BEST MANAGEMENT PRACTICES FOR

CONSTRUCTION AND MAINTENANCE ACTIVITIES

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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1.0 BACKGROUND INFORMATION

1.1 Introduction

1.2 Purpose of Manual

1.3 Ethics Policy

1.1 INTRODUCTION

Improper construction and maintenance practices can have significant impacts on water quality, stream ecology and aquatic habitat. The health of these aquatic systems impacts many aspects of life in North Carolina including fishing, travel and tourism, water-based recreation, drinking water supplies and aesthetics. Healthy stream ecology and aquatic habitat are necessary to support a healthy recreational and commercial fishing stock. Good water quality is key to providing clean and affordable drinking water supplies and maintaining attractive water bodies that invite recreational use.

Much of North Carolina's economy is supported by aquatic trades and tourism and many of North Carolina's citizens enjoy activities on or around the numerous streams, lakes and estuaries the state has to offer. By managing North Carolina Department of Transportation's (NCDOT) operation and maintenance activities to minimize adverse water quality impacts, we all help maintain the outstanding quality of life and stewardship that takes place in North Carolina.

NCDOT can best manage its water quality impacts by performing work in and around bodies of water with the utmost care and by using Best Management Practices (BMPs) that focus on minimizing sediment loss from a project. Sediment transport is a natural stream function. However, excess sediment is the number one pollutant in streams across the state of North Carolina and its impacts are often seen far downstream. When sediment enters a stream it can have a number of effects on the water body. It may cause turbidity, or clouding of the water, which reduces light penetration through the water column. Decreased light penetration can affect plant life and the levels of oxygen in the water, which in turn affects aquatic life that obtain oxygen from the water. Sediment particles suspended in the water column also add erosive force to a stream, much like a piece of sandpaper, and can contribute to accelerated bank erosion and wash away the streambeds. Sediment settles to the bottom of water bodies and smothers the insects, microbes and plants that support healthy populations of fish and other aquatic animals. Sediment can also serve as the transport mechanism for many other pollutants that adhere to sediment particles, such as nutrients, bacteria, pesticides, and organic matter which have their own adverse affects on the water body.

1.2 PURPOSE OF MANUAL

NCDOT is responsible for managing new roadway construction and operating and maintaining over 76,000 miles of existing roadway throughout the state. This manual is designed for employees and contractors to construct, and maintain the NCDOT roadway systems while minimizing adverse impacts on the water resources of the State.

This manual assumes that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

This manual includes the necessary information for the Department to perform essential activities while minimize their impacts on jurisdictional areas during normal construction, maintenance, and emergency repair situations.

Activities in and around streams, lakes and estuaries are regulated by a number of different programs and anyone performing work in these areas should have some idea of the magnitude of regulations governing their activities. This manual provides guidance on a number of BMPs consistent with existing regulatory programs that should be utilized when working within or adjacent to jurisdictional areas.

The Project Planning and Preconstruction section describes the actions that should be performed prior to any construction or maintenance activities. The Construction Supervisor is not responsible for performing these actions but should question the Lead Engineer and/or Division Environmental Officer (DEO) if it is unclear that these activities have been completed. The Construction Supervisor should ensure that all permit conditions are followed and that no work is performed outside of areas shown as impacted in permit drawings or plans.

The General Project Construction Practices/Operations section provides an overview and general guidance for field personnel/contractor that should be applied to all projects and activities within or adjacent to jurisdictional areas. Specific conditions that shall be followed on all projects are highlighted.

The overview and general process for all projects is followed by specific guidance in the Specific Construction Practices/Operations section. Specific construction practices

are identified and guidance provided so the project can be completed in an environmentally responsible manner. This section also identifies appropriate BMPs, provides a general overview of the construction sequence as it relates to protecting jurisdictional areas, and highlights specific conditions that must be followed in order to be in compliance with NCDOT Environmental Stewardship Policy, as well as State and Federal regulations.

The last section of the manual includes activity-specific information for each individual BMP such as where the practice is and is not applicable, construction standards, maintenance requirements, and typical problems. Some of the BMPs identify the appropriate NCDOT standard and specification for proper construction. While other BMPs have detailed construction specifications and installation procedures, the intent is to not duplicate existing standards and provide standards where none exist.

The overall goal of this manual is to provide guidance to construction crews when working within and adjacent to jurisdictional areas. At the same time providing flexibility to the crews to choose which method is suitable for each given situation.

North Carolina Department of Transportation

ENVIRONMENTAL *Stewardship Policy*

The mission of the North Carolina Department of Transportation is to provide an integrated transportation system that enhances the state's well being. Our goal is to provide a safe and well-maintained transportation system that meets the needs of our customers and supports the development of sustainable, vibrant communities. In so doing, we are committed to planning, designing, constructing, maintaining and managing an interconnected transportation system while striving to preserve and enhance our natural and cultural resources.

Environmental stewardship encompasses these responsibilities and is reflected in our day-to-day operations by:

- Safeguarding the public's health by conducting our business in an environmentally responsible manner
- Demonstrating our care for and commitment to the environment
- Recognizing that our customers expect us to provide mobility and a quality of life that includes the protection of the natural resources and the cultural and social values of their community.

Each employee is responsible for incorporating these principles of safety, environmental stewardship and customer focus into their daily activities.

Approved by the Board of Transportation on February 7, 2002.

J. Douglas Galyon
Chairman of the Board

Secretary of Transportation

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2.0 PROJECT PLANNING AND PRECONSTRUCTION

This section provides guidance to Lead Engineers, Division Environmental Officers, and Contractors with respect to planning and preconstruction activities on projects in or adjacent to jurisdictional waters. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

2.1 Planning

2.2 Preconstruction

2.1 PLANNING

- All projects shall have obtained the proper permits or authorization from the USACE, DWQ, DCM, CAMA, DLR-LQS, DWR, US Fish and Wildlife Service, and/or NC Wildlife Resources Commission prior to construction.

- For projects designed, bid, and awarded as part of the NCDOT Transportation Improvement Project process, the Lead Engineer and/or DEO will attend the pre-construction meeting or arrange a regulatory meeting to discuss permit conditions for the specific project if necessary.

- For NCDOT Division projects, the DEO shall confirm whether the project is located on a jurisdictional stream and delineate other environmentally sensitive areas such as wetlands, stream buffers, high quality waters, trout waters, Areas of Environmental Concern (AECs), etc. Final jurisdictional determination authority is with USACE.

- For NCDOT Division projects, the Lead Engineer and DEO shall determine if the project requires a Pre-Construction Notification to utilize a general 404 permit, a 401 certification and/or an authorization for buffer zone impacts, or other applicable permits prior to construction.

- If necessary, the DEO will also determine the potential for adverse impacts to known federally protected species populations (listed in that county by the Fish and Wildlife Service as shown on the NC Natural Heritage database) by conducting an onsite survey for those species and their suitable habitats.

- If necessary, the Lead Engineer or DEO will consult with the State Historic Preservation Office (SHPO).

- For NCDOT Division projects where CAMA AEC's exist in the project area, a pre-application meeting should be scheduled with the Division of Coastal Management (DCM) field representative. The

Lead Engineer or DEO shall schedule this meeting well in advance of letting or construction.

- No demolition, construction, filling, excavation, or other ground disturbance should occur in a CAMA AEC without specific approval by DCM.

- The Lead Engineer, DEO, and Contractor shall be well versed in the guidance provided in Sections 3.0, 4.0 and 5.0 of this manual prior to undertaking the design and construction of a project in the vicinity of jurisdictional waters.

- All projects shall have an erosion and sedimentation control plan in compliance with current NCDOT practices.

- Roadside Field Operation Engineer (RFOE) must review and approve the erosion and sedimentation control plan for trout waters before submission to District Wildlife Resources Commission Fisheries Biologist.

- All timber bridge deck removal, bridge demolition, and bridge construction projects shall have a detailed plan of these activities submitted and approved by the Resident Engineer.

- In general the Divisions should consult the NCDOT Hydraulics Unit for proper sizing of any pipes or culverts > 48” diameter.

- All appropriate BMPs for the given site conditions shall be followed by field personnel.

- The Construction Supervisor or Lead Engineer shall ensure issues such as vertical clearance, horizontal clearance, and access are addressed.

2.2 PRECONSTRUCTION

- The Construction Supervisor shall have a copy of all permits (including permit drawings showing all jurisdictional areas) on-site during construction or all jurisdictional areas should be clearly identified or marked

on the ground.

- The Lead Engineer shall check the project plans for consistency with the permit drawings and report any discrepancies to the DEO.
    - Any questions regarding general and special permit conditions should be discussed with the DEO and RFOE.
    - Any impacts to jurisdictional areas for waste/borrow activities other than shown on the permit drawings and project plans are prohibited.
    - The Contractor shall have submitted and received an approved Reclamation Plan that has been signed off by the RFOE.
    - For waste/borrow areas, the Contractor is responsible to identify jurisdictional surface waters, wetlands, AECs (CAMA), and address federally listed threatened and endangered species issues per NCDOT Standard Specification 802-2.

3.0 GENERAL PROJECT CONSTRUCTION PRACTICES/ OPERATIONS

This section provides general guidance for field personnel working on projects in or adjacent to jurisdictional waters. These guidelines are generic and should be universally applied to all projects. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

3.1 Project Monitoring

3.2 Erosion Control

3.3 Managing the Watercourse

3.4 Managing the Riparian Buffer

3.5 Managing the Work Area

3.6 Managing Spoil

3.8 Ground Stabilization

3.9 Site Cleanup

3.1 PROJECT MONITORING

- The Roadside Field Operations Engineer (RFOE) and the Division Environmental Officer (DEO) monitors construction activities for adherence to the Construction and Maintenance Manual and any permit conditions. Periodic field review will be made to ensure compliance with erosion and sedimentation control laws, permit conditions, buffer rules, and other environmental considerations.

- The RFOE, through the Chief Engineer's office, has the authority to require correction of erosion and sedimentation control problems on NCDOT projects through the Immediate Corrective Action (ICA) process.

3.2 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control consists of measures taken to prevent sediment from leaving the job site. Structural controls reduce erosion from disturbed areas. Sediment controls intercept and treat runoff before it is discharged from the project. Velocity controls also help reduce velocity, reduce the erosive force of runoff, and cause suspended particulates to settle out.

Figure 1. Typical Perimeter Erosion Controls

Several specific methods of erosion and sediment control are provided in this manual (see Section 5.1). However, the following general measures should be employed as appropriate:

- Install erosion and sedimentation control measures prior to any land disturbing activity, including clearing and grubbing.
- Sedimentation control measures are installed both within the work area and on the outside limits of the work area to control runoff from disturbed areas before it leaves the site.
- Remove erosion and sedimentation controls measures after graded project area is complete and stable.

3.3 MANAGING THE WATERCOURSE

The work area must be isolated from the normal flow of a stream and the flow in the stream that occurs during minor rainfall events. When the stream must be diverted on a project, the watercourse should be managed to minimize adverse impacts to the jurisdictional waters.

All projects should minimize the time that the watercourse will be diverted. Several specific methods of diverting a watercourse are provided in this manual (see Section 5.2). However, the following general measures should be employed on all projects as appropriate:

- The stream's normal flow and flow during minor rainfall events shall be maintained near normal downstream flow conditions without mixing with untreated water from the work area. This can be accomplished by diverting the stream around or through the work area.
- Where the construction time is anticipated to be less than one day and no normal flow occurs in the channel, the watercourse can be managed by keeping equipment and materials from entering the stream channel and maintaining appropriate erosion and sedimentation controls. Since these steam channels are intermittent, the

timing of construction should be during times of no stream flow.

- Where the construction time is anticipated to be less than one day and little or no base flow occurs in the channel, an impervious dike may be utilized to create an impoundment upstream of the work area.

Figure 2. Water Course Diversion

- The watercourse shall be managed to minimize any flooding of the work area.

3.4 MANAGING THE BUFFER AREAS

Buffers are legally protected areas along jurisdictional waters such as streams, lakes, ponds and estuaries. Buffer requirements may be applied throughout a regional area, such as a river basin, watershed or AEC, and may vary from region to region.

It is important to be familiar with the requirements that apply in your project area. The following general buffer requirements provide initial guidance:

Figure 3. Riparian Buffer

- Prior to 2003, state riparian buffer requirements were in place in the Neuse, Tar-Pamlico, and Catawba River Basins and in the Randleman Reservoir watershed as part of the Water Supply Watershed Rules. Be aware that buffer programs may have been added in other river basins or watersheds since 2003.

- Cities and counties may have specific local riparian buffer requirements. Be familiar with the specific buffer rules that apply in the work area. Consult with the DEO to determine if/what buffer rules are in effect in the project area.

- Riparian buffer requirements may also apply in coastal shoreline AEC's.

- Typically, the riparian buffer is a 50-foot wide vegetative strip along each side of a jurisdictional stream measured from the top of bank or the mean high water line. The riparian buffer typically cannot be disturbed unless specific conditions are satisfied.

- Trout waters must have a 25-foot minimum width of undisturbed buffer zone. When temporary and minimal disturbance is permitted, it shall be limited to a maximum of 10% of the total length of the buffer zone within the tract to be disturbed.

- Existing drainage ditches and roadside ditches are typically exempt from the buffer rules provided that they are managed to minimize sediment, nutrients and other pollution that enters jurisdictional waters. However, the

DEO should first determine whether a roadside ditch is a modified natural stream or not.

- Existing drainage ditches may not be deepened beyond original pre-construction depths.
- New ditches through a riparian buffer are typically not allowed unless specific conditions are satisfied.
- Excavation of stream beds is prohibited.
- Consult DWQ on installation of sediment and erosion control devices in zone 1, as needed.

3.5 MANAGING THE WORK AREA

For this manual, the work area consists of the area necessary to perform the construction or maintenance activity within or adjacent to jurisdictional areas. They include but are not limited to excavation and storage of material offsite in upland disposal sites, construction, and the maneuvering of equipment and manpower.

The following general measures should be employed on all projects as appropriate:

- All land disturbing activities shall be confined to the work area as shown in the permit drawings, including equipment staging and access.
- The work area shall be isolated from jurisdictional waters. The goal is to prevent the discharge of water from the work area prior to treatment.
- All runoff from the work area shall drain through a Sedimentation Control BMP or a Dewatering Device BMP prior to entering jurisdictional waters.
- Intermediate Sedimentation Control BMPs may be needed as work progresses and the work area changes in size and elevation.

Figure 4 – Managing the Work Area

- BMPs shall be maintained throughout the life of the project. Refer to Section 5.0 for proper maintenance of specific BMPs.
- Multiple small work areas in lieu of one large work area may be established to minimize the disturbance of jurisdictional waters.

3.6 MANAGING THE SPOIL

Excavated material or spoil shall either be:

- Contained within the work area.
- Stockpiled near the work area and contained by an appropriate Erosion and Sedimentation Control BMP.

- Removed from the site and disposed of properly.
- Spoil material shall not be placed in wetlands, protected riparian buffers, or other jurisdictional areas.
- Used for reestablishing groundcover.

Figure 5. Typical Spoil Management

3.7 GROUND STABILIZATION

After completion of construction or land disturbing activities, all disturbed areas must be stabilized to prevent future erosion. Establishing a good vegetative cover helps protect soil from the impact of raindrops and reduces the erosive forces of runoff. Hard armor, such as riprap, helps protect areas that cannot be stabilized with vegetation.

Several specific methods of ground stabilization are provided in this manual (see Section 5.6). However, the following general measures should be employed on all projects as appropriate:

- When construction/repairs are complete, remove all construction debris, including old concrete, asphalt, and

stockpiled material.

- Notify the seeding crews in advance when final grading is to be performed.

- Dress and fine grade disturbed areas.

Figure 6. Ground Stabilization

- Prepare an adequate seed bed. Wetland areas are to planted with appropriate seed mixtures. Consult with RFOE and DEO in your division to determine the appropriate seed mixture.

- Maintain erosion control BMPs until vegetation is well established.

- Do not apply fertilizer directly into streams.

- Temporary seeding shall be performed if the project is to remain idle for longer than 15 working days. Working days means days exclusive of Saturday and Sunday during which weather conditions or soil conditions permit land-disturbing activities to be undertaken.

- Do not spray straw tacking material into stream during seeding operation.

- Disturbed areas in riparian buffers may need planting of

woody species, in addition to seeding.

3.8 SITE CLEAN-UP

Figure 7 – Site Clean-up

- Temporary fill shall not be placed within jurisdictional waters and wetlands unless specifically identified in the permit.

- When temporary fill is approved, it shall be completely removed and the affected area restored to the pre-project conditions upon completion of the construction activity.

- After establishment of the groundcover vegetation, remove sedimentation control BMPs and restore the ground to pre-project conditions and stabilize.

- Continue to spot seed and mulch exposed, erodible areas.

4.0 SPECIFIC CONSTRUCTION PRACTICES/ OPERATIONS

This section provides detailed information on specific construction practices/operations that are performed in or adjacent to jurisdictional waters. Specific construction projects are identified along with the steps that shall be taken to complete the project in an environmentally responsible manner. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

For each practice/operation, appropriate BMPs are identified and specific conditions highlighted in order to be in compliance with NCDOT, State, and Federal regulations.

4.1 Pipe/Culvert Extensions

4.2 Pipe/Culvert Installation

4.3 Slope Repairs Adjacent to Jurisdictional Waters

4.4 Headwall Installation

4.5 Outlet Maintenance

4.6 Bridge Demolition

4.7 Bridge Construction

4.8 Channel Relocation

4.1 PIPE/CULVERT EXTENSIONS

This section describes the steps to take when performing a pipe extension on a jurisdictional stream.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Install temporary silt fence or silt ditch to treat runoff from the work area or isolate the work area from the jurisdictional areas (See Section 5.1)

3. Install Temporary Rock Silt Check Type “A” or Temporary Sediment Dam Type “B” in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1)

Managing Watercourse

4. Streamflow diversion is typically utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).

    - ***In CAMA AECs, the type of flow diversion is identified in the permit.***

5. Utilize a temporary stream crossing (See Section 5.5) when the stream must be crossed in an area that will not be permanently replaced by the pipe extension.

    - ***In CAMA AECs, the type of temporary stream crossing is identified in the permit***

Managing Work Area

6. Dewatering devices such as silt bags, stilling basins or Temporary Rock Sediment Dam Type “B” should be used to manage water from the work area prior to discharge (see Sections 5.4 and 5.1).

    - ***In CAMA AECs, the type of dewatering device is identified in the permit***

7. Install the pipe/culvert per the NCDOT standards and specifications.

    - ***Foundation material shall be confined to the***

pipe extension area and shall not be placed in the existing stream channel outside the pipe extension area.

- ***Excavation of stream channel shall not exceed 10 feet on either end of the new pipe/culvert. However, DEO should ensure that all work falls within the threshold of the riparian buffer rule or other rule.***

- ***No live or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.***

Figure 8. Culvert Construction

8. Install the riprap slope and outlet protection where required (See Section 5.6).

    - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes.***

    - ***Minimal riprap should be used to line stream channel and should not impede aquatic***

organism passage.

- ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***

- ***If the streambed is subject to high velocity at the outlet of the culvert, engineering outlet protection measures, such as energy dissipaters should be installed a minimum of 1.0 foot below the existing streambed.***

9. Remove flow diversion and allow the stream to flow through the new pipe/culvert extension.

    - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***

10. Begin backfill operations. Intermediate erosion and sediment control BMPs shall be installed prior to the backfill operation to provide containment between the work area and the watercourse.

Figure 9. Completed Culvert Extension

Ground Stabilization

11. Upon completion of backfill operations, prepare slopes and other disturbed areas and stabilize (See Section 5.6).

12. Maintain erosion and sedimentation control measures until groundcover or vegetation is well established.

Site Cleanup

13. Upon establishment of vegetation, remove any remaining erosion and sedimentation control BMPs and stabilize disturbed areas.

    - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions and planted with appropriate plant species.***

4.2 PIPE/CULVERT INSTALLATION

This section describes the steps to take when an existing pipe or culvert is being constructed or replaced on a jurisdictional stream.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Install temporary silt fence or silt ditch to treat runoff from the work area or isolate the work area from the jurisdictional areas, such as wetlands or riparian buffers (See Section 5.1).

3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1).

    - ***Do not install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in stream channel***

Figure 10. Pipe Repair/Replacement

Managing the Water Course

4. On larger streams, flow diversion may be used to isolate the work area using bypass pumping, piped diversion or fabric-lined channel (See Section 5.2). On smaller streams, or at low flow conditions, an impervious dike may be used to temporarily dewater the work area within the stream channel (See Section 5.3).

    - ***All temporary in-stream structures must be installed with geotextile fabric beneath them, and removed in their entirety immediately upon completion of in-stream work***

    - ***In CAMA-AECs, the type of flow diversion is identified in the permit.***

5. Temporary stream crossings may be utilized in order to provide equipment access, if underlain by geotextile fabric, so that the riprap may be entirely removed (See Section 5.5).

    - ***Confirm that the temporary stream crossing is shown in the permit drawings as an approved temporary impact.***

    - ***In CAMA-AECs, the type of temporary stream crossing is identified in the permit.***

Figure 11. Pipe/Culvert Foundation Installation

Managing the Work Area

6. Dewatering devices are typically needed to keep the work area dry (see Section 5.4). The permit conditions and the amount of available space and length of pipe replacement or project limits will determine the type of dewatering device to be used. Every effort should be made to minimize the extent of the area to be dewatered and the length of time the site is dewatered.

    - **In CAMA-AECs, the type of dewatering device is identified in the CAMA permit.**

7. Install the pipe/culvert per the NCDOT standards and specifications, and any specified permit conditions. Note that pipes and culverts shall be buried a minimum depth below the existing streambed, as defined below, in order to allow for aquatic organism passage during low flow conditions. Variance may be obtained by the DEO to allow for deviations in pipe burial depths due to bedrock, steep gradients in the stream channel, existing headcutting, potential for drainage of upstream wetlands, or other concerns.

Figure 12. Pipe/Culvert Installation

- ***Foundation material shall be confined to the pipe/culvert area and shall not be placed in the existing stream channel outside of the permitted impact area.***

- ***Excavation of the stream channel shall not exceed 10 feet on either end of the new pipe or culvert unless the stream is being relocated per Section 4.9, or if indicated in the permit.***
- ***Within river basins subject to the Riparian Buffer Rules, projects may be exempt if work in the stream channel is limited to a total of 40 feet of additional impact, including pipe extension.***
- ***In CAMA AECs (within the twenty coastal counties), all pipes and culverts must be buried one foot below the existing average streambed elevation.***
- ***In other parts of the state, pipes/culverts must be buried as follows:***
  - ***Culverts 48-inches in diameter or greater shall be buried one foot below the streambed elevation. Average streambed elevation shall be measured from multiple measurements taken outside of the area of scour or road crossing disturbance, outside of the ROW limits, if necessary.***
  - ***Culverts less than 48-inches shall be buried a depth equal to 20% of the pipe/culvert diameter, such as the following examples. The hydraulic conveyance of the culvert however should not be compromised.***

Examples:
- ***36" = 7"***
- ***30" = 6"***
- ***24" = 5"***
- ***18" = 4"***

8. Stream pattern, dimension and profile shall be maintained by pipe/culvert installation.

- ***A 4-foot diameter pipe/culvert installed in a 2-foot wide stream may require baffles in order to maintain aquatic organism passage (AOP) during low flow conditions.***
- ***Pipe size should at least match stream width wherever possible, but a 2-foot wide culvert installed in a 4-foot wide stream may also need baffles to reduce velocities.***
- ***Two 48 inch pipes installed in a 10-foot wide***

stream would require that one pipe be installed at a lower elevation, and in alignment with the low flow stream channel elevation, so that AOP is maintained during low flow conditions.

- ***The low flow pipe should be aligned with the deepest part of the stream channel, so that flow is maintained during low flow conditions.***
- ***No "live" or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.***

Figure 13. Pipe/Culvert Outlet Protection

9. Install the riprap shoulder slope and outlet protection on upstream and downstream channels where indicated on the permit drawings (See Section 5.6). Do not exceed approved limits in the permit. Contact the DEO if the permit or permit drawings are not clear.

- ***Riprap shall consist of clean rock or masonry material free of debris or pollutants (such as asphalt).***
- ***Outlet protection should be countersunk at least one foot below the average stream bed elevation.***
- ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure shoulder slope and streambank stability.***

10. Remove temporary flow diversion or dewatering devices and accumulated sediment before allowing stream flow to resume through the new pipe or culvert.

    - ***The impervious dike shall be completely removed to pre-project conditions.***

    - ***Care should be taken to not disturb or destabilize the undisturbed streambed during removal of temporary devices.***

11. Stream realignment can occur within approved permit impact limits. Minimize sharp or acute angles in stream alignment wherever possible. Stream channel pattern, dimension and profile should be maintained similar to the upstream and downstream stream reach.

12. Bioengineering techniques may be used to stabilize streambanks where feasible.

13. Begin backfill operations. Intermediate erosion and sedimentation control BMPs shall be installed prior to the backfill operation to provide containment between the work area and the watercourse.

14. If the pipe/culvert is part of a larger roadway project, enough backfill should be placed to allow for the removal of the temporary stream crossing. If no temporary stream crossing is required then enough backfill should be placed to prevent a washout during a minor storm event.

Ground Stabilization

15. Upon completion of backfill operations, prepare slopes and other disturbed areas and stabilize (See Section 5.6).

16. Maintain erosion and sedimentation control measures until ground vegetation is well established.

Site Cleanup

17. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize and reestablish remaining disturbed areas to proper grade, such as buffers, wetlands, and water.

    - ***Within jurisdictional waters & wetlands all temporarily disturbed areas shall be restored to the pre-project conditions.***

Figure 14. Completed Pipe/Culvert Installation

4.3 SLOPE REPAIRS ADJACENT TO JURISDICTIONAL WATERS

This section describes the steps to take when channel bank slopes, cut slopes, or fill slopes are repaired on or adjacent to jurisdictional waters, including wetlands. The required permits should be obtained or coordinated with the ACOE, DWQ, or DCM before removing sediment from jurisdictional waters.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Temporary silt fence or silt ditches are typically installed along the toe of the slope to intercept runoff from the work area (See Section 5.1).

3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into jurisdictional waters (See Section 5.1).

Managing the Water Course

4. Where normal flow occurs or for projects where potential in-stream impacts may occur, an impervious dike or turbidity curtain may be utilized to isolate the work area from the stream flow. The curtain or impervious dike should be placed adjacent to the work area and securely anchored to isolate the work area from the stream. The curtain shall not be used to cross or dam the stream flow. (See Section 5.2 and 5.3).

5. If sediment from a slope failure must be removed from the stream channel, the work area should be isolated from the stream by installing an impervious dike or turbidity curtain prior to beginning work.

    - ***Removal of sediment resulting from fill slope failure into a waterway is limited to the minimum necessary to restore the waterway to the pre-existing conditions***.

Managing the Work Area

6. Repair the slope.

   - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
   - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***
   - ***No material shall be placed which impairs surface water flow into any wetland area.***
   - ***No material shall be placed in a manner that will be eroded or displaced by normal or expected high flows.***

Ground Stabilization

7. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

8. Remove turbidity curtains or impervious dike after any significant sediment accumulations have been removed and turbidity of water has cleared.

   - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***

Figure 15. Slope Repair

9. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize, and reestablish disturbed areas, such as buffers, wetlands, and water.

   - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions.***

4.4 HEADWALL INSTALLATION

This section describes the steps to take when a headwall is being installed on an existing pipe or culvert on a jurisdictional stream.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Install temporary silt fence or silt ditch to contain sediment in the work area (See Section 5.1).

3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1).

Managing the Watercourse

4. Typically, flow diversion is utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).

   - ***In CAMA-AECs, the type of flow diversion is identified in the permit*.**

Figure 16. Headwall BMP Installation

Managing the Work Area

5. If needed, dewatering devices such as silt bags or Temporary Rock Sediment Dam Type "B" should be used to manage water from the work area prior to discharge (See Section 5.4 and 5.1).

    - ***In CAMA-AECs, the type of dewatering device is identified in the permit.***

6. Install the headwall per the NCDOT standards and specifications.

    - ***Foundation material shall be limited to the headwall repair area and shall not be placed in the existing stream channel outside the repair area.***

    - ***Excavation of stream channel shall not exceed 10 feet on either end of the pipe/culvert. However, DEO should insure that all work falls within the threshold of the riparian buffer rule or other rule.***

    - ***No live or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.***

Figure 17. Prefabricated Headwall

7. Remove the flow diversion and allow the stream to flow through the new pipe/culvert.

    - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***

8. Place backfill around headwall. Install intermediate erosion and sedimentation control BMPs where needed.

Ground Stabilization

9. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

10. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize, and reestablish disturbed areas, such as buffers, wetlands, and water.

    - ***Within jurisdictional waters and wetlands, all temporarily disturbed areas shall be restored to the pre-project conditions***

Figure 18. Completed Headwall Installation

4.5 OUTLET MAINTENANCE

This section describes the steps to take when outlet protection is being installed on an existing pipe or culvert located on a jurisdictional stream.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Minimize disturbed area needed for equipment access and install appropriate erosion control device to contain sediment in the work area (See Section 5.1).

Managing the Watercourse

3. Typically, flow diversion is utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).

    - ***In CAMA-AECs, the type of flow diversion is identified in the permit.***

4. When the construction time is anticipated to be less than one day and no normal flow occurs in the channel, the watercourse can be managed by keeping equipment and materials from entering the stream channel and maintaining appropriate erosion and sedimentation controls.

5. When the construction time is anticipated to be less than one day and little or no base flow occurs in the channel, an impervious dike may be utilized to create an impoundment upstream of the work area. Since these channels are intermittent, the timing of construction should occur during times of no flow.

Managing the Work Area

6. If needed, dewatering devices such as silt bags, stilling basins, or Temporary Rock Sediment Dam Type “B” should be used to manage pumped water from the work area prior to discharge (see Sections 5.4 and 5.1.)

    - ***In CAMA-AECs, the type of dewatering device is identified in the permit***

7. Remove debris and sediment.

8. Install riprap slope and outlet protection where required.

    - ***Outlet protection shall be buried a minimum of one foot below the streambed.***

    - ***Excavation of stream channel just for pipe installation shall not exceed 10 feet on either end of the pipe/culvert. However, DEO should insure that all work falls within the threshold of the riparian buffer rule or other rule.***

Ground Stabilization

9. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

10. Remove the flow diversion and allow the stream to flow through the new pipe/culvert.

    - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***

Figure 19. Completed Outlet Maintenance

4.6 BRIDGE DEMOLITION

This section describes the steps to take when an existing bridge is demolished over jurisdictional areas.

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Erosion Control

2. Install temporary silt fences around each bridge approach (See Section 5.1).

3. Install additional work area BMP measures when required.

Managing the Watercourse

4. Install turbidity curtains when water surface velocity and depth are sufficient to move debris outside of work area in sensitive water bodies (See Section 5.2).

Managing the Work Area

5. Evaluate structure and site for best demolition method that will create the least amount of debris and sediment loss.

6. Locate all equipment on existing roadway or specially constructed work pads

7. Transfer of fuel and vehicle maintenance should occur in a containment site and away from surface water

8. Collect and remove all loose debris and asphalt-wearing surfaces from the roadway

9. Collect and remove all road surface material before removing bridge sections.

10. Remove bridge in the fewest number of sections as possible to limit the amount of loose debris created.

    - ***Always use non-shattering demolition methods. If alternative methods such as explosives are required, approval must be granted from permitting agencies.***

    - ***Concrete bridge decks should be removed by***

sawing full depth or full span length in order to remove deck and beam sections as one unit.

- ***Remove any material that falls into the water body. No bridge deck or substructure components shall be dropped into the water. If this is not possible, such as the case of concrete arch design, demolition should not occur over more than one-half of the channel width at a time.***

- ***If a CAMA permit is required, dropping any component of a bridge into the water will not be acceptable unless it is proven that there is no feasible alternative. Such an activity would require coordination with and approval from DCM.***

11. Remove loose debris and road surface material piles from the work site promptly to eliminate possible scattering by wind and rain

12. Remove any debris and sediment resulting from the bridge demolition at the end of each workday.

13. Inspect all equipment used near surface water for possible leakage of liquid or semi-liquid fuels and lubricants daily. Promptly remove any leaking equipment from the area.

Figure 20. Bridge Demolition

Ground Stabilization

14. Reevaluate temporary BMP measures that are

required when the bridge demolition is complete.

15. Stabilize exposed stream banks with indigenous vegetation or riprap if required.

    - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
    - ***No asphalt or concrete debris recycling allowed in jurisdictional waters.***
    - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***
    - ***No material is placed which impairs surface water flow into any wetland area.***
    - ***No material is placed in a manner that will be eroded by normal or expected high flows.***
    - ***Plant material should be installed during the proper planting season and as soon as possible to help stabilize the stream.***

Site Cleanup

16. Remove inactive equipment from temporary causeways or floodplain areas

17. Upon establishment of vegetation cover remove remaining erosion and sediment control BMPs and stabilize disturbed areas.

    - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions***

4.7 BRIDGE CONSTRUCTION

This section describes the steps to take when a new bridge is constructed.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

2. Install temporary silt fence, silt ditch, temporary rock silt check type “A”, or temporary sediment dam type “B” to manage runoff from the work area required to install the approach roadway approach fill (See Section 5.1).

3. Conduct approved clearing and grubbing necessary to construct the roadway approach fill.

4. When stream banks are exposed due to clearing and grubbing operations, banks should be stabilized with indigenous vegetation or riprap.

    - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***

    - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***

    - ***No material shall be placed which impairs surface water flow into any wetland area.***

    - ***No material shall be placed in a manner that will be displaced by normal or expected high flows.***

5. Temporarily seed and mulch roadway approaches and maintain erosion control measures (See Section 5.6).

6. Install and or relocated erosion control measures to manage runoff from the work area required for bridge construction.

Managing the Watercourse

7. Install turbidity curtain when water surface velocity and depth are sufficient to move debris downstream outside of work area in sensitive water bodies (See Section 5.2).

8. At the end of each workday, remove any debris or sediment deposited outside of the work area as a result of the bridge construction.

Figure 21 – Bridge Construction within Wetlands

Managing the Work Area

9. Evaluate proposed bridge structure and site for best construction methods that will minimize erosion potential and construction debris. Steps for sequencing are required on work plan.

10. Store construction material and equipment within the construction limits of the project and away from flood prone areas. No equipment should be stored in wetlands, surface waters, or protected riparian buffers.

11. Transfer of fuel and vehicle maintenance should occur in a fuel containment area which is at least 50 feet away from any surface water.

12. Locate all equipment on existing roadways or specially constructed work pads.

13. Inspect and repair equipment for possible leakage of liquid or semi-liquid fuels and lubricants. Promptly remove any leaking equipment from the area.

14. Contain fresh concrete in wood or plastic forms and properly clean-out areas so that no seepage occurs into the adjacent water body, especially with the pouring of foundation work.

    - ***No live or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.***

15. Install any scour protection measures in accordance with permit conditions.

Ground Stabilization

16. Maintain and adjust erosion and sedimentation control measures as needed during all construction phases of the project

Figure 22. Completed Bridge Construction

Site Cleanup

17. Remove inactive equipment from temporary causeway or floodplain areas.

18. Dispose of construction debris and stockpiles of erodible material properly and stabilize the site with sufficient ground cover that will restrain erosion.

4.8 CHANNEL RELOCATION

This section describes the steps to take when an existing stream or channel is being relocated.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

2. Install temporary silt fence, silt ditch, temporary rock silt check type “A”, or temporary sediment dam type “B” to treat runoff from the work area (See Section 5.1).

3. Typical channel relocation projects require erosion control measures to be added and removed throughout construction to prevent sediment and debris from reaching the active stream.

Figure 23. Stream Channel Relocation

Managing the Watercourse

4. The existing stream shall be maintained as much as practical while the relocated channel section is constructed

5. Typically flow diversion is utilized to isolate the work area using a fabric-lined diversion channel (See Section 5.2) when the existing stream cannot be maintained.

    - **The existing stream shall not be diverted during fish migration periods.**

6. The existing stream flow shall only be diverted into either a stable temporary flow diversion channel or a completed and stabilized relocated channel reach.

Managing the Work Area

7. Channel relocation projects typically include inactive and active work areas to minimize the amount of exposed soil at any given time.

8. Inactive work areas shall be stabilized by seed and mulch temporarily, such that the work performed will not be displaced in the event the area is inundated during a storm event. (See Section 5.6).

9. Active areas shall be temporarily stabilized prior to an anticipated precipitation event to prevent the work performed from being displaced in the event the active work area is inundated.

Figure 24. Completed Stream Channel Relocation

10. Riprap shall only be placed when specifically shown on the plans.

    - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
    - ***No material shall be placed which impairs surface water flow into any wetland area.***
    - ***No material shall be placed in a manner that will be eroded by normal or expected high flows.***

11. The stream dimensions and depth shown on the plans are critical to the proper function of the channel relocation. Notify the Resident Engineer and/or regulatory agencies immediately if these dimensions cannot be maintained.

Ground Stabilization

12. The relocated channel and surrounding area shall be properly stabilized prior to receiving the normal stream flow. It is important that vegetative plantings occurs at the proper time of the year and as soon as possible to help stabilize the stream.

Site Cleanup

13. Remove the flow diversion, if necessary, and allow the stream to flow through the new channel.

    - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions***

14. Remove all temporary erosion control measures and properly dispose of excess spoil in upland disposal area which require field confirmation/verification by DEO.

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5.0 OPERATION BEST MANAGEMENT PRACTICES

Best Management Practices, or BMPs, include the host of tools that are applied to a project to prevent pollutants from entering jurisdictional waters and to minimize any pollutant loading. These tools include structural and non-structural measures. In some cases, a BMP is a structure that is installed on the site and in other cases it is the way in which a project is managed or, more typically, a combination of both. BMPs in this manual are targeted at reducing the impact to jurisdictional waters by roadway construction and/or maintenance activities. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

5.1 Erosion Control Measures

5.2 Flow Diversion

5.3 Impervious Dikes

5.4 Dewatering

5.5 Temporary Stream Crossings

5.6 Ground Stabilization

5.7 Outlet Stabilization

5.8 Maintaining Normal Flow

5.1 EROSION CONTROL

Erosion control consists of measures taken to prevent sediment from leaving the job site. These controls intercept and settle sediment from runoff before it is discharged from the project. Erosion controls also help reduce velocity and reduce the erosive force of runoff. All erosion and sedimentation devices should be placed outside of wetlands, streams, and buffer areas.

5.1.1 Temporary Silt Fence

5.1.2 Special Sediment Control Fence

5.1.3 Temporary Silt Ditch

5.1.4 Temporary Rock Silt Check Type "A"

5.1.5 Temporary Rock Sediment Dam Type "B"

5.1.1 Temporary Silt Fence

Purpose

A temporary sediment device consisting of geotextile fabric installed between supporting posts. The silt fence intercepts water flow from the site, decreases velocity, and causes suspended particles to settle.

Figure 25. Silt Fence

Conditions Where Practice Applies:

- ✓ Below small disturbed areas less than ¼ acre per 100 feet of fence.
- ✓ Where runoff can accumulate behind the sediment fence without damaging the fence or the inundated area behind the fence.

Conditions Where Practice Does Not Apply:

- ✓ Do not install sediment fences across streams, ditches, waterways or areas that have concentrated flow.

Construction

- Reference Std. 1605.01 – Erosion and Sedimentation Control Field Guide.
- Reference Section 1605 – Standard Specifications for Roads and Structures, Current Edition
- Reference Std. 1605.01 – Roadway Standard Drawings, Current Edition

Maintenance

- Inspect silt fences on a regular basis and after each rainfall. Make any required repairs immediately.
- Inspect silt fence to be sure bottom edge is keyed in properly.
- Remove and replace deteriorated or clogged silt fence.
- Remove and dispose of sediment accumulations when depth reaches one-half the height of the filter fabric. Take care to avoid undermining the fence during cleanout.
- Replace silt fence removed for access at the end of each day's operation.
- Install additional posts or wire backing if fence is sagging.

Typical Problems

- Improper installation (bottom of fabric not buried or keyed-in properly.
- Failure due to installation across streams, ditches, waterways, and other areas that receive concentrated flow.
- Excessive sediment accumulations.
- Knocked down or cut by fallen trees, equipment, excess water flows, or for work access.
- Inadequate access to maintain and remove fence.
- Installed across contours creating channelized flow behind fence.

5.1.2 Special Sediment Control Fence

Purpose

A special sediment control fence is a hardware cloth with sediment control stone at the base and contained by wire mesh fence. Water from the site drains through the sediment control stone causing sediment to be trapped or settle.

Figure 26 – Typical Special Sediment Control Fence

Conditions Where Practice Applies:

Where the volume of water is too extensive for a silt fence
Where inadequate right of way is available for a silt ditch

Conditions Where Practice Does Not Apply

Where topography forces water to run along the base of the sediment control stone instead of allowing the water to pond up and flow through the stone.

Construction

- Reference Std. 1606.01 – Erosion and Sediment Control Field Guide.

Maintenance

- Inspect sediment control fence on a regular basis and after each rainfall. Make any required repairs immediately.
- Remove and replace clogged sediment stone.
- Install additional posts or wire if fence is sagging.

5.1.3 Temporary Silt Ditch

Purpose

Used in place of Silt Fence where room allows. Use in conjunction with Rock Sediment Dams or other measures to contain sediment at the outlet.

Figure 27. Temporary Silt Ditch

Conditions Where Practice Applies

- ✓ Toe of fill slopes where fill exceeds 3 feet (1 meter) in vertical height.
- ✓ Adjacent streams to intercept flow and/or divert to a controlled outlet.
- ✓ Along project perimeters to minimize sediment loss from the site.

Conditions Where Practice Does Not Apply

- ✓ Within jurisdictional waters and wetlands.
- ✓ When access is difficult due to high fill slope.

Construction

- Reference Std. 1630.03 – Erosion and Sediment Control Field Guide.
- Reference Std. 1630.03 – Roadway Standard Drawings, current edition.

Maintenance

- Clean out sediment when silt ditch is one half full.
- Rebuild ditch daily when damaged by equipment or covered by fill.
- Inspect erosion control devices at outlet. Remove sediment and repair any damage.

Typical Problems

- Excessive sediment accumulations.
- Outlet protection not maintained.
- Requires room for stockpiling sediment cleanout material or material must be hauled off from the site.

5.1.4 Temporary Rock Silt Check Type "A"

Purpose

A small dam with a weir outlet that uses a naturally-formed storage area to trap sediment (rather than an excavated pit). These are generally referred to as check dams.

Figure 28. Rock Silt Check Type "A"

Conditions Where Practice Applies:

- ✓ In channels, roadside ditch outlets, temporary silt ditches, and temporary diversions.
- ✓ In conjunction with Type-B silt basins.
- ✓ In channels where sandy soil prohibits the use of Type-B silt basins.
- ✓ In jurisdictional wetlands without any excavation, Type B silt basins, and any silt deposits must be removed upon completion.

Conditions Where Practice Does Not Apply:

- ✓ These check dams may not be placed in live streams

Construction

- Reference Std. 1633.01 – Erosion and Sediment Control Field Guide.
- Reference Section 1633 – Standard Specifications for Roads and Structures, Current Edition
- Reference Std. 1633.01 – Roadway Standard Drawings, Current Edition

Maintenance

- Inspect after each significant rainfall.
- Remove sediment from device when sediment accumulates.
- Rebuild and reshape structure and weir when damaged.
- Clean out when clogged by straw, limbs, or other debris.

Typical Problems

- Rock structure is not rebuilt when damaged by storms, equipment, etc.
- Rock weir sections are not constructed properly.
- When weir is constructed higher than outside edges, water may flow around dam and erode ditch.
- Not built wide enough to intercept ditch slope at top of check dam.

5.1.5 Temporary Rock Sediment Dam Type "B"

Purpose

A small Class B stone dam with sediment control stone and built in sediment basin. Typically, used at the outlets of roadside ditches or channels to impound and settle runoff prior to entering streams or exiting site.

Figure 29. Temporary Rock Sediment Dam Type "B"

Conditions Where Practice Applies:

- ✓ At outlets of temporary diversions, temporary silt ditches, channels, and temporary slope drains.
- ✓ In locations where dam can be cleaned and maintained on a regular basis.
- ✓ In locations where runoff is exiting the construction site.
- ✓ In small natural drainage turnouts.

Conditions Where Practice Does Not Apply:

- ✓ Use may be limited in buffer zones

Construction

- Reference Std. 1634.02 – Erosion and Sediment Control Field Guide.
- Reference Std. 1634.02 – Roadway Standard Drawings, Current Edition
- Reference Section 1634 – Standard Specifications for Roads and Structures, Current Edition.

Maintenance

- Inspect after each significant rainfall.

- Remove sediment from device when sediment accumulates to one-half the basin area formed by the dam.
- Remove and replace sediment control stone when water no longer drains between rainfall events.
- Rebuild and reshape structure and weir when damaged.
- Clean out when clogged by straw, limbs, or other debris.

Typical Problems

- Sediment accumulations are not removed when needed.
- Structure not rebuilt when damaged.
- Rock weirs are not constructed properly.
- Stone is not cleaned or replaced when clogged.
- Stone is not tied into slopes.
- Fabric not placed under stone for reinforcement

5.2 FLOW DIVERSION

The normal flow of a stream must be diverted and the work area isolated to allow a project to proceed. The watercourse should be managed to minimize adverse impacts to the jurisdictional waters. All projects should be planned to minimize the time that the watercourse will be diverted.

Several methods of diverting a watercourse are provided in this section. There may be certain seasonal components to consider when attempting flow diversion of a stream, such as spawning times of individual fish species.

5.2.1 Bypass Pumping

5.2.2 Suspended Bypass Pipe

5.2.3 Piped Diversion

5.2.4 Fabric Lined Diversion Channel

5.2.1 Bypass Pumping

Purpose

A bypass pump and an impervious dike divert the flow of the watercourse from the inlet of the pipe to the outlet of the pipe. This is a water-to-water operation and care should be taken that the discharge is at a low flow rate to minimize turbidity at the outlet of the bypass pipe and/or eroding the channel.

Figure 30. Bypass Pumping

Conditions Where Practice Applies

- ✓ When another type of diversion is not physically possible or practical.
- ✓ When the repair or construction activities will not require pumping for an extended period of time.

Conditions Where Practice Does Not Apply

- ✓ When the discharge location can not be adequately stabilized
- ✓ When ponding of the stream to adequately submerge the pump suction line is not allowed or not practical.
- ✓ When the normal flow of the stream cannot be handled by the typical bypass pump.

Construction

Step 1 – Set up bypass pump and temporary piping. Place outlet of temporary pipe to minimize erosion at discharge site or provide temporary energy dissipation measures. Firmly anchor pump and piping.

Step 2 – Construct outlet protection if needed.

Step 3 – Construct impervious dike upstream of work area to impound water for bypass pump intake. Use a floating intake for

pumps where possible.

Step 4 – Construct an impervious dike downstream, if necessary, to isolate work area.

Step 5 – Check operation of pump and piping system Step 4 -

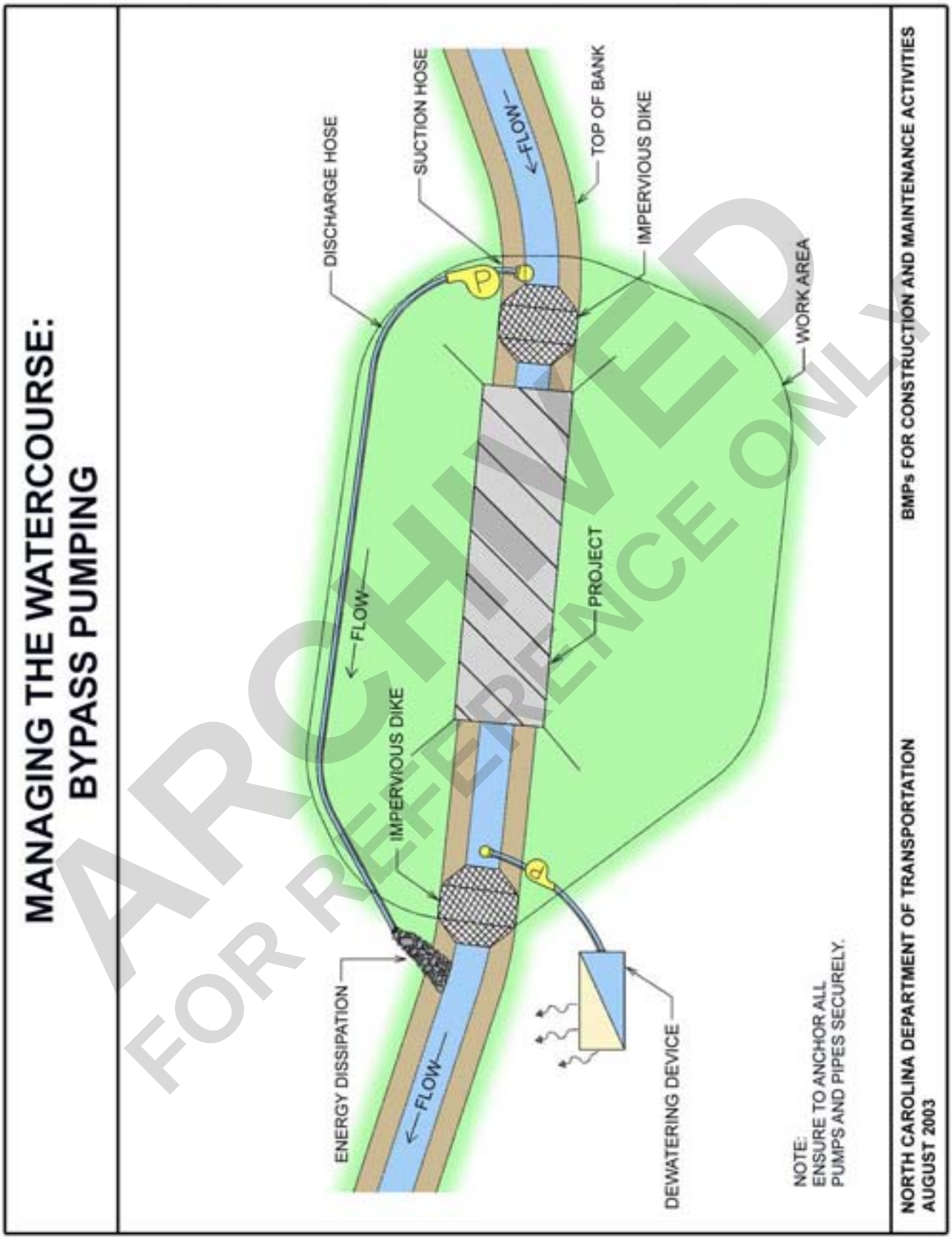
Step 6 – Upon completion of construction, remove impervious dike, bypass pump, and temporary pipe.

Maintenance

- Routinely inspect bypass pump and temporary piping to ensure proper operation.
- Inspect impervious dike for leaks and repair any damage.
- Inspect discharge point for erosion.
- Ensure flow is adequately diverted through pipe.

Typical Problems

- Pump failure.
- Erosion at outlet.
- Leaks in piping and improper connection to pump.



5.2.2 Suspended Bypass Pipe

Purpose

The suspended bypass pipe is used where an existing pipe or culvert is extended. This bypass pipe is constructed inside the existing pipe or culvert to divert the watercourse through the work area while allowing the work area to remain dry.

Figure 31 Suspended Bypass Pipe

Conditions Where Practice Applies

- ✓ When a pipe or culvert is being extended and is large enough to accommodate the bypass pipe.
- ✓ When space limitations do not allow for a fabric lined diversion channel

Conditions Where Practice Does Not Apply

- ✓ When the upstream ponding required to enter the suspended pipe inlet is unacceptable.

Construction

Step 1 – Install sediment controls.

Step 2 – Install temporary pipe through the existing pipe or culvert to be extended. Place outlet of temporary pipe to minimize erosion at discharge site or provide temporary energy dissipation measures.

Step 3 – Construct an impervious dike upstream of the work area to divert flow through the temporary pipe. Anchor and seal temporary pipe securely at inlet.

Step 4 – Construct an impervious dike at the downstream side of the bypass pipe to isolate work area.

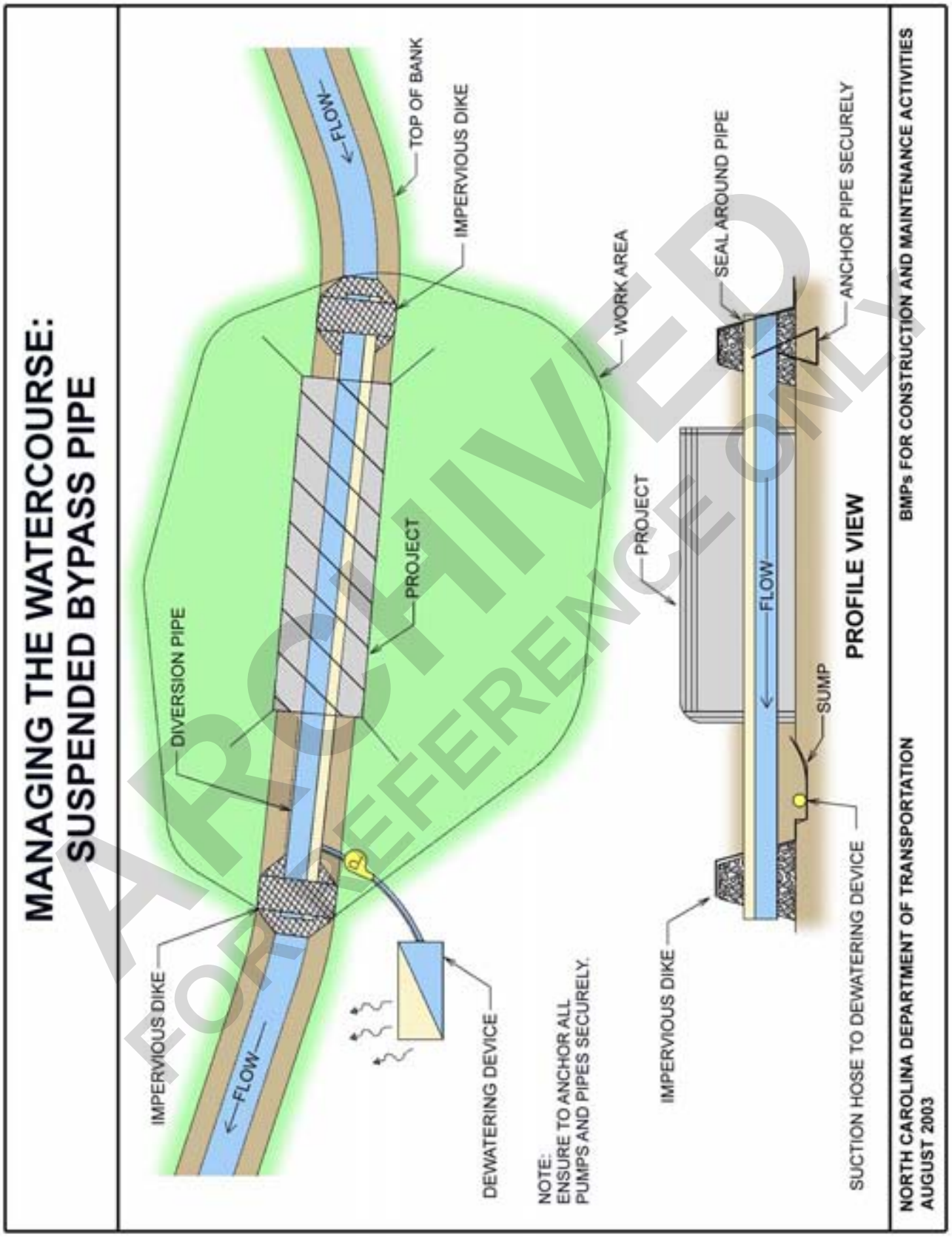
Step 5 – Upon completion of the culvert or pipe extension, remove the impervious dike and temporary pipe.

Maintenance

- Inspect the inlet regularly and dike for damage and/or leakage and to ensure flow is adequately diverted.
- Remove sediment and trash that accumulate behind the dike and at the inlet on a regular basis.
- Inspect the outlet regularly for erosion and to ensure flow is adequately diverted through the system.

Typical Problems

- Failure because inlet is not properly anchored and sealed.
- Erosion at outlet.
- Inlet clogged with debris.



5.2.3 Piped Diversion

Purpose

Install a temporary pipe to divert the flow of the watercourse around the work area without the use of pumping operations. While the cost is higher for this operation, the probability of offsite sediment loss is much lower than with an open diversion channel.

Conditions Where Practice Applies

- ✓ Where adequate slope and space exist between the upstream and downstream ends of the diversion.

Conditions Where Practice Does Not Apply

- ✓ Pipe extensions, headwall installations and some pipe/culvert replacements where adequate space is unavailable.
- ✓ When the pipe would adversely impact the aquatic habitat migration.

Construction

Step 1 – Install sediment controls.

Step 2 – Install temporary pipe adjacent to work area. Excavation may be required to provide a positive drainage slope from the upstream to downstream side.

Step 3 – Connect the downstream temporary pipe into the downstream existing channel. Place outlet of pipe to minimize erosion at the discharge site or provide temporary energy dissipation measures.

Step 4 – Connect the upstream temporary pipe into the upstream existing channel.

Step 5 – Construct an impervious dike at the upstream side of the existing channel to divert the existing channel into the temporary pipe.

Step 6 – Construct an impervious dike at the downstream side of the bypass pipe to isolate work area.

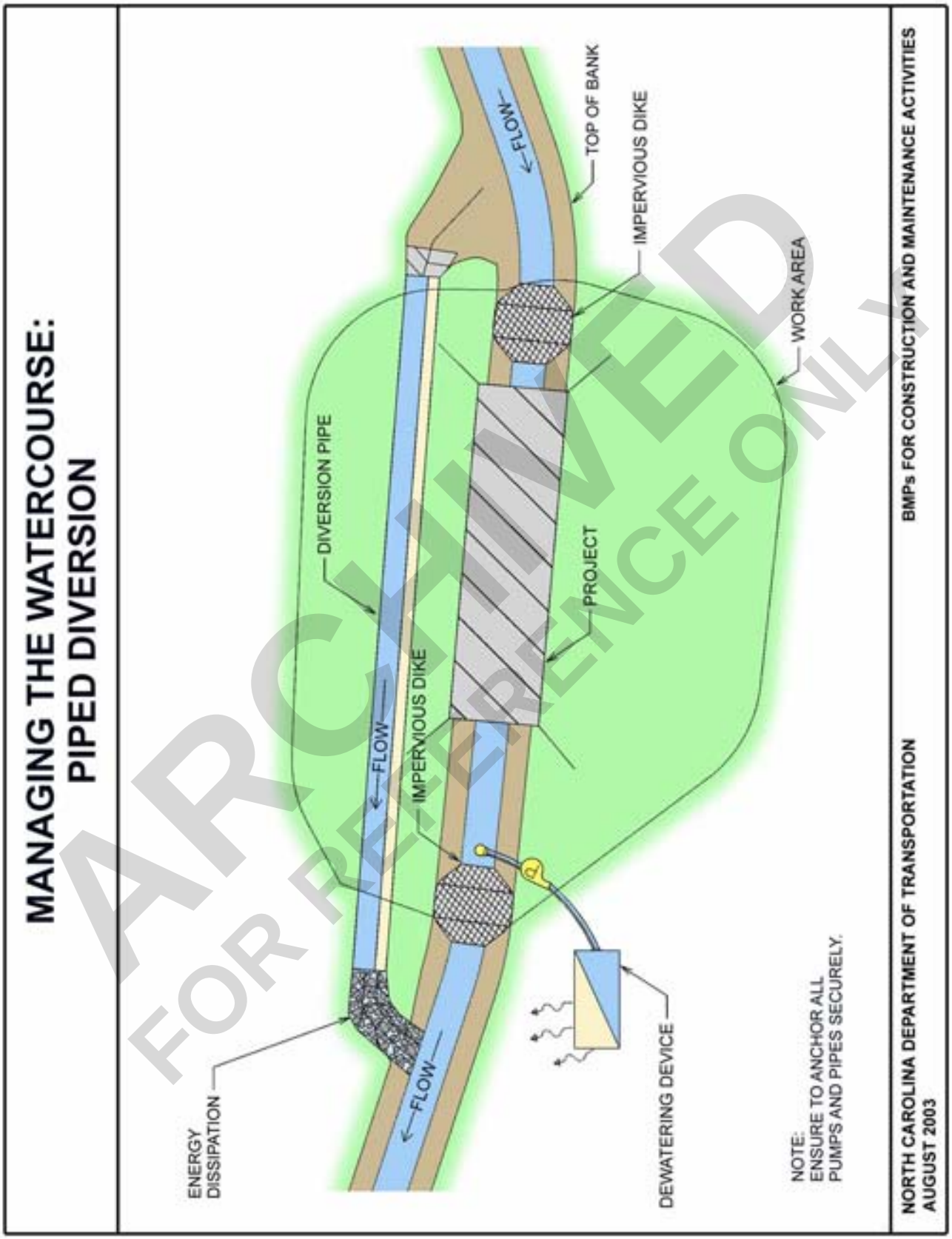
Step 7 – Upon completion of construction, remove the impervious.

Maintenance

- Inspect diversion berm and piping for damage.
- Remove accumulated sediment and debris from berm and inlet.
- Inspect outlet for erosion.

Typical Problems

- Improper amount of slope that impedes diverted flow.
- Diverted flow bypasses the temporary pipe and causes erosion as surface flow.



5.2.4 Fabric Lined Diversion Channel

Purpose

Used to divert the normal flow and small storm events around the work area without the use of pumping operations. The diversion channel is typically constructed adjacent to the work area and is lined with a poly-fabric to prevent erosion of the diversion channel.

Figure 32. Fabric Lined Diversion Channel

Conditions Where Practice Applies

- ✓ When adequate space and slopes exist adjacent to the work area.

Conditions Where Practice Does Not Apply

- ✓ Pipe extensions, headwall installations and some pipe/culvert replacements where adequate space is unavailable.

Construction

Step 1 – Install sediment controls.

Step 2 – Excavate the diversion channel without disturbing the existing channel.

Step 3 –Place poly-fabric liner in diversion channel with a minimum of 4 feet of material overlapping the channel banks. Secure the overlapped material using at least 1 foot of fill material.

Step 4 – Connect the downstream diversion channel into the downstream existing channel and secure the poly-fabric liner at the connection.

Step 5 – Connect the upstream diversion channel into the upstream existing channel and secure the poly fabric liner at the connection.

Step 6 – Construct an impervious dike in the existing channel at the upstream side to divert the flow into the diversion channel.

Step 7 – Construct an impervious dike in the existing channel at the downstream side to isolate the work area.

Step 8 – Upon completion of the culvert construction, remove the impervious dikes and divert the channel back into the culvert.

Step 9 – Remove the poly-fabric liner and fill in the diversion channel.

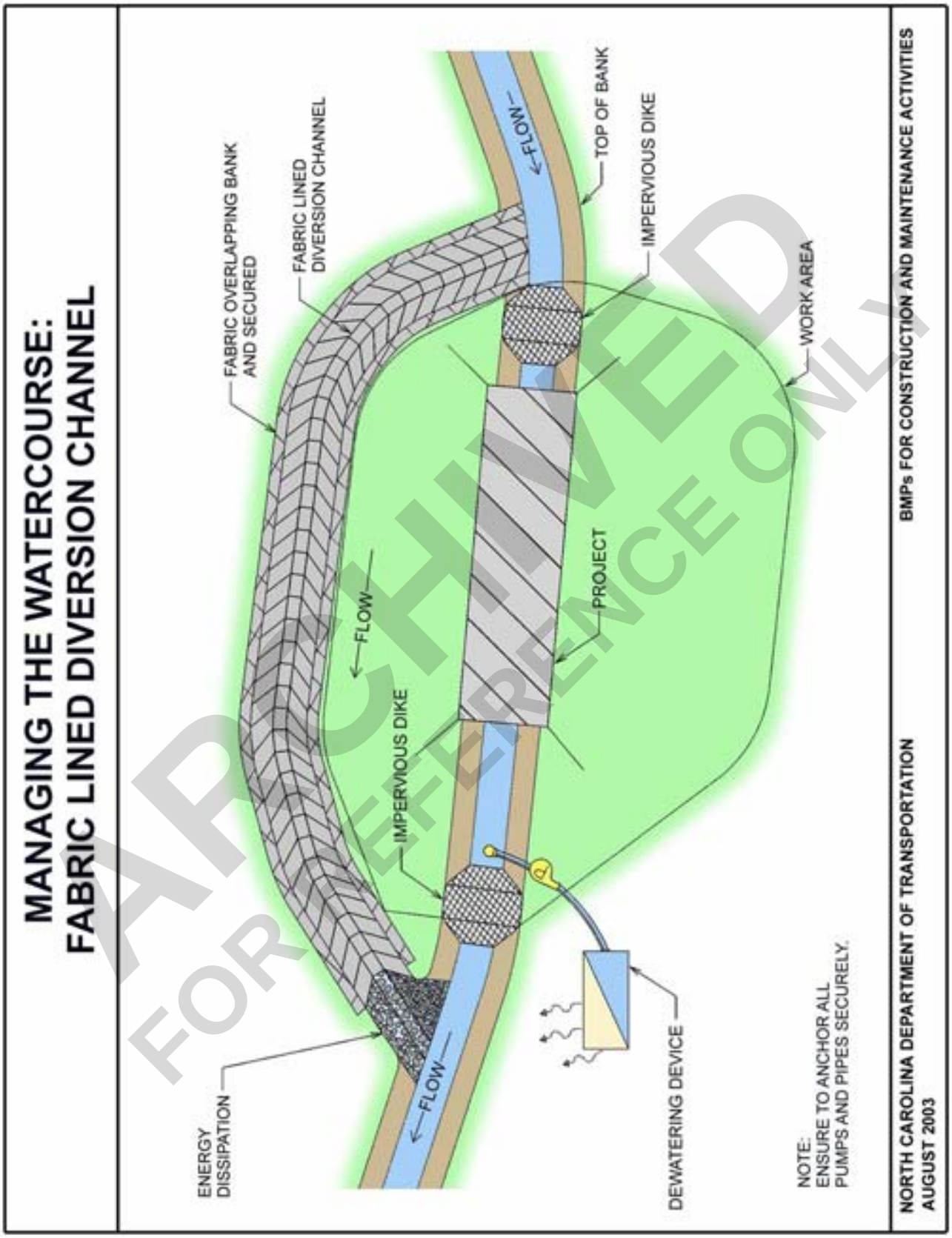
Step 10 – Establish vegetation on fill section and all other bare areas.

Maintenance

- Check the poly-fabric liner for stability during normal flow
- Check the liner for stability after each rainfall event

Typical Problems

- Improperly installed liners.
- Filter fabric not installed (secured) properly.
- Earthen material allowed to come into contact with water body.
- There maybe certain times of the year, especially in the summer, when fabric-lined channels may cause thermal pollution. This could be a problem in trout waters during certain times of the year.



5.2.5 Turbidity Curtain

Purpose

Used as instream erosion control filtration device to isolate the streambank work from the normal flow of the stream. This device is normally used in open waters for containment in work zones. May also be used across channels with very low flow for short-term work when anchored properly.

Figure 33. Turbidity Curtain

Conditions Where Practice Applies

- ✓ When performing work on a stream bank in a small localized area.
- ✓ When the repair or construction activities will not require an extended period of time to complete.

Conditions Where Practice Does Not Apply

- ✓ Across flowing streams. Turbidity curtains are not designed as prefabricated dams.

Construction

The curtain should be made of a tightly woven nylon, plastic or other non-deteriorating material. The material shall meet the following specifications:

Property	Value
Grab tensile strength	*md-370 lbs. (1.65 Kn) *cd-250 lbs. (1.11 Kn)
Mullen burst strength	480 psi (3307 kpa)
Trapezoid tear strength	*md-100 lbs. (0.45 Kn) *cd-60 lbs. (0.27 Kn)
Apparent opening size	70 us standard sieve (0.210 mm)
Percent open area	4% permittivity 0.28 sec-1

*md – machine direction
*cd – cross machine direction

- A flotation material with over 29 lbs./ft. (43 kg/m) buoyancy shall support the curtain material. A 5/16 inch (7.8 mm) galvanized chain shall act as ballast for the floating curtain. Dual 5/16 inch (7.8 mm) galvanized wire ropes with a heavy vinyl coating shall be used as the load lines.

Maintenance

- Inspect the curtain, flotation and ballast to ensure the work area is securely partitioned from the stream flow.
- Remove accumulated sediment and debris.

Typical Problems

- Does not permanently remove sediment.
- Improper anchoring of curtain on channel bottom.
- Tidal flows requiring frequent repositioning

5.3 IMPERVIOUS DIKES

Impervious dikes are used to divert normal stream flow around a construction site. Acceptable materials for impervious dikes include, but are not limited to, sheet piles and sandbags and/or the placement of an acceptable size stone lined with polypropylene or other impervious fabric. Also, prefabricated dams and/or the placement of appropriately sized stone lined with polypropylene or other impervious fabric can be used. Earthen material should not be used to construct an impervious dike when it is in direct contact with the stream unless cover of vegetation can be established before there is contact with the stream.

5.3.1 Stone with Impervious Fabric

5.3.2 Sand Bags

5.3.3 Prefabricated Dams

5.3.4 Sheet Piles

5.3.1 Stone with Impervious Fabric

Purpose

A stone dike encapsulated with a high tensile impervious geotextile fabric material to create a temporary impervious barrier that will either impound or divert water. This barrier can be constructed to the shape of the existing channel.

Figure 34. Installation of Stone with Impervious Fabric

Conditions Where Practice Applies

- ✓ When the size of the pipe is less than 48-inches.
- ✓ When heavy equipment can be used for installation.

Conditions Where Practice Does Not Apply

- ✓ When the pipe is 48-inches or greater

Construction

Step 1 – Prepare the channel and overbanks for installation.

- Remove all branches and debris from location of the stone dike.
- Make sure that there are no sharp rocks or roots that can puncture the fabric.
- Do not excavate the existing channel or banks.

Step 2 – Place the high tensile impervious fabric with the center over the center of the proposed dike. Utilize a small amount of stone to hold down the fabric while adjustments are being made. Ensure there is enough extra fabric on each side of the dike to wrap up and over the stone dike to make it impervious.

Step 3 – Pile stone on top of the fabric to create dike.

Step 4 – Roll fabric up over the stone to form an impervious dike. Make sure the top layer is rolled from the upstream to downstream direction. Secure fabric with metal fence stakes or other suitable material.

Maintenance

- Inspect dike regularly for damage and leakage.
- Remove impounded trash and sediment.

Typical Problems

- Leaks through puncture in fabric.
- Blow-out by large storm events.
- Erosion around the side of dike.

5.3.2 Sand Bags

Purpose

Filter bags filled with sand can be manually stacked to form a temporary impervious dike when encapsulated with an impervious poly-fabric liner. This impervious dike can be used to impound or divert water and can be easily removed.

Figure 35. Sand Bag Installation

Conditions Where Practice Applies

- ✓ Used when low flow rates exist.
- ✓ Used when the height of the dike is less than 15 feet.
- ✓ Used when heavy equipment cannot be utilized.

Conditions Where Practice Does Not Apply

- ✓ Concrete is not allowed in sand mixture.

Construction

Step 1 – Remove branches and large rocks from area where the sand bags will be placed.

Step 2 – Lay out the impervious poly-fabric liner with the center of the liner located over the center of the sand bag dike.

Step 3 – Place the sandbags to the desired height. The dikes shall have a width suitable to support the height. Each row shall be offset so the joints are staggered. Pack sandbags tightly together.

Step 4 – Wrap impervious poly-fabric liner around sandbag dike and secure with final layer of sandbags.

Maintenance

- Periodically inspect sandbag dike for damage and leaks.
- Remove impounded trash and sediment.

Typical Problems

- Leakage due to improper construction or liner failure.
- Blow-out by large storm event.

5.3.3 Prefabricated Dams

Purpose

Prefabricated dams are typically made of an impervious poly-fabric that can be placed in an existing channel. The weight of the water is used to hold the prefabricated dam in place to temporarily impound or divert water.

Figure 36. Prefabricated Dam

Conditions Where Practice Applies

- ✓ When there is a normal flow in the existing channel.
- ✓ When the area of the temporary dam will not puncture the dam.

Conditions Where Practice Does Not Apply

- ✓ Where there is no water to hold the temporary dam in place.

Construction

There are various types and manufacturers of prefabricated temporary dams. The construction guidelines given below are typical. Prefabricated dams shall be installed based on the manufacturers installation guidelines.

Step 1 – Remove the branches, debris, sharp rocks and roots where the prefabricated dam is to be placed.

Step 2 – Place the prefabricated dam in the channel bottom and utilize sandbags or heavy rocks to temporarily anchor to the bottom of the channel.

Step 3 –Secure each end upslope above the toe.

Step 4 – Allow the prefabricated dam to utilize the upstream water pressure to seal the dam and impound or divert the water.

Maintenance

- Monitor prefabricated dam for volume of water flowing, inherent safety, and dam stability.

Typical Problems

- Poor sealing between the prefabricated dam and the bottom of the channel.

5.3.4 Sheet Piles

Purpose

A flat cross-section piling that is driven into the ground and interlocked to create a wall or bulkhead. Sheet piles can be used to detain water in low-flow situations or coupled with bypass pumps to keep a site moderately dry during construction.

Figure 37. Sheet Piles

Conditions Where Practice Applies

- ✓ Where minimum channel disturbance is required.
- ✓ Preferred method of sealing the work area from the watercourse on pipe sizes of 48" and greater.

Conditions Where Practice Does Not Apply

- ✓ Small channel with little or no flow.
- ✓ Where the access to drive piles requires more disturbance to jurisdictional areas than other impervious dikes.
- ✓ Locations where rocks and other obstructions prevent piles from being driven

Construction

- Install by placing and driving piles with a backhoe, excavator, hammer, or other suitable equipment.
- Be sure pile is free of dirt, grease and other potential contaminants before installation.
- Ensure the piles penetrate to a sufficient depth in order to bear the load of water being diverted.
- Overlap or interlock piles in a manner that prevents any

seepage of water into the work area and prevents seepage of sediment from the work area into the stream.

- Remove trapped debris and sediment prior to removing.

Maintenance

- Inspect sheet piles daily for water leaks and signs of instability and implement repair procedures accordingly.

Typical Problems

- Improperly installed piles cause leaks.
- Piles not driven deep enough to withstand pressure of water.

5.4 DEWATERING

Dewatering is the practice of removing water from the work area. This water is considered effluent polluted and must be treated to remove sediment before being discharged into a stream, channel, or other area. Effluent water is typically pumped out of the work area and into one of the erosion control devices identified in this section before being discharged from the site.

5.4.1 Stilling Basin for Pumped Effluent

5.4.2 Special Stilling Basin (Silt Bag)

5.4.1 Stilling Basin for Pumped Effluent

Purpose

Used at sites where dewatering of the work area is required to perform work. The effluent is pumped into the stilling basin to allow the heavier particles to settle out prior to being discharged.

Figure 38. Stilling Basin for Pumped Effluent

Conditions Where Practice Applies

- ✓ Where there is enough room in the work area to form or excavate the basin.
- ✓ Where large volumes of water will be pumped from the work area.

Conditions Where Practice Does Not Apply

- ✓ Not allowed to be constructed in jurisdictional wetlands
- ✓ Should not be built in ditch lines.

Construction

- Reference Std. 1630.04 – Erosion and Sediment Control Field Guide.
- Reference Std. 1630.04 – Erosion and Sedimentation Control Guidelines for Contract Construction.

Maintenance

- Inspect basin after each significant rainfall.
- Basin should be cleaned out when approximately one half full.
- Clean and replace sediment control stone when needed.

Typical Problems

- Inadequate basin capacities – basins are not constructed to dimensions specified on plans.
- Accumulated sediment not removed when needed.

- Basins built in sandy soils may cause sloughing of slopes.
- Erosion occurs at inlet end when basin is too deep.
- Pump discharge entering too close to outlet.

5.4.2 Special Stilling Basin (Silt Bag)

Purpose

Used at sites where the construction limits do not allow for the construction of a stilling basin. The effluent from the work area is pumped into a prefabricated silt bag. Water slowly filters out of the bag in a dispersed manner and the sediment is captured in the bag. Sediment control stone is used as a foundation for the bag.

Figure 39. Silt Bag

Conditions Where Practice Applies

- ✓ When the effluent can be pumped out of the work area at a rate of 1500 gallons per minute or less.
- ✓ When the work area and dewatering volume is small.
- ✓ When there is not enough available non-jurisdictional area to excavate stilling basin.
- ✓ When the repair or construction activities will not require an extended period of time.

Conditions Where Practice Does Not Apply

- ✓ Construction sites that will require large amounts of dewatering.

Construction

- The silt bag shall be at least 10 ft. by 15 ft. The bag should be made from a nonwoven fabric and have a sewn-in sleeve for receiving pump discharge.
- The sediment control stone shall meet the requirements of Section 1005.

- The bag seams should be sewn with a double needle machine using a high strength thread. The seams shall have a wide width strength of at least 60 lb./in. (using test method ASTM D-4884).
- The filter fabric shall meet the requirements of Section 1056 for Type 2 fabric. It shall also meet the following specifications for flow rates, strength, and permeability:

Property	Test Method	Units	Minimum Specifications
Weight	ASTM D-3776	oz/yd	8.0
Grab tensile	ASTM D-4632	lb.	200.0
Puncture	ASTM D-4833	lb.	130.0
Flow rate	ASTM D-4491	gal/min/s.f.	80.0
Permittivity	ASTM D-4991	1/sec	1.5
UV Resistance		ASTM D-4355	%70.0

The silt bag shall be placed on top of at least 6-inches of sediment control stone in an area that will drain away from the work area. Plan ahead for acceptable methods of removal and disposal of silt bag.

Maintenance

- Inspect inlet pipe and bag for damage and blockage.
- Replace bag when ¾ full of sediment.

Typical Problems

- Discharge too large for pump.
- Pump is too large.
- Continued use when bag is full.
- Inlet pipe disconnected from bag.

5.5 TEMPORARY STREAM CROSSINGS

Temporary stream crossings provide a means for construction equipment to cross streams. The goal is to keep sediment generated by construction traffic out of the water body and minimize the impacts to the stream channel's bottom and banks. Without a stabilized crossing, the constant disturbance of the channel's bottom and banks by construction traffic will result in downstream impacts.

5.5.1 Temporary Fording

5.5.2 Temporary Piped Crossing

5.5.3 Temporary Access Bridge

5.5.1 Temporary Fording

Purpose

The temporary ford uses filter fabric and stone to provide a stable crossing that can be easily removed. These crossings are best suited for streams with a rock channel bottom and having no normal flow. A temporary rock filter should be constructed downstream to capture sediment deposited on the crossing by equipment that may be washed away during storm events.

Figure 40. Temporary Fording (Device should be constructed during no flow conditions)

Conditions Where Practice Applies

- ✓ When performing work and the only equipment access is to cross a stream.
- ✓ Fording should only be used on small streams having intermittent flow. Timing of these impacts should be during no flow periods.
- ✓ Where adequate space is available to accommodate the temporary ford and any construction across the channel.
- ✓ Where banks can be graded back to a slope that will allow equipment access if needed.

Conditions Where Practice Does Not Apply

- ✓ Streams with normal flows.
- ✓ Sites where instream moratorium periods apply.

Construction

Temporary fords should be constructed with Class-A or riprap structural stone over a Type II filter fabric. The crossing must be installed so that erosion during construction and use is minimized.

Step 1 – Locate crossing where approaches and crossing will disturb the least amount of the channel's bank and bottom.

Step 2 – Divert stormwater runoff from the top of the approaches to prevent runoff flowing down the approach and into the stream.

Step 3 – If needed, construct approaches by pulling soil back away from the stream channel. Do not contour the bank by pushing the soil down into the stream.

Step 4 – Center filter fabric on crossing and temporarily anchor ends.

Step 5 – Place stone over fabric on approaches and across stream channel.

Step 6 – Construct temporary rock filter downstream of crossing.

Step 7 - Completely remove all of the ford from stream when construction is complete.

Step 8 – If over-widening of stream channel occurs, structures (i.e. floodplain bench, rock vanes, etc.) will need to be installed to restore natural stream pattern and dimension profile.

Maintenance

- Inspect the ford to ensure that stormwater runoff is diverted away from approach ramps.
- Inspect crossing for erosion and/or damage by construction traffic.
- Inspect temporary rock filter. Remove accumulated sediment and repair any damage.
- Revegetate the stream-side buffers when the crossing approach is complete.

Typical Problems

- Channelization and erosion of approaches from off-site stormwater runoff.
- Over-widening the stream at the crossing location.

5.5.2 Temporary Piped Crossing

Purpose

Provides a means for equipment to cross streams while minimizing the impact of sediment to the stream channel. The temporary crossing uses filter fabric, stone, and piping to provide a stable travel surface that does not restrict normal flow and flow during minor storm events. Ensure stone size is large enough when required to help prevent washouts.

Figure 41. Temporary Piped Crossing

Conditions Where Practice Applies

- ✓ When the existing channel has a normal flow.
- ✓ When performing work and the only equipment access is to cross a stream.

Conditions Where Practice Does Not Apply

- ✓ Sites where instream work moratoriums apply, such as anadromous fish species, etc.

Construction

Step 1 – Locate crossing where approaches and crossing will disturb the least amount of the channel's bank and bottom.

Step 2 – Divert stormwater runoff from the crossing approaches to prevent runoff flowing down the approach and into the stream.

Step 3 – If needed, construct approach ramps by pulling soil back away from the stream channel. Do not contour the bank by pushing soil into the stream. Disturbing stream banks to construct approach ramps should only be undertaken where stone for the crossing cannot effectively be raised to the level of the top of bank.

Step 4 – Center filter fabric on the crossing and temporarily

anchor ends.

Step 5 – Place washed stone over filter fabric across stream channel.

Step 6 – Install temporary pipes on bed of washed stone and cover with stone to a depth sufficient to support equipment loads. Soil should not be used as backfill material.

Step 7 – Armor sides and top of fill to prevent erosion and provide a firm travel surface.

Step 8 – If approach ramps have been excavated, armor side slopes with riprap to prevent erosion when water flows over crossing.

Step 9 – Completely remove crossing immediately upon completion of construction. Establish permanent vegetation on graded areas outside of stream channel.

Maintenance

- Inspect crossing daily and after each rainfall event for damage.
- Inspect runoff diversions along approaches.
- Keep pipes clear of debris.
- Need to revegetate the stream-side buffers when the crossing approach is complete.

Typical Problems

- Runoff channelizes and erodes approaches to the stream crossing.
- Damage to crossing from high flow events.
- Erosion of side slopes where approach ramps are used.
- Flooding upstream due to crossing not being properly designed to handle large flows because over-topping of crossing not allowed or pipes are too small.

5.5.3 Temporary Access Bridge

Purpose

The temporary access bridge is a stream crossing made of wood, metal, or other materials designed to limit the amount of disturbance to the stream banks and bed.

Figure 42. Temporary Access Bridge

Conditions Where Practice Applies

- ✓ Streams with normal flows.
- ✓ Sites where seasonal instream work moratoriums apply.
- ✓ When performing work and the only equipment access is to cross a stream.
- ✓ Where adequate space is available to accommodate the temporary bridge and any construction across the channel.

Conditions Where Practice Does Not Apply

- ✓ Channels with little or no base flows
- ✓ Short construction time frame.

Construction

All erosion and sedimentation control devices, including stream diversions, should be implemented first. Finally, dewatering basins should be built as needed and swales or ditches should be used to prevent surface drainage from entering the stream via the bridge crossing. The proposed construction, maintenance, and removal sequence is as follows:

Step 1 - Abutments should be placed parallel to, and on, stable banks such that the structure is at or above bankfull depth to prevent the entrapment of floating materials and debris.

Step 2 - Temporary access bridges should be constructed to span the entire channel. If the bankfull channel width exceeds 8 feet (2.5 meters), then a footing, pier, or other bridge support may be constructed within the waterway. No support will be permitted within the channel for waterways less than 8 feet wide. One additional bridge support will be permitted for each additional 8-foot width of the channel.

Step 3 - All decking members should be placed perpendicularly to the stringers, butted tightly, and securely fastened to the stringers. Decking materials must be butted tightly to prevent any soil material tracked onto the bridge from entering the waterway.

Step 4 -Although run planks are optional, they may be necessary to properly distribute loads. One run plank should be provided for each track of the equipment wheels and should be securely fastened to the length of the span.

Step 5 - Curbs or fenders may be installed along the outer sides of the deck to provide additional safety.

Step 6 - Bridges should be securely anchored at one end using steel cable or chain to prevent the bridge from floating downstream and possibly causing an obstruction to the flow. Anchoring at only one end will prevent channel obstruction in the event that flood waters float the bridge. Acceptable anchors are large trees, boulders, or driven steel anchors.

Step 7 - All areas disturbed during installation should be stabilized.

Step 8 - When the temporary bridge is no longer needed, all structures including abutments and other bridging materials should be removed. In all cases, the bridge materials should be

removed. Removal of the bridge and clean-up of the area, including protection and stabilization of disturbed stream banks, should be accomplished without the use of construction equipment in the waterway. Any debris that falls into the stream during removal should be taken out.

Maintenance

- Periodic inspection should be performed by the user to ensure that the bridge, streambed, and stream banks are maintained and not damaged
- Maintenance should be performed as needed to ensure that the structure complies with all standards and specifications. This should include the removal of trapped sediment and debris which should then be disposed of and stabilized outside the floodplain.

Typical Problems

- Construction debris falling into stream.

5.6 GROUND STABILIZATION

After completion of construction or land disturbing activities, all disturbed areas must be stabilized to prevent future erosion. The establishment of a good vegetative cover helps protect soil from the impact of raindrops and reduces the erosive forces of runoff. Hard armor protection, such as riprap, helps protect areas that cannot be stabilized with vegetative cover.

5.6.1 Temporary Seeding and Mulching

5.6.2 Permanent Seeding and Mulching

5.6.3 Erosion Control Blankets

5.6.4 Riprap Slope Protection

5.6.5 Riprap Outlet Protection

5.6.1 Temporary Seeding and Mulching

Purpose

To prevent erosion of exposed soil material by covering with mulch and quick germinating seed mixture. Disturbed areas may need planting of woody species, in addition to seeding.

Figure 43 – Temporary Seeding

Conditions Where Practice Applies

- ✓ When work areas will not be active for more than 15 days
- ✓ Prior to anticipated precipitation events which will severely damage work performed or jurisdictional areas.

Conditions Where Practice Does Not Apply

- ✓ Permanent stabilization
- ✓ Areas permanently under water.

Construction

Reference Section 1620 – Standard Specifications for Roads and Structures, Current Edition

Maintenance

- Inspect after heavy rains and repair seed and mulch bare areas until vegetative cover is established.
- Inspect seeded areas periodically until vegetation has permanently stabilized. Repair damaged areas or failure accordingly.

Typical Problems

- Inadequate seed germination due to use of wrong seed mix for season or regional area, poor seed bed preparation, or poor fertilizer application.
- Insufficient amount of tack on mulch.
- Inadequate seed bed preparation.

5.6.2 Permanent Seeding and Mulching

Purpose

Perform as soon as possible after final grade is complete to stabilize the site and minimize erosion. Coordination with seeding crews prior to completion of the project is essential. Disturbed areas may need planting of woody species in addition to seeding.

Figure 44. Permanent Seeding and Mulching

Conditions Where Practice Applies

- ✓ On all bare soil that will not be perennially under water or covered with a permanent land cover such as riprap, stone, asphalt, or concrete.

Conditions Where Practice Does Not Apply

- ✓ Areas that are perennially under water.

Construction

- Reference Section 1660 – Standard Specifications for Roads and Structures. Current edition.
- Shall be performed within 15 working days unless otherwise specified in the permit conditions or in the contract specifications. Work day means days exclusive of Saturday and Sunday during which weather conditions or soil conditions permit land-disturbing activities to be undertaken.
- Topdressing shall be conducted in a manner that is consistent
- Do not overspray tacking material into stream during operation

Maintenance

- Inspect after heavy rains and repair seed and mulch bare areas until vegetative cover is established.
- Inspect seeded areas periodically until vegetation has permanently stabilized. Repair damaged of failure areas accordingly.

Typical Problems

- Inadequate seed germination due to use of wrong seed mix for season or regional area, poor seed bed preparation or poor fertilizer application.
- Insufficient amount of tack on mulch.
- Inadequate seed bed preparation.

5.6.3 Erosion Control Blankets

Purpose

A temporary blanket of thin biogradable materials is bound together between a plastic material. The blankets are placed over a surface that has been properly prepared and seeded. The blanket is stapled or stacked in place. An erosion control blanket serves as mulch and ultimately becomes part of the vegetation layer that protects the soil.

Figure 45. Erosion Control Blankets

Conditions Where Practice Applies

- ✓ In drainage ditches to prevent erosion and scour prior to the establishment of vegetation.
- ✓ On steep slopes where normal mulching practices will readily erode during a rainfall event. Always check manufacturer slope velocity limits for specific blankets.
- ✓ On slopes less than 2:1 to provide slope protection/ stabilization around inlets and outlets of pipes.

Conditions Where Practice Does Not Apply

- ✓ In areas that are perennially inundated with water.
- ✓ In area where slope and water velocity exceeds blanket capabilities.

Construction

Reference Section 1631 – Standard Specifications for Roads and Structures, Current edition.

Maintenance

- Reshape, repair, or replace damaged erosion control blankets.

- Secure staples that become loose.

Typical Problems

- Erosion control blankets being undermined.
- Staple numbers are not adequate to anchor blankets.
- Ends not properly anchored.

5.6.4 Riprap Slope Protection

Purpose

Used at the inlets and outlets of pipe to provide stabilization of roadway fill slope and on slopes of the channel to transition from the pipe outlet to the natural channel. Dissipates energy of flowing water, reduces velocity, and prevents scouring and erosion.

Figure 46. Riprap Slope Protection

Conditions Where Practice Applies

- ✓ When the velocities at the inlet and outlet of the pipe exceed the allowable limits of an erosion control blanket with vegetative cover.
- ✓ When field conditions exist that will prevent the establishment of a stable vegetative cover.
- ✓ Above normal high water line.
- ✓ May want to also consider the use of other natural stream design devices

Conditions Where Practice Does Not Apply

- ✓ When the anticipated velocities and natural stream require outlet protection per 5.6.5

Construction

Step 1 – Place geotextile filter fabric on the slope and temporarily anchor.

Step 2 – Place riprap on slope and dress uniformly. Do not extend riprap into bottom of stream channel. Do not use gravel, small stone with fines or asphalt for slope protection.

Maintenance

- Inspect to ensure uniform coverage and stabilization has been successful. Make repairs if necessary.

Typical Problems

- Riprap is displaced by the force of the water.
- Erosion may occur where there is inadequate structural control.
- Excessive amounts of riprap placed in jurisdictional areas.

5.6.5 Riprap Outlet Protection

Purpose

Where the natural streambed cannot withstand the anticipated outlet velocities, riprap is typically used to absorb energy and reduce velocity from the outlet flow. This prevents outlet scouring and protects the pipe from being undermined.

Figure 47. Riprap Outlet Protection

Conditions Where Practice Applies

- ✓ At pipe or culvert outlets where scour is present and is endangering the stability of the pipe or culvert.
- ✓ At new pipe or culvert outlets where the natural stream bed cannot withstand the anticipated outlet velocities and failure will endanger the stability of the pipe or culvert.
- ✓ *Areas must be permitted.*

Conditions Where Practice Does Not Apply

- ✓ When scouring of the natural stream will not endanger the stability of the pipe or culvert.
- ✓ When scouring is not present.

Construction

- Reference Standard 876.01 and 876.02 – Roadway Standard Drawings, Current Edition
- Riprap should typically be placed for a distance of 4 times the pipe diameter from the outlet.
- The area in which to install a dissipater should be undercut the thickness of the riprap such that the riprap is flush with the channel side slopes.

- Unless otherwise specified, use the following:
  - Pipes < 48”, use Class B riprap
  - Pipes > 48”, use Class I riprap

Maintenance

- Inspect and repair areas of erosion.

Typical Problems

- Erosion due to inadequate riprap coverage.
- Riprap exceeds permit allowances.

5.7 MAINTAINING NORMAL FLOW

Maintaining normal stream flow is critical to aquatic organisms. Multiple barrel culverts or pipes are designed for peak flow conditions, and during low flow conditions they may distribute normal flow over a large cross-section. Practices such as sills and rock vanes are installed to direct the stream flow through a single culvert or pipe, thereby maintaining a more natural channel condition.

5.8.1 Sills

5.8.2 Cross Vane Rock Weir

5.7.1 Sills

Purpose

Often a 6- to 12-inch high structure is placed at the upstream side of a multiple barrel culvert to divert the stream's normal flow into a single barrel. The goal is to maintain a similar depth and velocity of water in the existing channel similar to the natural stream geometry. During larger storm events, the sill is overtopped and all of the barrels are utilized. When utilizing multiple barrel culverts, the design of the sill should mimic the stream cross-section.

Figure 48. Sills

Conditions Where Practice Applies

- ✓ Streams that have a normal flow and multiple culvert barrels.

Construction

Step 1 – Divert the normal flow into the designated barrel using an approved temporary impervious dike.

Step 2 – Construct the sill such that wet concrete does not come into contact with the stream.

Step 3 – Leave the temporary impervious dike in place long enough to allow the concrete to cure.

Step 4 – Remove the temporary impervious dike.

Maintenance

- Inspect for damage.
  Remove debris and sediment.

Typical Problems

- Debris and sediment accumulation blocks flow and causes premature overtopping when culvert is not properly sized to accommodate a sill.

5.7.2 Cross Vane Rock Weir

Purpose

A 6- to 12-inch high rock structure keyed into streambank with declining surface plane in center. Device placed just downstream or upstream of culverts to maintain stream stability and streamgrade. The goal is to maintain a similar depth and velocity of water as in the existing channel. During larger storm events, the cross vane rock weir is overtopped and the other openings are utilized to convey water. The device should be sized and the dimension is a function of the stream bank full dimension.

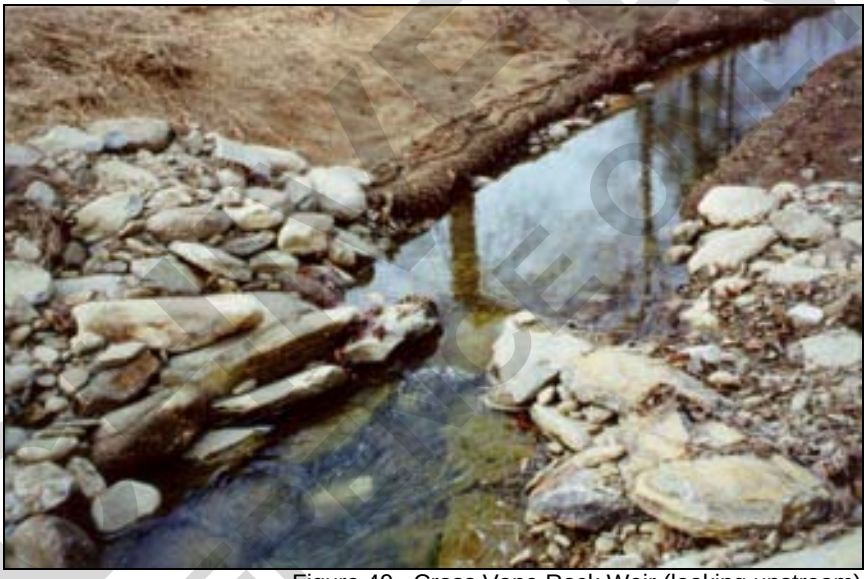


Figure 49. Cross Vane Rock Weir (looking upstream)

Conditions Where Practice Applies

- ✓ Streams that have a normal flow
- ✓ Existing multiple pipes and culvert barrels.
- ✓ Stream retrofit to improve low flow, decrease stream bank erosion, and improve AOC.

Construction

Step 1 – Divert the normal flow into the designated barrel using an approved temporary impervious dike.

Step 2 – Construct the cross vane rock weir using footer rocks. The rocks should be uniform enough to form a solid barrier to divert the normal flow and minor storm flows

Step 3 – Remove the temporary impervious dike.

Maintenance

- Inspect for damage.
- Remove debris and sediment.

Typical Problems

- Debris and sediment accumulation blocks flow and causes premature overtopping.

APPENDIX

Appendix A - ACRONYMS

Appendix B – TERMS AND DEFINITIONS

Appendix C – CONTACT LIST

Appendix D – REGULATIONS 2003

Appendix E – ENVIRONMENTAL PERMITS & CERTIFICATIONS

Appendix F – PREDICTABLE PERMIT CONDITIONS

Acronyms

AECs	Areas of Environmental Concern
AOP	Aquatic Organism Passage
BMP	Best Management Practices
CAMA	Coastal Area Management Act
CRC	Coastal Resources Commission
DCM	North Carolina Department of Environment and Natural Resources, Division of Coastal Management
DEO	Division Environmental Officer
DLR LQS	North Carolina Department of Environment and Natural Resources, Division of Land Resources, Land Quality Section
DWQ	North Carolina Department of Environment and Natural Resources, Division of Water Quality
E &SC	Erosion and Sedimentation Control
HQW	High Quality Waters
NCDOT	North Carolina Department of Transportation
ORW	Outstanding Resource Waters
RFOE	Roadside Field Operations Engineer
SHPO	State Historic Preservation Officer
SSMP	State Stormwater Management Program
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

Terms & Definitions

Areas of Environmental Concern	Designated areas within the 20 coastal counties and set rules for managing development activities within these areas.
Base Flow	The portion of streamflow that is not runoff and results from seepage of water from the ground into a channel slowly over time. The primary source of running water in a stream during dry weather.
Best Management Practices	Best Management Practices, or BMPs, are the host of tools that are applied to a project to prevent pollutants from entering jurisdictional waters and to minimize any pollutant loading. These tools include structural and non-structural measures.
Biological Assessment	Information provided by, or under the direction of the Federal agency to determine whether the proposed action is likely to adversely affect listed species or designated critical habitat.
Biological Opinion	Document that includes the opinion of the Service as to whether or not a Federal action is likely to jeopardize the continued existence of listed species, or result in destruction or adverse modification of designated critical habitat.
Candidate Species	Any species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
Construction Activities	All activities associated with building and operation of a new transportation structure, or modifications to an existing structure.
Critical Habitat	(1) Specific areas within the geographic area occupied by a listed species that is determined to be essential to the conservation of the species and (2) Specific area outside of the geographical area occupied by the species at the time of listing, that are determined to be essential to the conservation of the species.
Dewatering	Dewatering is the practice of removing water from the construction area. This water is considered polluted and must be treated to remove sediment before being discharged back into the channel.
Endangered	Any species, which is in danger of extinction throughout all or a significant portion of its range
Federal Species of Concern	Any species that are under consideration for listing as endangered or threatened for which there is insufficient information to support listing (further biological research and field study are needed to determine if listing is warranted). *Is likely to adversely affect: The appropriate conclusion when a proposed action may pose any effects on listed species, or designated critical habitat and the effect is not discountable, insignificant, or beneficial. When the Federal Agency preparing the Biological Assessment determines that a "is*

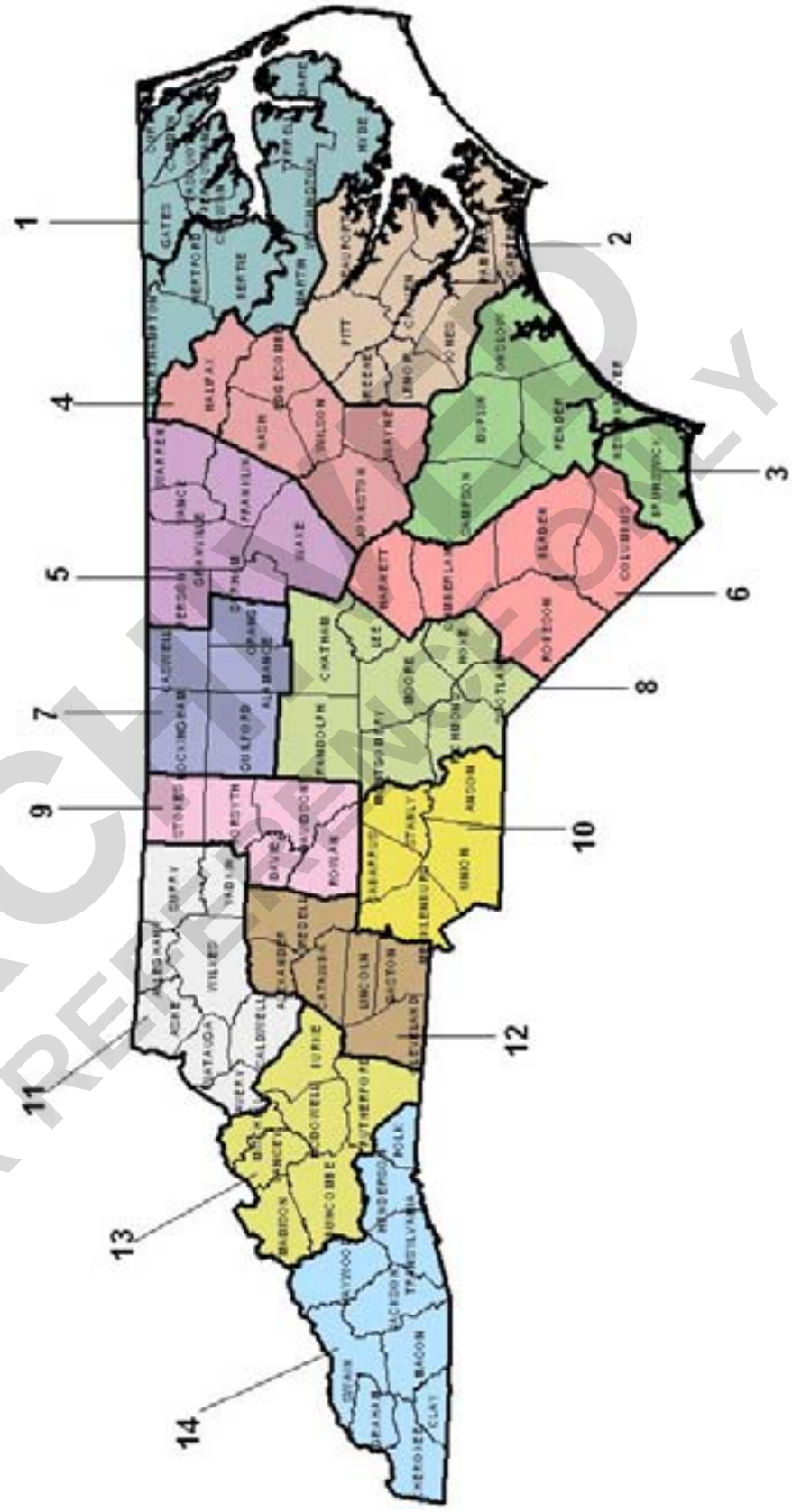
	likely to adversely affect" situation exists, then they must initiate formal consultation. *Is not likely to adversely affect: The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or beneficial. A concurrence (by the Service) with this conclusion is the termination point of an Informal Consultation.* *Jeopardize the continued existence of: To engage in an action that reasonably would be expected directly or indirectly to appreciably reduce the likelihood of both the survival and recovery of a listed species.*
Erosion Control	Erosion control consists of measures taken to prevent sediment from leaving the job site. These controls intercept, and settle sediment from runoff before it is discharged from the project. Erosion controls also help reduce velocity and reduce the erosive force of runoff.
Formal Consultation	If a proposed Federal action may affect a listed species, Formal Consultation is required. Formal consultation is a process between the Service and the Federal agency or applicant that: determines whether a proposal Federal action may affect the continued existence of listed species, or results in adverse modification of designated critical habitat. This process begins with a written request from the Federal agency to initiate consultation. A complete initiation package (Biological Assessment) is submitted with the request. If a determination is made that the action is not likely to "Jeopardize the continued existence" of a listed species, the Consultation concludes with the issuance of a Biological Opinion and incidental take statement by the Service.
Jurisdictional Areas	Waters of the United States including streams, lakes, estuaries, and wetlands that are regulated by the federal and state government.
Maintenance Activities	All activities associated with the repair or replacement and operation of an existing transportation structure which reflect current design specifications and safety standards but do not result in a change from an existing use.
May Affect	The appropriate conclusion when a proposed action may pose any effects on listed species, or designated critical habitat. When the Federal agency preparing the Biological Assessment determines that a "may affect" situation exists, then they must initiate formal consultation.
Natural Channel	The channel area that conveys the intermittent or year round water from the respective drainage area.
Peak Flow	The highest rate of flow during a specified rainfall event.
Riparian Buffers	Legally protected areas along jurisdictional waters such as streams, lakes, ponds, and estuaries in certain basins.
Rip Rap	Rock of varying size place to reduce or eliminate erosion

	caused by falling rain or running water.
Service(s)	The U.S. Fish and Wildlife (FWS) or National Marine Fisheries Service (NMFS), or both
Take	To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.
Threatened	Any species, which is likely to become an endangered species within the foreseeable future.
Watercourse	Flow path through the normal channel and/or diversion that occurs during minor rainfall events.
Work Area	The area necessary to perform the construction or operation activity within or adjacent to jurisdictional areas. They include but are not limited to, excavation and storage of material, construction, and the maneuvering of equipment and manpower.

NCDOT CONTACTS

Contact Division for Resident Engineer, Environmental Officer, Field Operations Engineer.

DIVISION MAP



NCDOT CONTACTS

Contact Division for Resident Engineer, Environmental Officer, Field Operations Engineer.

ORGANIZATION	MAILING ADDRESS	PHONE	FAX
NCDOT Division of Highways	1536 Mail Service Center Raleigh, NC 27699-1536	(919) 733-7384	(919) 733-9428
NCDOT Headquarters Secretary of Transportation	1501 MAIL SERVICE CENTER RALEIGH NC 27699-1501	(919) 733-2520	(919) 733-9150
NCDOT Highway Division 01	113 Airport Drive, Suite 100 Edenton, NC 27932	(252) 482-7977	(252) 482-8722
NCDOT Highway Division 02	105 Pactolus Hwy. (NC 33) PO Box 1587 Greenville, NC 27835	(252) 830-3490	(252) 830-3352
NCDOT Highway Division 03	124 Division Drive Wilmington, NC 28401	(910) 251-5724	(910) 251-5727
NCDOT Highway Division 04	PO Box 3165 Wilson, NC 27895	(252) 237-6164	(252) 234-6174
NCDOT Highway Division 05	2612 N. Duke Street Durham, NC 27704	(919) 560-6851	(919) 560-3371
NCDOT Highway Division 06	PO Box 1150 Fayetteville, NC 28302	(910) 486-1493	(910) 486-1959
NCDOT Highway Division 07	PO Box 14996 1584 Yanceyville Street Greensboro, NC 27415-4996	(336) 334-3192	(336) 334-3637
NCDOT Highway Division 08	902 N Sandhills Blvd, PO Box 1067 Aberdeen, NC 28315	(910) 944-2344	(910) 944-5623
NCDOT Highway Division 09	2125 Cloverdale Avenue Winston Salem, NC 27103	(336) 631-1340	(336) 761-2347
NCDOT Highway Division 10	716 W Main St. Albemarle, NC 28001	(704) 982-0101	(704) 982-3146
NCDOT Highway Division 11	P O Box 250 North Wilkesboro, NC 28659	(336) 667-9111	(336) 667-4549
NCDOT Highway Division 12	P O Box 47 Shelby, NC 28151-0047	(704) 480-9020	(704) 480-5401
NCDOT Highway Division 13	PO Box 3279 Asheville, NC 28802	(828) 251-6171	(828) 251-6394
NCDOT Highway Division 14	253 Webster Road Sylva, NC 28779	(828) 586-2141	(828) 586-4043
NCDOT Roadside Environmental Unit	1557 Mail Service Center (MAIL) Raleigh NC 27699-1557	(919) 733-2920	(919) 733-9810

United States Army Corps of Engineers (Civil)

Regulatory Field Office	MAILING ADDRESS	PHONE	FAX
ASHEVILLE REGULATORY FIELD OFFICE (NCDOT Divisions 10, 12, 13 & 14)	151 Patton Avenue, Room 208 Asheville, North Carolina 28801-5006	(828) 271-7980	(828) 281-8120
RALEIGH REGULATORY FIELD OFFICE (NCDOT Divisions 5, 7, 9 & 11)	6508 Falls of the Neuse Road, Suite 120 Raleigh, North Carolina 27615	(919) 876-8441	(919) 876-5823
WASHINGTON REGULATORY FIELD OFFICE (NCDOT Divisions 1, 2 &4)	Post Office Box 1000 Washington, North Carolina 27889-1000	(252) 975-1616	(252) 975-1399
WILMINGTON REGULATORY FIELD OFFICE (NCDOT Divisions 3, 6 & 8)	Post Office Box 1890 Wilmington, North Carolina 28402-1890	(910) 251-4511	(910) 251-4025

United States Fish & Wildlife Services*

RALEIGH FIELD OFFICE FOR ECOLOGICAL SERVICES	SS1-F Pylon Drive Raleigh, NC 27636-3726	(919) 856-4520	(919) 856-4556
ASHEVILLE FIELD OFFICE FOR ECOLOGICAL SERVICES	160 Zillicoa Street Asheville, NC 28801	(828) 258-3939	(828) 258-5330

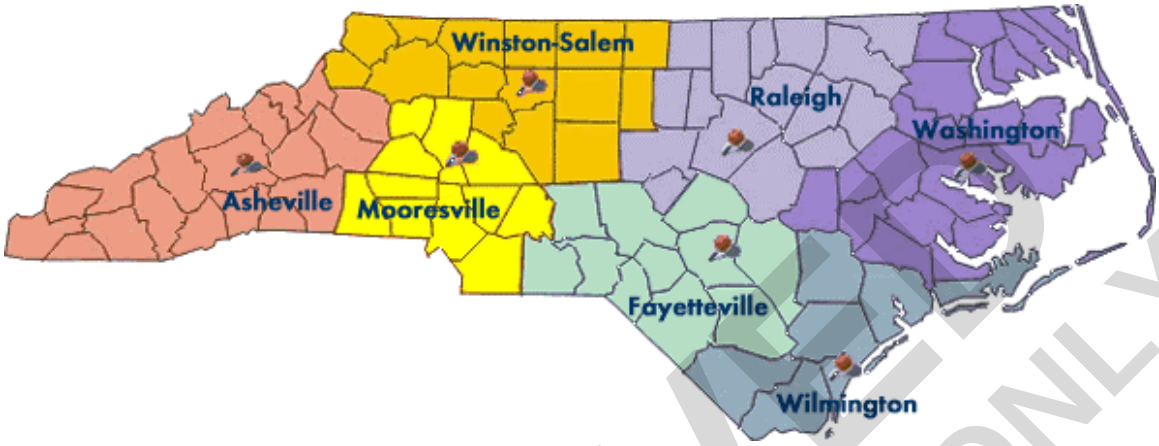
* County list of threatened and endangered species can be found at the website http://nc-es.fws.gov

National Marine Fisheries Service

HABITAT CONSERVATION DIVISION	Pivers Island Beaufort, NC 28516	(252) 728-5090	(252) 728-8728

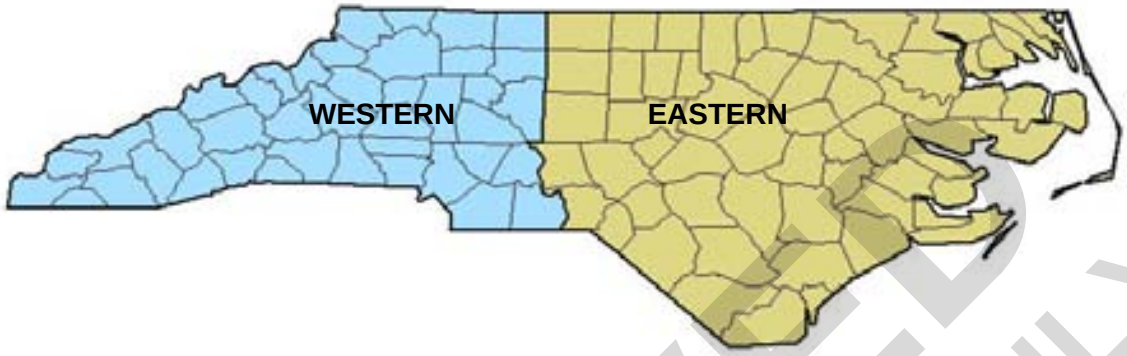
NCDENR Regional Contacts

DWQ, DLR-LQS



Region Offices	Address	Phone	Fax
Asheville Regional Office	Interchange Building 59 Woodfin Place Asheville, NC 28801-2482 (Courier 12-59-01)	(828) 251-6208	(828) 251-6452
Fayetteville Regional Office	Systel Building, 225 Green St., Suite 714 Fayetteville, NC 28301-5094 (Courier 14-56-25)	(910) 486-1541	(910) 486-0707
Mooresville Regional Office	919 North Main Street Mooresville, NC 28115 (Courier 09-08-06)	(704) 663-1699	(704) 663-6040
Raleigh Regional Office	1628 Mail Service Center Raleigh, NC 27699-1628 Location: 3800 Barrett Drive Raleigh, NC 27611 (Courier 52-01-00)	(919) 571-4700	(919) 571-4718
Washington Regional Office	943 Washington Square Mall Washington, NC 27889 (Courier 16-04-01)	(252) 946-6481	(252) 975-3716
Wilmington Regional Office	127 Cardinal Drive Extension Wilmington, NC 28405 (Courier 04-16-33)	(910) 395-3900	(910) 350-2004
Winston-Salem Regional Office	585 Waughtown Street Winston-Salem, NC 27107 (Courier 13-15-01)	(336) 771-4600	Main (336) 771-4631 Water Quality (336) 771-4630

Wildlife Resources Commission Contacts



Eastern Counties Highway Project Coordinator	1142 I-85 Service Road Creedmoor, NC 27522 (919) 528-9886
Western Counties Highway Project Coordinator	12275 Swift Road Oakboro, NC 28129 (704) 485-2384
Northern Coastal Plain Regional Non-Game Biologist Coordinator	NCWRC, DENR 943 Washingto Square Mall Washington, NC 27889 (252) 946-6061 Ext. 345
Southern Coastal Plain Regional Non-Game Biologist Coordinator	901 Laroque Avenue Kinston, NC 28501 (252) 522-9736
Eastern Piedmont Regional Non-Game Biologist Coordinator	1142 I-85 Service Road Creedmoor, NC 27522 (919) 528-9886
Western Piedmont Regional Non-Game Biologist Coordinator	3855 Idlewild Road Kernersville, NC 27284 (336) 769-9453
Mountain Regional Non-Game Biologist Coordinator	20830 Great Smoky Mountain Expressway Waynesville, NC 28786 (828) 452-2546

CAMA COUNTIES

Beaufort

Bertie

Brunswick

Camden

Carteret

Chowan

Craven

Currituck

Dare

Gates

Hertford

Hyde

New Hanover

Onslow

Pamlico

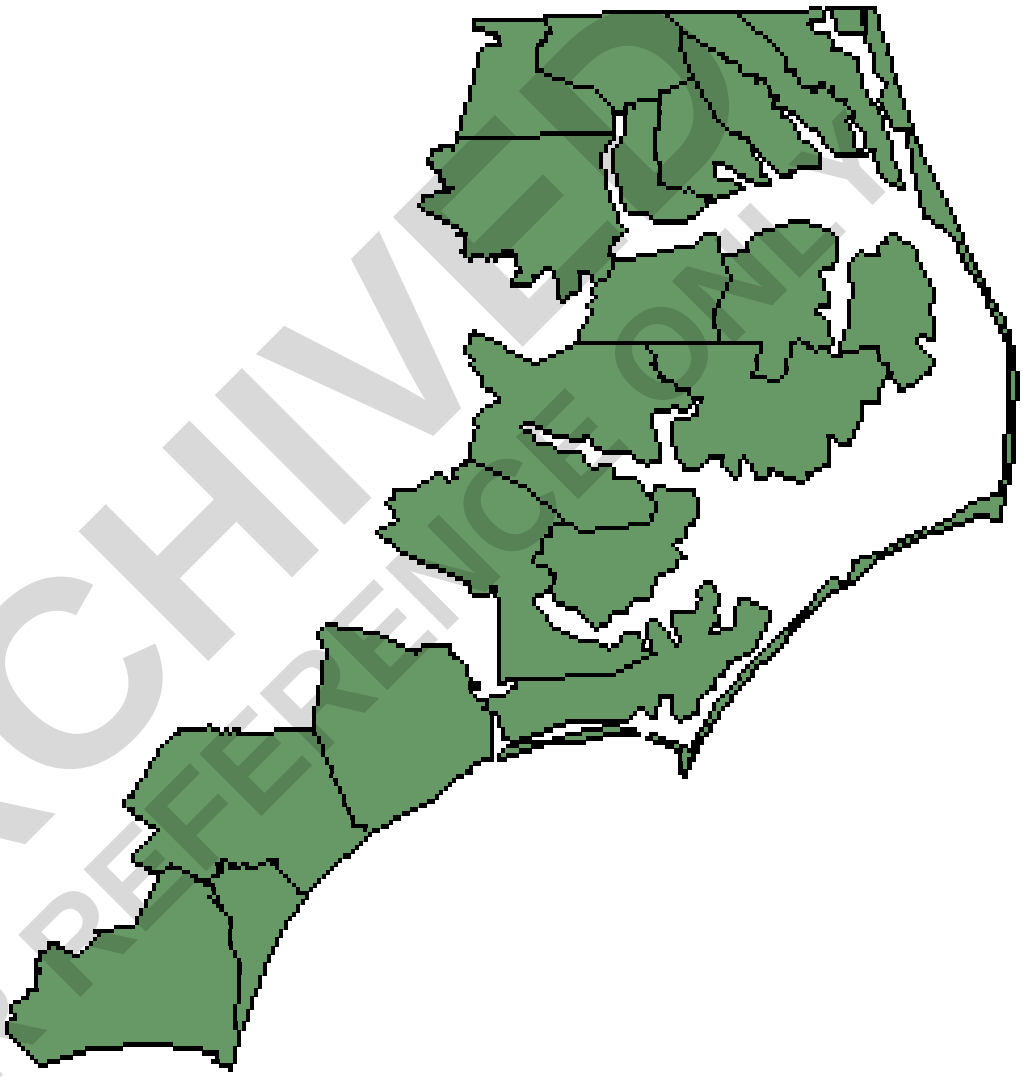
Pasquotank

Pender

Perquimans

Tyrrell

Washington

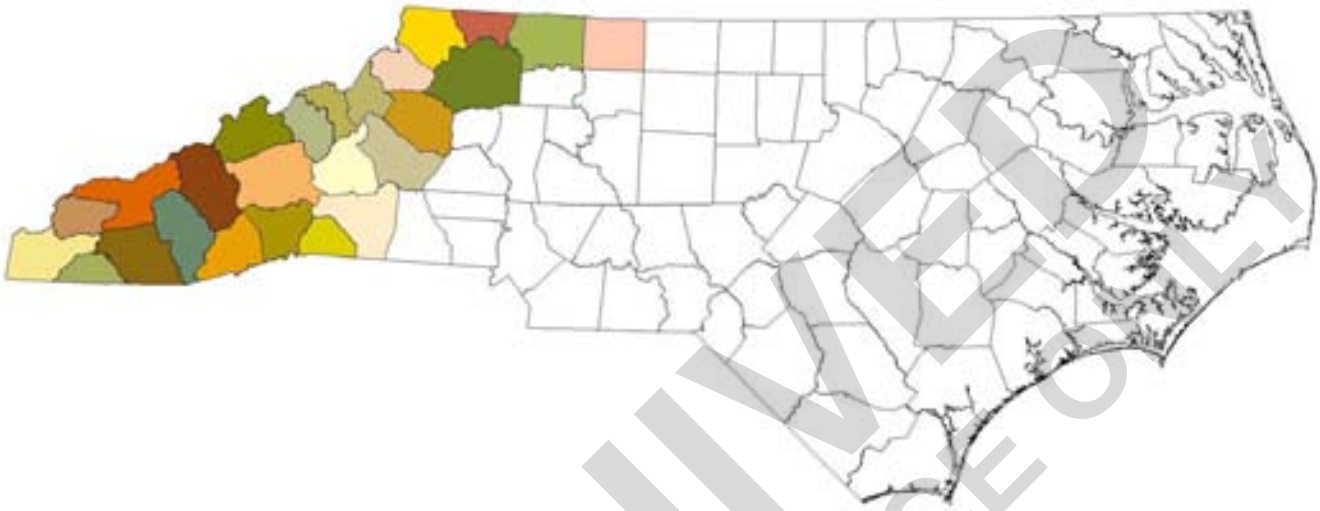


CAMA CONTACTS

OFFICE	ADDRESS	PHONE	FAX
Raleigh Central Office	1638 Mail Service Center Raleigh, NC 27699-1638	(919) 733-2293	(919) 733-1495
Elizabeth City District Serves: Camden, Chowan, Currituck, Dare, Gates, Pasquotank and Perquimans counties	1367 U.S. 17 South Elizabeth City, NC 27909	(252) 264-3901	(252) 264-3723
Morehead City District Serves: Carteret, Craven, Pamlico counties and Onslow County south to New River	151-B Hwy. 24 Hestron Plaza II Morehead City, NC 28557	(252) 808-2808	(252) 247-3330
Washington District Serves: Beaufort, Bertie, Hertford, Hyde, Tyrrell and Washington counties	943 Washington Square Mall Washington, NC 27889	(252) 946-6481	(252) 948-0478
Wilmington District Serves: Brunswick, New Hanover, Pender counties, and Onslow County north to New River	127 Cardinal Drive Ext. Wilmington, NC 28405-3845	(910) 395-3900	(910) 350-2004

NORTH CAROLINA TROUT WATERS

(Named West to East)



Cherokee	Yancey	Wilkes
Graham	Mitchell	Surry
Clay	McDowell	Stokes
Macon	Rutherford	
Swain	Polk	
Jackson	Burke	
Haywood	Caldwell	
Transylvania	Avery	
Henderson	Watauga	
Buncombe	Ashe	
Madison	Allegany	

Regulations

Clean Water Act

In 1972, Congress enacted the first comprehensive national clean water legislation in response to growing public concern for serious and widespread water pollution. The Clean Water Act is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers and coastal areas. The Clean Water Act's primary objective is to restore and maintain the integrity of the nation's waters. This objective translates into two fundamental national goals:

- To eliminate the discharge of pollutants into the nation's waters, and
- To achieve water quality levels that are fishable and swimmable.

Section 404

Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into ***waters of the United States, including wetlands (waters of the U.S. are referred to as jurisdictional waters in this manual)***. Activities in jurisdictional waters that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for agriculture and forestry.

The basic premise of the program is that no discharge of dredged or fill material can be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the jurisdictional waters would be significantly degraded. In other words, when you apply for a permit, you must show that you have

Taken steps to avoid wetland impacts where practicable,
Minimized potential impacts to wetlands, and
Provided compensation for any remaining, unavoidable impacts through activities to restore or create wetlands.

A permit review process controls regulated activities. An individual permit is usually required for potentially significant impacts. However, for most discharges that will have only minimal adverse effects, The United States Army Corps of Engineers (USACE) has established nationwide general permits and some specific regional general permits, which allow an activity under specific conditions.

If the USACE determines that a 404 Permit is required because the proposed project involves impacts to jurisdictional waters, then a 401 Water Quality Certification is also required. In North Carolina, a single form is used to request both a 404 Permit and 401 Certification.

Section 401

Section 401 of the Clean Water Act delegates authority to the states to issue a 401 Water Quality Certification for all projects that require a Federal Permit (such as a Section 404 Permit). The "401" is essentially a verification by the state Division of Water Quality (DWQ) that a given project will not degrade jurisdictional waters or otherwise violate water quality standards.

Endangered Species Act (ESA) Section 7 Interagency Cooperation

Applicability: Applies to all NCDOT projects that have a federal involvement including FHWA funded projects, or projects requiring a federal permit such as an Army Corps of Engineers permit.

Requirements: Section 7 of the ESA requires every Federal agency to insure any action it authorizes, funds, or carries out "is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of designated critical habitat."

Procedures: The procedural regulations governing interagency cooperation (consultation process) under Section 7 of the ESA were established by a joint rule (50 CFR Part 402) between the U.S. Fish and Wildlife Service (Service) and the National Marine Fisheries Service (NMFS) on June 3, 1986.

Protocol for Division Projects Performed by NCDOT Division Environmental Officer

- Determine presence/absence of listed species in a project area
    - Review NC Natural Heritage Program database of rare species to determine presence. If not present in database, conduct specific on-site habitat evaluation to confirm absence.
    - Habitat evaluation: consult with USFWS or NCWRC representative for latest information
    - Conduct specific surveys for plants during identified flowering periods. All surveys (plant and animals) should be conducted by the appropriate personnel.

- Evaluate and Document Project Impacts
  - Avoidance/Minimization/Offset Impacts
  - Direct Impacts
  - Secondary Impacts
  - Cumulative Impacts

- Determination of Affect
  - No Effect – no written concurrence needed (no suitable habitat, no individuals observed)
  - Not Likely to Adversely Affect – written concurrence from the Service required (suitable habitat in the impact area but no individuals observed or species may be present but project as proposed is not expected to result in adverse impact to species or critical habitat)
  - May Affect – may require formal consultation if effects cannot be avoided or minimized (individuals or critical habitat affected).

- Maintain Documentation
  - Maintain adequate documentation in terms of GIS screening, maps, correspondence, and photographs in a permanent record.
  - Provide documentation in the event of individual request or audit of programmatic projects.
  - Document negative findings as well as positive findings. Explain how conclusions were reached for either scenario.

Emergency Protocols: Requirements of the Endangered Species Act are still applicable. Appropriate NCDOT representative should immediately contact local USFWS representative to initiate appropriate coordination/consultation.

Coastal Area Management Act

In 1972, Congress passed the Coastal Zone Management Act, which encouraged states to keep our coasts healthy by establishing programs to manage, protect and promote our country's fragile coastal resources. Two years later, the North Carolina General Assembly passed the landmark Coastal Area Management Act, known as CAMA. As a part of this program, the Coastal Resources Commission (CRC) designated "Areas of Environmental Concern" (AECs) within the 20 coastal counties and set rules for managing development activities within these areas. Section 103(5)(b) of CAMA exempts road maintenance within a public right-of-way.

Sedimentation Pollution Control Act	North Carolina General Statute 113A, Article 4 was promulgated in 1973 to establish minimum mandatory controls for sedimentation from land disturbing activities. The Division of Land Resources (DLR) implements the Erosion and Sediment Control (E/SC) Program which requires approval of erosion and sediment control plans for all development activities disturbing one acre or more. DLR has delegated NCDOT authority for the NCDOT E/SC Program. The State E/SC program may also be delegated to local governments.
State Stormwater Management Program	The State Stormwater Management Program (SSMP) was established in the late 1980's and is implemented through the North Carolina Division or Environment and Natural Resources, Division of Water Quality Regional Offices. A permit is required for development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or a CAMA major permit within one or both of the following areas: The twenty North Carolina coastal counties, and/or development activities draining to Outstanding Resource Waters (ORW), High Quality Waters (HQW), Trout Waters, or Water Supply Watersheds. The SSMP requires protection of these sensitive waters through the use of BMPs designed to minimize the impacts of development activities on water quality (e.g., wet detention ponds, low-density development, etc.).
Basinwide Stream Buffers	Since the late 1990's, the DWQ has established several major river basinwide programs that require protected buffers along jurisdictional waters of the State (as shown on soil surveys, USGS topo maps or by field determination) such as streams, lakes, ponds and estuaries. Typically, a 50-foot wide vegetative band along each side of the water body is protected from development activities. The buffer is usually measured from the top of the bank or the Mean High Water line. Existing drainage ditches and roadside ditches are typically exempt from the buffer rules provided that they are managed to minimize the amount of sediment, nutrients and other pollution that enters jurisdictional waters. New ditches are allowable if stormwater management is provided. Excavation of streambeds usually require authorization from the appropriate state agency. Prior to 2002, buffer protection rules were established in the Neuse River Basin, the Tar-Pamlico River Basin, the Catawba River Basin, and the Randleman Reservoir Watershed. Additional State basinwide buffer programs may be developed in the future or

	may already be in place.
CAMA Buffers	Coastal shoreline rules require a 30-foot buffer for new development along coastal shorelines in the 20 counties governed by the Coastal Area Management Act. The buffer is measured landward from the normal high water or normal water level. The rules apply to all navigable waterways in the coastal counties, including upstream public trust shorelines. In some cases, large drainage ditches could be determined to be navigable. The buffer requirement does not apply to the oceanfront, which already has its own setback requirements.
Local Buffers	Local stream buffer programs may be established by cities, towns, counties or other public entities. These requirements may be more stringent than state buffer requirements.

Environmental Permits and Certifications

401 General Certifications	The Division of Water Quality (DWQ) issues general certifications that correspond to the Nationwide 404 permits listed below. All conditions of the Nationwide 404 permits and General Certification must be followed throughout construction and maintenance of projects authorized under the General Certification. The activities and measures described in this manual are consistent with the conditions in the Nationwide 404 permits and the State's General Certification conditions. It is the Contractor's or Construction Supervisor's responsibility to know of any special conditions identified for a specific project.
404 General Permit No. 31: NCDOT Bridges	This general permit is issued by the Wilmington District United States Army Corps of Engineers (USACE) specifically for the North Carolina Department of Transportation or other institutions charged with the construction and maintenance of public transportation infrastructure projects. This permit authorizes repair and replacement of bridges and culverts following natural disaster events. This general permit identifies general and specific conditions that must be followed in order for the permit to be applicable. Requires corresponding DWQ General Certification 3404.
404 Nationwide Permit No. 3: Maintenance	This permit authorizes the minimal impact repair, replacement, or rehabilitation of any previously authorized structure or fill that does not qualify for the Section 404(f) exemption for maintenance. Requires corresponding DWQ General Certification 3376.
404 Nationwide Permit No. 12: Utility Line Discharges	This permit authorizes the construction, maintenance and repair of utility lines and associated facilities. Requires corresponding DWQ General Certification 3374.
404 Nationwide Permit No. 13: Bank Stabilization	This permit authorizes bank stabilization activities necessary for erosion prevention. This permit may not be used for the channelization of jurisdictional waters. Requires corresponding DWQ General Certification 3399.

404 Nationwide Permit No. 14: Road Crossings	This permit authorizes activities for the construction, expansion, modification or improvement of linear transportation crossings (e.g. highways, railways, trails, etc.) in jurisdictional waters, and is subject to specific acreage and linear limits. Authorization for public linear transportation projects in non-tidal waters, excluding non-tidal wetlands adjacent to tidal waters, is provided if the discharge does not cause the loss of greater than 1/2 acre of jurisdictional waters. Authorization for public linear transportation projects in tidal waters or non-tidal wetlands adjacent to tidal waters is provided if the discharge does not cause the loss of greater than 1/3 acre of jurisdictional waters and the length of fill for the crossing does not exceed 200 linear feet. Requires corresponding DWQ General Certification 3404.
404 Nationwide Permit No. 18: Minor Discharges	This permit authorizes discharges of dredged or fill material into all jurisdictional waters, provided that the activity meets specific criteria including (a) the discharge and the volume of the excavated area does not exceed 25 cubic yards below the high water line, (b) the discharge, including excavated areas, will not cause the loss of more than 1/10 acre of a special aquatic site, including wetlands and (c) the discharge is part of a single and complete project and is not placed for the purpose of stream diversion. Requires corresponding DWQ General Certification 3402.
404 Nationwide Permit No. 23: Approved Categorical Exclusions	This permit authorizes activities undertaken, assisted, authorized, regulated, funded or financed, in whole or in part, by a federal agency or department where that agency or department has determined that the activity, work or discharge is categorically excluded from environmental documentation because it is included within a category of actions which neither individually nor cumulatively have a significant effect on the human environment. Requires corresponding DWQ General Certification 3403.
404 Nationwide Permit No. 27: Wetland and Riparian Restoration and Creation	This permit authorizes activities in jurisdictional waters associated with the restoration of former waters, the enhancement or creation of degraded tidal and non-tidal wetlands and riparian areas, and the restoration and enhancement of non-tidal streams and non-tidal open water areas. This permit does not authorize stream channelization or conversion of natural wetlands to another use. Activities authorized by this permit include, but are not limited to, the removal of accumulated sediments; the installation, removal and maintenance of small water control structures,

	dikes and berms; the installation of current deflectors, the enhancement, creation or restoration of pool and riffle stream structure; the backfilling of artificial channels and drainage ditches; activities needed to reestablish vegetation; and other related activities. Requires corresponding DWQ General Certification 3399.
404 Nationwide Permit No. 33: Temporary Construction, Access and Dewatering	This permit authorizes temporary structures, work and discharges necessary for construction activities, access fills, or dewatering of construction sites. Requires corresponding DWQ General Certification 3366.
CAMA General Permit (07H.2300)	This permit authorizes demolition, removal, and replacement of existing bridges and culverts spanning no more than 250 feet of estuarine water, public trust area, and coastal wetland AECs and has threshold limits for AEC and wetland impacts. This permit does not authorize temporary fill causeways or temporary bridges associated with bridge replacements.
CAMA Dredge and Fill Permits	Under General Statute 113-229, a dredge and fill permit must be obtained before any excavation or filling project is begun in any estuarine waters, tidelands, marshlands, or State-owned lakes. Emergency permits may be issued when life or structural property is in imminent danger as a result of rapid recent erosion or sudden failure of a man-made structure.
Isolated Wetlands Permit	Isolated wetlands, which are not claimed by the USACE, are under the jurisdiction of the DWQ. The DWQ issues an Isolated Wetlands Permit following public review of the proposed work.
State Stormwater Management Permit	The DWQ issues this permit for development activities in the 20 coastal CAMA counties. The permit specifies stormwater runoff controls for projects that require a CAMA Major Permit or an approved Erosion and Sediment Control Plan.

Predictable Permit Conditions

Environmental permits typically include special conditions to ensure that impacts to the aquatic environment are minimal. Some of the more common conditions are included in this appendix. However, this list is not inclusive. The permittee must read, understand, and comply with all of the permit conditions that are associated with each maintenance and construction activity.

Proper Maintenance	Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
Soil and Erosion Controls	Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow. All sediment and erosion control measures placed in wetlands and waters shall be removed and the original grade restored within two months after the project is permanently stabilized.
Aquatic Life Movements	No activity may substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.
Equipment	Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.
Endangered Species	No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species.
Historic Properties	No activity that may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the District Engineer has complied with the provisions of 33 CFR part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties

	listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized.
Anadromous Fish Spawning Areas	Discharges into Waters of the United States designated by either the N. C. Division of Marine Fisheries (NCDMF) or the N. C. Wildlife Resources Commission (NCWRC) as anadromous fish spawning area, are prohibited during the period between February 15 and June 30, without prior written approval form NCDMF or NCWRC and the Corps.
Sturgeon Spawning	Discharges into Waters of the United States designated as sturgeon spawning areas are prohibited during the period between Feb. 1 and June 30, without approval from the National Marine Fisheries Service (NMFS).
High Quality Waters	Outstanding Resource Waters, High Quality Waters, Inland Primary Nursery Areas, Contiguous Wetlands, and Primary Nursery Areas.
Areas of Environmental Concern	Area of Environmental Concern (AEC) in the twenty (20) coastal counties of Eastern North Carolina covered by the N.C. Carolina Coastal Area Management Act (CAMA), must also obtain the required CAMA permit.
Trout Waters	Prior to the use of any NWP in Mountain Trout Waters within twenty-five (25) designated counties of North Carolina, applicants must comply with NWP 13. The applicant shall furnish a written statement of compliance with all of the conditions listed in the applicable NWP. Notification will include a letter of comments and recommendations from the North Carolina Wildlife Resources Commission (NCWRC), the location of work, a delineation of wetlands, a discussion of alternatives to working in the Mountain Trout Waters, why other alternatives were not selected, and a plan to provide compensatory mitigation for all unavoidable adverse impacts to the Mountain Trout Waters.
Riparian Buffer Protection Rules	Impacts to any stream length in the Neuse, Tar-Pamilico, Randleman and Catawba River Basins (or any other river basins with Riparian Area Protection Rules [Buffer Rules]), requires written concurrence from DWQ in accordance with 15A NCAC 2B.0200. Activities listed as “exempt” from these rules do not need to apply for written concurrence.

Concrete in Water	Measures will be taken to prevent live or fresh concrete, including bags of uncured concrete, from coming into contact with waters of the state until the concrete has hardened.
Riprap Bank Stabilization	Filter cloth must be placed underneath riprap used for streambank stabilization.
Pipe/Culvert Installation	Installation shall be in a manner to promote the safe passage of fish and other aquatic organisms. All culverts in the 20 CAMA coastal counties must be buried to a depth of one foot below the bed of the stream or wetland. The dimension, pattern, and profile of the stream, (above and below a pipe or culvert), should not be modified by widening the stream channel or by reducing the depth of the stream. Culvert inverts will be buried at least one foot below the bed of the stream for culverts 48 inches in diameter. For culverts 48 inches in diameter or smaller, culverts must be buried below the bed of the stream to a depth equal to or greater than 20 percent of the diameter of the culvert.
Steam Relocations	Natural channel design must be applied to the maximum extent practicable for stream relocations.

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Additional copies of this manual or further questions should be addressed to:

Ken Pace, PE
Roadside Environmental Unit
Operation Section
NC Department of Transportation
1557 Mail Service Center
Raleigh, NC 27699-1557
Phone: (919) 733-2920