downward cutting.
- **Definitions:**
  Intensive Forest Management - Using a wide variety of silvicultural practices, such as planting, thinning, fertilization, release, harvesting and genetic improvement, to increase the capability of producing forest products.

  Passive Forest Management - Allowing previously harvested lands to naturally regenerate without the use of the silvicultural practices associated with intensive forest management (see above).

  Bay - "Carolina bays" are isolated wetlands in natural shallow depressions that are largely fed by rain and shallow groundwater. These bays have an elliptical shape and are typically oriented from northwest to southeast.

Flatwoods - A site with flat to gently-sloping topography and relatively poorly drained, sandy soils that often have standing water during wet weather.

Foothills - Hilly land on the lower slopes of the mountains that is characterized by moderate slopes.

Mountain - A landform that extends above the surrounding land and is characterized by steep slopes.

Pocosin - An upland swamp of the coastal plain of the Southeastern United States. Generally, these swamps are characterized by poorly drained, organic soil and evergreen trees and shrubs.

Rolling Topography - A land form characterized by gentle to moderate slopes.

Wetlands - Areas that are saturated by surface or ground water sufficient enough to support most of the vegetation typically adapted for saturated or near-saturated soil conditions. In order for a wetland to be considered a *"jurisdictional wetland"* for regulatory purposes it must possess all of the following characteristics: (1) hydrophytic vegetation (2) hydric soils and (3) wetland hydrology.

Part III (Forestry Operations) – Page 2

- Forested wetland roads are regulated by the US Army Corps of Engineers and are not a part of NCDFR's Forestry BMPs. If a site appears to be out of compliance with the USACE mandatory guidelines (outlined in Appendix 3) you may choose to inform the landowner.

Part IV (BMP Practices Applicable to Operations, BMPs, Overall Summary) – Pages 3-13 should be completed with the following points noted:

- Check the applicable boxes on the matrix found on page 3 of the survey. Those BMP descriptions not deemed applicable to the survey should be left blank, however, the survey should be left intact (i.e., do not tear out and discard pages containing BMP practices not applicable to the surveyed logging operation). **Please remember that the surveyor determines the BMPs that apply, <u>not</u> the logger or landowner's actual BMP implementation itself (which may be appropriate or inappropriate).**
- BMP practice questions are worded to yield a **"Yes"** answer provided the surveyor finds the BMP correctly installed, maintained and functioning. A **"No"** answer will imply that the BMP is not present or has not been correctly installed; however, it does not mean a water quality problem has resulted from improper BMP implementation. The **"N/A"** (i.e., Not Applicable) box should be checked if the BMP practice is <u>not</u> <u>required</u> for the harvest operation at the time the survey is conducted.

Check the **"Yes"** box under **Threats or Risks to Water Quality** if one or more of the following has, or potentially will occur, prior to the tract "healing over" naturally over time:

1. Sediment is actually being delivered to a stream or waterbody (e.g., logs are being skidded through a stream; water diversion devices are absent or are present but have failed allowing sediment to enter or appear proximate to the stream or waterbody).
2. Sediment is likely to be delivered to a stream or waterbody during a **"normal"** rainfall event. **"Normal" rainfall events are defined to be a precipitation occurrence that amounts to less than or equal to one inch (≤1") within a 24-hour period.**
3. Substantive amounts of sediment are likely to be delivered to a stream or waterbody via wind gusts or sustained winds eroding bare mineral soils. Fugitive or escaping soil emissions from logging decks and forest roads exhibiting exposed mineral soil can be wind-transported substantial distances to streams and waterbodies.
4. Adverse stream temperature fluctuations resulting from overcutting a previously well-forested stream channel and substantially reducing or eliminating shading over the stream channel.
5. Logging debris and/or other logging by-products are left in a stream or waterbody to the extent and magnitude that water flow or water movement is adversely impeded or completely obstructed, the later resulting in water damming on the upstream side and/or the debris remaining will adversely effect the dissolved oxygen (DO) levels through decomposition of this organic debris.
6. Chemical or petroleum products associated with the harvest operation have a moderate to high potential of reaching the stream or waterbody.

Check the **"No"** box under **Threats or Risks to Water Quality** if any of the following are true:

1. The appropriate BMP was properly installed and maintained (e.g. you checked "Yes" in the adjacent "BMP Properly Implemented and Maintained" box).
2. The disturbed area is far enough from the nearest water body that it is very unlikely that sediment or any other adverse water quality impacts will affect the water body before the tract heals over.
3. The topography of the land is too gentle to allow sediment to enter the stream before groundcover is naturally reestablished.
4. For reasons other than those listed above, you do not believe that there is any risk of water quality being negatively affected by the forestry operation before the tract heals over.

- The surveyor will evaluate all applicable BMPs on each harvest operation. For example, a logging operation may involve only timber harvesting, road construction, SMZs, and waste disposal (with no stream crossings).
- The surveyor will describe and evaluate any "Innovative BMP" utilized for each BMP category (excluding SMZ width); these data will be incorporated into the overall BMP Implementation Summary. [Note: All "Innovative BMPs" identified will be further assessed for incorporation into future forestry BMP manual revisions.]
- Enter the total number of responses ("yes," "no," N/A," and "threats or risks" (Yes, No)) for each applicable statement for each practice observed in the total responses box of each BMP.
- When it is determined that no apparent effort was made to apply a BMP practice but no threat to water quality exists, place a check in the appropriate box(es) that appear just above the "Comments" section.
- Enter any additional pertinent information about any aspect of the practice that may provide clarification in the "Comments" section at the bottom of the page.

Buffer Rules

- Operations that occur in the Neuse or Tar-Pamlico River Basins, the Randleman Watershed, or adjacent to the main stem of the Catawba River are subject to mandatory buffer rules. If applicable, complete these sections in addition to other sections of the survey related to SMZs.

SMZ Width

- Braided streams are characterized by successive division and rejoining of streamflow with accompanying islands.
- Stream order – See Appendix 4.
- For an intact mature forest, pre-harvest shade is generally assumed to be 76 – 100%.
- The post harvest canopy question assumes leaf-on shade – if you are surveying in the wintertime, use your best estimate of summertime conditions based on canopy characteristics.
- SMZ Width Table
  This table allows for up to four different streams to be represented; use only as many as you need. Average width is determined from the top of the bank to the outer edge of the apparent SMZ. Check "Yes" for risk to water quality if there is evidence of sediment entering the stream as a result of surface flow through the buffer or if you expect that it would occur during a normal rain event. If you check "Yes", please give a brief explanation of why sediment is entering the stream or why you think it will likely do so in the "Comments" section (ie, "Sediment entering stream through unprotected gully" or simply "SMZ width inadequate for slope and ground cover").

SMZ Conditions

- When completing this section, ignore the portion of the SMZ for any stream crossings - that will be addressed in the "Stream Crossing" section.

Stream Temperature

- This question addresses shade on the stream channel and not for the entire SMZ.

Debris Entering Stream

- An "obstruction" completely blocks stream flow such that aquatic organisms (fish, bugs) cannot migrate freely beyond that point. An "impairment" is a lesser blockage that affects but does not block stream flow.
- A stream channel alteration occurs when a section of the stream flows outside of its normal channel as a result of blockage from the forestry operation.

Waste Entering Stream

- No notes for this section.

Forest Access Roads

- This section refers to any roads leading up to the logging deck from the entrance to the property.

Skid Trails

- No notes for this section.

Stream Crossings

- No notes for this section.

Access Road Entrances

- Excess soil on the highway can be considered a risk to water quality if there is a surface flow path that will likely deliver sediment to a nearby water body.

Rehabilitation of Project Site

- Although this survey covers active logging operations, this section can still apply to areas that have been closed out such as unused skid trails or logging decks that have been abandoned.

Complete the Overall BMP Implementation Summary as follows:

- Enter the total number of "yes" and "no" answers tallied on pages 4 through 12 for the practices that apply to the operation in the corresponding spaces on page 13 and the total for each at the bottom of each column.
- Enter the sum of "yes" and "no" answers tallied in the "total yes + no" column.
- Calculate the percent "yes" answers for each practice by dividing the total number of "yes" answers by the sum of both "yes" and "no" answers for the practice, and enter them in the "% yes" column.
- Calculate the overall implementation percent by dividing the total number of "yes" answers by the sum of both "yes" and "no" answers (bottom of Total yes + no column), and enter it in the appropriate space at the bottom of the "% yes" column.
- Enter the total number of "Yes" **"threats"** or **"risks"** to water quality observed at the bottom of the last column. You do not need to total the "No" answers.
- Calculate the **Total Practices with Threats or Risks to Water Quality (%)** by dividing the total number of **"threats"** or **"risks" to water quality** by the sum of both "yes" and "no" answers (bottom of Total yes + no column) and enter it in the appropriate space at the bottom of the summary matrix.
- Enter any appropriate comments about the **operation as a whole** in the "Comments" section.

Completing the FPG Compliance Notification

After completing the BMP Implementation Survey, the "Site Evaluation/Compliance Notification" component must be completed. This FPG compliance information will be correlated to the survey data on an annual basis. The data will also be compared to other inspections performed outside of this 319 research project.

Documenting Total Survey Time/Travel and "Zero" Harvest Sites

In order to document the Division's labor and equipment investment in this project, we have amended the survey (page 15) to capture the total hours and mileage for each attempted survey event(s). We are also documenting time/travel invested that fails to yield a successful survey(s). There are several potential benefits in acquiring this information that will be addressed in a forum outside of this procedure.

We continue to ask surveyors to attempt to locate candidate harvest operations (in all counties historically known to have a history of sustainable harvest operations) **throughout the sample year**. To document this effort, we amended the survey (Page 14) to include a compressed check-the-applicable-box(es) for a 100 county matrix that documents, on each survey accomplished, whether effort was expended on any additional counties visited in the "timeframe" of the completed survey. The completion of this query is not limited to the day an actual survey is successfully

accomplished; therefore, fruitless effort expended either before, during, or after the day of the successful survey capture can be documented on that survey by transposing notes from another reference source (e.g., DFR daily pocket calendar or work log) accordingly. As all surveys are dated, the chronological order of their collection coupled with the required monthly submittal to the CO will serve to document and track your efforts to capture, without success, survey effort in a given county throughout the sample year. You will also have available the option of photocopying the modified survey page and recording each "day event" if so desired and submitting a photocopy(ies) of the single page along with the surveys completed for the given month – the choice is left up to you.

Disposition of Survey Forms

Submit the original survey forms to the CO (Attention: Will Summer) **at the end of each month**. Make a copy for your records in case the original is lost in the mail or questions arise and subsequent discussion is required between CO and field staff. The surveyor will maintain a map of their respective districts which spatially depicts sampled tracts. As time progresses, grids and quadrants therein not previously sampled may be subject to sampling to ensure all counties have been sampled and that sampling "over time" (i.e., over a three-year period) has occurred uniformly throughout North Carolina.

When "Threats" or "Risks" to Water Quality are Discovered

Anytime a water quality problem is encountered that relates to the logging operation, the surveyor should notify the appropriate NCDFR employee charged to address FPG compliance concerns. **Should the surveyor and compliance contact be one in the same, then we encourage you to disassociate the survey from the FPG compliance issue in order to prevent the survey from being viewed as a "compliance hammer" as opposed to the research tool it is intended to be.**

Water Quality Related Complaints

In order to minimize project bias, a BMP implementation survey shall not be conducted as follow-up to a water quality-related complaint on a logging operation. However, no attempt should be made to avoid potential "bad actor'" harvest tracts, provided the site(s) are randomly selected for the survey effort without prior knowledge of the on-site logger or logging company.

Questions/Problems/Feedback

Any questions or comments concerning the survey or support documents should be addressed to Will Summer of the CO staff.
Office (919) 733-2162 ext. 247
Cell (919) 218-6285
Email: Will.Summer@ncmail.net

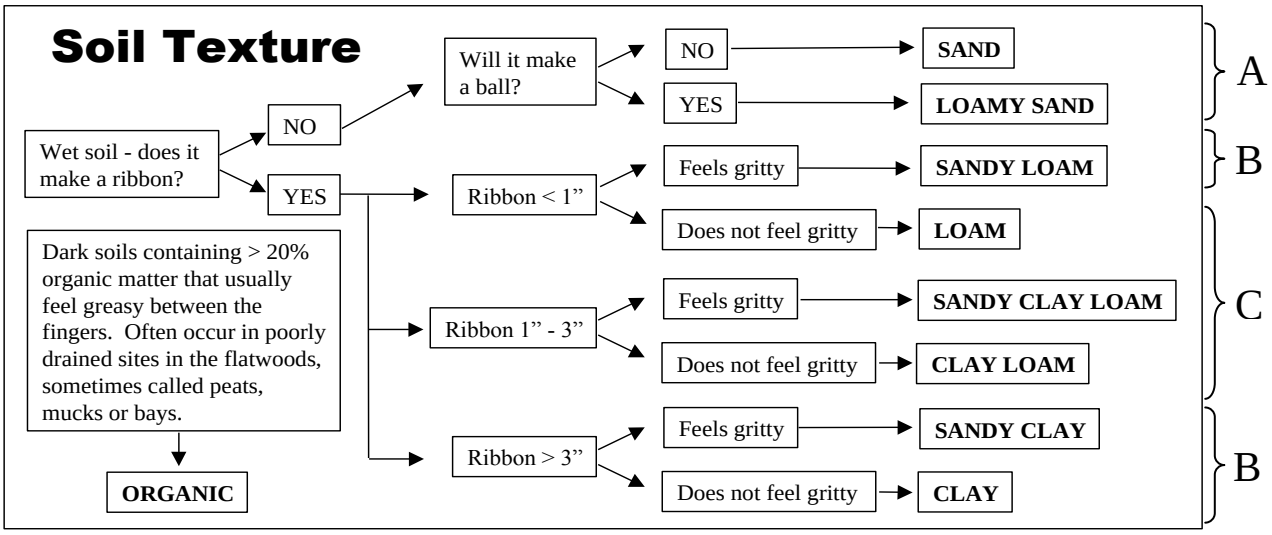
Appendix I. Number of BMP Surveys to be conducted in each county.

Region 1 Counties	Number of surveys: 73
District 4	**24**
Beaufort	5
Carteret	2
Craven	4
Jones	3
Lenoir	2
Onslow	3
Pamlico	3
Pitt	2
District 7	**20**
Bertie	5
Camden	1
Chowan	2
Currituck	1
Gates	3
Hertford	3
Martin	2
Pasquotank	1
Perquimans	2
District 8	**19**
Bladen	4
Brunswick	4
Columbus	5
Duplin	2
New	1
Pender	3
District 13	**9**
Dare	1
Hyde	2
Tyrrell	3
Washington	3

Region 2 Counties	Number of surveys: 93
District 3	**24**
Anson	5
Chatham	3
Lee	2
Montgomery	3
Moore	4
Richmond	3
Scotland	2
Stanly	2
District 5	**22**
Edgecombe	2
Franklin	2
Greene	2
Halifax	3
Nash	2
Northampton	3
Warren	4
Wayne	2
Wilson	2
District 6	**14**
Cumberland	2
Harnett	2
Hoke	2
Johnston	2
Robeson	3
Sampson	3
District 10	**18**
Davidson	2
Davie	1
Forsyth	1
Guilford	1
Randolph	2
Rockingham	3
Rowan	2
Stokes	2
Surry	2
Yadkin	2
District 11	**16**
Alamance	2
Caswell	2
Durham	2
Granville	2
Orange	2
Person	2
Vance	2
Wake	2

Region 3 Counties	Number of surveys: 49
District 1	**13**
Buncombe	1
Henderson	1
Madison	2
McDowell	1
Mitchell	2
Polk	1
Rutherford	3
Yancey	2
District 2	**15**
Alexander	1
Alleghany	1
Ashe	2
Avery	1
Burke	3
Caldwell	2
Watauga	2
Wilkes	3
District 9	**11**
Cherokee	2
Clay	1
Graham	1
Haywood	3
Jackson	1
Macon	1
Swain	1
Transylvania	1
District 12	**10**
Cabarrus	1
Catawba	1
Cleveland	1
Gaston	1
Iredell	2
Lincoln	1
Mecklenburg	1
Union	2

Appendix II. Soil texture flow chart.



Soil Erodibility - All things being equal the designations to the right indicate soil erodibility potential with A = Low, B = Moderate, and C = High. You must also consider slope length and gradient, ground cover and practices that would effectively prevent erosion. For example, a sandy clay loam on a low (2%) slope with good ground cover would be a low soil erodibility class for the purposes of this survey.

Appendix III. USACE 15 Mandatory Rules For Forest Roads in Wetlands.

The paragraph and list of mandatory BMPs shown below are quoted from the US Army Corps of Engineers Regulatory Program Regulations, Permits for Discharges of Dredged or Fill Material Into Waters of the United States.

(6) Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment, where such roads are constructed and maintained in accordance with best management practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. These BMPs which must be applied to satisfy this provision shall include those detailed BMPs described in the state's approved program description pursuant to the requirements of 40 CFR Part 233.22(i), and shall also include the following baseline provisions:

(i)Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii)All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

(iii)The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv)The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(v)Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(vi)In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

(vii)The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(viii)Borrow material shall be taken from upland sources whenever feasible;

(ix)The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(x)Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi)The discharge shall not be located in the proximity of a public water supply intake;

(xii)The discharge shall not occur in areas of concentrated shellfish production;

(xiii)The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv)The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv)All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Appendix IV. Strahler Steam Order.

This is the most commonly used system for classifying steam order. The basic procedure is as follows: A headwater stream (the smallest perennial or intermittent stream) is designated as a first order stream. When a first order stream joins another first order stream, the resulting stream is a second order stream, and two second order streams join to make a third order stream and so on… The only catch is that it takes two of the same stream order to make the next order. For instance, if a third order stream is joined by a second order stream, the result is still a third order stream. Only two third order streams can join to make a fourth order stream. See the diagram for clarification.