BOOK 2848 PAGE 162

Doc ID: 010506020027 Type: CRP
Recorded: 04/07/2011 at 04:21:05 PM
Fee Amt: $97.00 Page 1 of 27
WAYNE COUNTY, NC
LOIS J MOORING REGISTER OF DEEDS
BK 2848 PG 162-188

UNDEXED

27-97.00

STATE OF NORTH CAROLINA

Conservation Easement for Stormwater Best Management Practice (BMP)
WAYNE COUNTY

SPO File Number ***96-R***
EEP Number ***670***

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS CONSERVATION EASEMENT DEED, pursuant to the provisions of N.C. General Statutes Chapter 121, Article 4 and made this 22nd day of March, 2011, by Wayne County Community College Board of Trustees, a corporation, (**"Grantor"**), whose mailing address P.O. Box 8002, Goldsboro, NC, 27533, to the State of North Carolina, (**"Grantee"**), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Ecosystem Enhancement Program (formerly known as the Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Ecosystem Enhancement Program in the Department of Environment and Natural Resources has approved acceptance of this instrument; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003. This MOA recognizes that the Ecosystem Enhancement Program is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in the City of Goldsboro, Wayne County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land along Wayne Memorial Drive, Goldsboro, NC 27533. The **Parent Tract** subject to the **Conservation Easement** is recorded in Deed Book 853, Page 303, Wayne County Registry. Property is also identified as being Tax Parcel Number 3610426791 and is located along Wayne Memorial Drive.

WHEREAS, Grantor is willing to grant a Conservation Easement over the herein described areas of the Property, thereby restricting and limiting the use of the included areas of the Property to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept such Conservation Easement. This Conservation Easement shall be for the protection and benefit of the waters of the Stoney Creek Drainage Area.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, for thirty years, a Conservation Easement of the nature and character and to the extent hereinafter set forth, over a described area of the Property, referred to hereafter as the "**Easement Area**", for the benefit of the people of North Carolina, such property being all of the tract of land as identified as **Conservation Easement (Zone 1 and 2)** as shown on a plat of survey entitled "**30 Year Conservation Easement Survey for the State of North Carolina Ecosystem Enhancement Program, BMP Wayne Community College**" dated October 25, 2010, certified by G. Scott Wilson, PLS, 2601, and **recorded in Plat Cabinet N, Slide 49G, Wayne County Registry**. The tract being more particularly described as follows (the "Easement Area"):

Commencing at an existing concrete monument in the eastern right-of-way of Wayne Memorial Drive, an 80 ft. public right-of-way, said monument being the southwest corner of the property of the City of Goldsboro as referenced in Deed Book 1892, Page 813 and recorded in the Wayne County Registry; thence leaving the said right-of-way of Wayne Memorial Drive, S 31°43'42"W, 144.30 feet to a rebar and cap being the Point and Place of BEGINNING; thence S 58°33'39"E, 145.23 feet to a rebar and cap;

thence N 73°37' 57"E, 151.94 feet to a rebar and cap; thence S 50°46'28"E, 125.13 feet to a rebar and cap; thence S 07°42'37"W, 74.12 feet to a rebar and cap; thence N 82°24'18"W, 272.04 feet to a rebar and cap; thence S 36°26'21"W, 82.31 feet to a rebar and cap; thence N 53°56'11"W, 150.56 feet to a rebar and cap; thence N 33°18'54"E, 152.15 feet to the Point and Place of BEGINNING and containing 1.1823 acres.

The purposes of this Conservation Easement are to maintain, restore, enhance, create and preserve wetland and/or riparian resources in the Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain for thirty years the Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement shall be for thirty years and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee.

The Grantor expressly agrees to maintain and repair, as well to bear the sole financial responsibility for, **the Wayne Community College BMP as described in the *Wayne Community College BMP – Memorandum of Agreement and the Wayne Community College Stormwater Best Management Practice Maintenance Requirements,* attached hereto as "Exhibit A" and incorporated herein by reference.**

Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Easement Area for the purposes thereof. Usage of motorized vehicles in the Easement Area is prohibited, except as they are used exclusively for management, maintenance, or stewardship purposes, and on existing trails, paths or roads.

B. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Easement Area not inconsistent with this Conservation

Easement, and the right of access to the Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

C. **Vegetative Cutting.** Except as related to the removal of non-native plants, diseased or damaged trees, and vegetation that obstructs, destabilizes or renders unsafe the Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Easement Area is prohibited except where identified on plat of survey.

D. **Industrial, Residential and Commercial Uses.** All are prohibited in the Easement Area.

E. **Agricultural Use.** All agricultural uses within the Easement Area including any use for cropland, waste lagoons, or pastureland are prohibited.

F. **New Construction.** There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Easement Area.

G. **Roads and Trails.** There shall be no construction of roads, trails, walkways, or paving in the Easement Area. Existing roads or trails located in the Easement Area may be maintained by Grantor in order to minimize runoff, sedimentation and for access to the interior of the Property for management, maintenance, stewardship purposes, or undeveloped recreational and educational uses of the Easement Area. Existing roads, trails or paths may be maintained with loose gravel or permanent vegetation to stabilize or cover the surfaces.

H. **Signs.** No signs shall be permitted in the Easement Area except interpretive signs describing restoration activities and the conservation values of the Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Easement Area may be allowed.

I. **Dumping or Storing.** Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances or machinery, or other material in the Easement Area is prohibited.

J. **Grading, Mineral Use, Excavation, Dredging.** There shall be no grading, filling, excavation, dredging, mining, or drilling; no removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

K. **Water Quality and Drainage Patterns.** There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Easement Area may

temporarily be used for good cause shown as needed for the survival of livestock and agricultural production.

L. **Subdivision and Conveyance.** Grantor voluntarily agrees that no subdivision, partitioning, or dividing of the underlying fee that is subject to this Easement is allowed. Unless agreed to by the Grantee in writing, any future conveyance of the underlying fee for the Easement Area and the rights as conveyed herein shall be as a single block of property. Any future transfer of the fee simple shall be subject to this Conservation Easement. Any transfer of the fee is subject to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Easement Area for the purposes set forth herein.

M. **Development Rights.** All development rights are removed from the Easement Area and shall not be transferred.

N. **Disturbance of Natural Features.** Any change, disturbance, alteration or impairment of the natural features of the Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is consistent with the purposes of this Conservation Easement. The Grantor shall not vary from the above restrictions without first obtaining written approval from the N.C. Ecosystem Enhancement Program, whose mailing address is 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. **Ingress, Egress, and Inspection.** The Grantee, its employees and agents, successors and assigns, receive the right of unlimited and repeated ingress and egress to the Easement Area over the Property for thirty years at reasonable times to undertake any activities to restore, manage, maintain, enhance, and monitor the wetland and riparian resources of the Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. **Restoration Activities.** These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

IV. ENFORCEMENT AND REMEDIES

A. **Enforcement.** To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Easement Area that is inconsistent with the purposes of this Easement and to require the restoration of such areas or features of the Easement Area that may have been damaged by such activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, their successors or assigns, which comes to the attention of the Grantee, the Grantee shall, except as provided below, notify the Grantor, their successors or assigns in writing of such breach. The Grantor shall have ninety (90) days after receipt of such

notice to correct the conditions constituting such breach. If the breach remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by appropriate legal proceedings including damages, injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief if the breach of the term of this Conservation Easement is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement. The Grantor and Grantee acknowledge that under such circumstances damage to the Grantee would be irreparable and remedies at law will be inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. **Inspection.** The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor, their successors or assigns are complying with the terms, conditions and restrictions of this Conservation Easement.

C. **Acts Beyond Grantor's Control.** Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor, their successors or assigns, for any injury or change in the Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life, damage to property or harm to the Property resulting from such causes.

D. **Costs of Enforcement.** Beyond regular and typical monitoring, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, their successors or assigns, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown above or to other address(es) as either party establishes in writing upon notification to the other.

C. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees to make any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed subject to the Conservation Easement herein created.

D. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

E. This Conservation Easement may be amended, but only in writing signed by all parties hereto, and provided such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement.

F. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Easement Area, and the right of quiet enjoyment of the Easement Area.

TO HAVE AND TO HOLD the said rights and easements for thirty years unto the State of North Carolina for the aforesaid purposes.

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same are free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

Gwyndell Wilson
Chairman-Wayne Community College Board of Trustees

Dr. Kay H. Albertson
President-Wayne Community College
Secretary-Wayne Community College Board of Trustees

Trustee-Wayne Community College Board of Trustees

Trustee-Wayne Community College Board of Trustees

Trustee-Wayne Community College Board of Trustees

NORTH CAROLINA

COUNTY OF Wayne

I, Leasa O. Holmes, a Notary Public in and for the County and State aforesaid, do hereby certify that Kay H. Albertson, personally appeared before me this day and acknowledged that he/she is Secretary of Wayne Community College Board of Trustees , and that by authority duly given and as an act of the Board of Trustees the foregoing instrument was signed by Gwyndella Wilson its Chairman, attested by himself/herself as Secretary, Kay H. Albertson.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 22nd day of March, 2011.

Leasa O. Holmes
Notary Public

My commission expires:
September 7, 2013

(Notary Seal)

LEASA O. HOLMES NOTARY PUBLIC My Comm. Exp. Sept. 7, 2013 WAYNE COUNTY, NC

EXHIBIT A BOOK 2848 PAGE 171

D06122

STATE OF NORTH CAROLINA
WAYNE COMMUNITY COLLEGE

MEMORANDUM OF AGREEMENT

THIS MEMORANDUM OF AGREEMENT, made this the 5 day of May, 2006, by and between THE WAYNE COMMUNITY COLLEGE (WCC) and THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, ECOSYSTEM ENHANCEMENT PROGRAM (EEP)

WITNESSETH:

NOW THEREFORE, in consideration of the mutual promises, obligations, and benefits hereunder exchanged and obtained, WCC and EEP mutually covenant and agree as follows:

Section 1 - Purpose

The purpose of this Memorandum of Agreement (MOA) is to define and set forth the responsibilities of WCC and EEP for the design, construction and maintenance of a stormwater best management practice (BMP). The entire costs associated with the design and construction of the Stormwater BMP will be funded by EEP through other contracts. Maintenance of the Stormwater BMP to ensure proper function will be the responsibility of WCC and no monies will be paid to WCC. The Stormwater BMP will be constructed on a parcel of land located near Wayne Memorial Drive and north of the front parking lot on WCC campus in Goldsboro, Wayne County, North Carolina.

The Project is intended to enhance water quality within The Stoney Creek Drainage Area (Cataloging Unit # 03020202, Hydrologic Unit 03020202010010) through the reduction of nitrogen and phosphorous discharges into surface waters within the watershed. This reduction is to be accomplished through the use of a Stormwater Wetland BMP as outlined in the MICHAEL E. REGANS STORMWATER WETLAND PROJECT STATEMENT, a copy of which is attached hereto as ATTACHMENT 1. It is anticipated that the Stormwater Wetland BMP will reduce Total Nitrogen discharges from the 35 acre sub-watershed by approximately 40%, to 253 pounds per year, and Total Phosphorous discharges by approximately 35%, to 28 pounds per year.

Section 2 - Areas of Authority and Responsibility

The primary responsibilities of WCC during and after the project will be:

1. To provide a designated contact person from WCC to coordinate and review all aspects of the Project with EEP and its contractors or consultants. WCC will respond in writing to any Project approval request within thirty (30) days from the date of request. If WCC fails to respond within thirty (30) days of the request, the request will be deemed approved by WCC.

activities are necessary. Details related to the implementation of the remedial action plans will be jointly discussed by both entities as necessary.

Section 3 - Duration of this Agreement

The Project shall commence on the date a Memorandum of Agreement (MOA) is signed by all parties. The site maintenance phase of the Project will commence upon completion of the Stormwater BMP construction. WCC agrees to maintain the constructed Stormwater BMP site for a 30-year period and submit site maintenance and inspection reports to EEP every two (2) years for a period of thirty (30) years following completion of the construction phase of the project.

Section 4 - Considerations

This MOA will not transfer the ownership of the land or the management and maintenance responsibilities for the Project from WCC to EEP. All provisions of the MOA will be consistent with such understanding.

Section 5 - Review of Project Plans

In order to protect the interests of all parties, the EEP shall provide to WCC copies of all plans and maps for the this project for review and comment prior to the project's implementation.

Section 6 - Inspection

In order to ensure compliance with all regulations and policies, WCC and EEP staff shall have unrestricted access to all project areas where right of entry, ingress and egress are granted.

Section 7 - Termination for Cause

If any party fails to perform or comply with any condition of this agreement, and such failure should continue more than 30 days after written notice from the other party, and if the non-compliant party should not within 30 days commence to cure with due diligence the failure, then the aggrieved party may terminate this MOA on written notice to the other parties describing the failure to perform. Termination will be effective not less than 15 days from receipt of the written notice by the recipient parties.

Section 8 - No Waiver

The failure of any party to insist on strict performance of any condition of this agreement shall not be construed as a waiver of the right to insist on the performance of that condition or other conditions in any other instance.

Section 9 - Modification or Termination by Consent

This MOA may be modified or terminated by mutual agreement of the parties as long as such modifications or termination are made in writing and signed by authorized officers from all parties.

BOOK 2848 PAGE 173

IN TESTIMONY WHEREOF, the WCC has caused this instrument to be executed in its name by its President and attested by its _____, and its Seal affixed thereto by authority duly given.

Edward H. Wilson, Jr. Ed.D.
President
Wayne Community College

STATE OF NORTH CAROLINA
WAYNE COUNTY

I, Carol J. Weeks, a Notary Public in and for the County and State aforesaid, do hereby certify that Edward H. Wilson, Jr. personally came before me this day and acknowledged that he is (TITLE), and that by authority duly given and as an act of Wayne Community College, the foregoing instrument was signed by Edward H. Wilson, Jr., its President, attested by himself as President, and sealed with the common seal of said County.

IN WITHNESS WHEREOF, I have hereunto set my hand and Notarial Seal this the 3 day of May, 2006.

Carol J. Weeks
Notary Public

My commission expires: January 31, 2007

BOOK 2848 PAGE 174

IN TESTIMONY WHEREOF, the State has caused this instrument to be executed in its name by its _____ and attested by its _____, and its Seal affixed thereto by authority duly given.

Suzanne Klimek
Director of Operations
North Carolina Ecosystem Enhancement Program

STATE OF NORTH CAROLINA
Wake COUNTY

I, Jeffrey M. Horton, a Notary Public in and for the County and State aforesaid, do hereby certify that Suzanne Klimek personally came before me this day and acknowledged that she is Director of Operations, and that by authority duly given and as an act of NC Ecosystem Enhancement the foregoing instrument was signed by Suzanne Klimek, its Director of operations Program

IN WITHNESS WHEREOF, I have hereunto set my hand and Notarial Seal this the 5th day of May, 2006.

Notary Public

JEFFREY M. HORTON NOTARY PUBLIC BERTIE COUNTY, NC

My commission expires:

2/05/2011

MICHAEL E. REGANS STORMWATER WETLAND PROJECT STATEMENT

Site Location

River Basin: Neuse
CU: 03020202
14-digit HU: *03020202010010*
County: Wayne
Municipality: Goldsboro
Receiving Water: Unnamed tributary to Stoney Creek; 27-62; 030405
DWQ Classification of Receiving Water: Stoney Creek - C NSW
Use Support Rating for Receiving Water: Stoney Creek - NS

(See attached site location map, Figure 1)

Watershed Description

Drainage Area: 35 acres (estimated)
Soils: Lynchburg, Rains, Norfolk, Wagram
Land Use: Site drains a large portion of Wayne Community College (including future development) and some previously agricultural area that will likely be developed
Average Watershed Slope: 1%
Pre-BMP Nutrient Loading Estimate: TN- 422 lb/yr, TP- 43 lb/yr

Site Description

Current Property Owners: Wayne Community College
Owners Willing to Cooperate: Yes
Land Area Available: 0.9 acres
Accessibility: Accessible from school grounds
Site Constraints: There is an irrigation line running near the property boundary between the School and the City of Goldsboro's parcel. This line will probably need to be moved if necessary. There is an existing golf green that must remain. There is an electrical line that is runs perpendicularly underneath the ditch. It may or may not need to be moved. The location of all utilities should be verified by the designer or construction contractor. The BMP must be downstream of the existing wooden bridge.

(See attached site layout, Figure 2)

Ecosystem Enhancement

NCDENR

BMP Recommendation

Type of BMP Recommended: Stormwater treatment wetland
Approximate BMP Surface Area: 0.8 acres
Permits Required: possible DLR erosion and sedimentation control, DWQ stormwater
Post-BMP Nutrient Export Estimate: TN- 253 lb/yr (40% reduction), TP- 28 lb/yr (35% reduction)
Additional Project Notes: This site was selected because it will treat a large, developed/developing watershed. NCSU has done BMP work at the Community College in the past and they have been found to be very good cooperators. They are also very supportive of the proposed project.

The channel that the wetland would intercept has been called exempt from the Buffer Rules by NCDENR, so an in-line wetland would be allowed here and would provide the most treatment.

The watershed has been estimated to be 35 acres. Due to an unknown quantity and extent of drainage tiles in the adjoining field, it is difficult to determine the watershed size exactly.

The College has asked that a 25-foot access path be left between the wetland and the northern property boundary. They want to be sure that all disturbed areas outside of the project area are returned to their existing condition. They have offered to use all of the excavated soil material on site. They have agreed to maintain the wetland in accordance with to EEP's requirements. The College believes that the existing wooden bridge is in need of repair and would like to include that work in the project to help with construction and maintenance access. They would also like to add a water line in the area near the wetland and will need to coordinate that with the EEP.

NCSU strongly recommends the construction of this stormwater wetland. WCC has proven to be good cooperators and is very excited about the installation of this facility. It is an excellent demonstration and educational site as well. The project's location in Stoney Creek makes it additionally appealing.

Ecosystem Enhancement

NCDENR

EXHIBIT A cont'd

Wayne Community College Stormwater Best Management Practice Maintenance Requirements

GENERAL:

1. Inspect outlet monthly and within 24 hours after a rainfall event of an inch or more. Ensure that the orifice and overflow openings remain clear and free of debris.

2. Remove trash and other debris from the wetland quarterly and as needed.

3. Inspect inlets and outlet for sediment deposits. Sediment should be removed periodically, stockpiled, and redistributed evenly across the main body of the wetland.

4. Rip rap pads should be inspected for sediment accumulation twice a year. Remove the sediment when the rip rap is covered and reshape the pads.

PLANTINGS:

Regular Maintenance and Monitoring

Frequency: First three years, twice yearly (once during growing season and once during non-growing season). After first three years, once yearly inspections for lifetime of wetland. Observations should be recorded and provided to NCEEP.

Tasks:

1. Observe and record notes on the following:

   Types and distribution of dominant wetland plants.
   The presence and distribution of planted wetland species.
   The presence and distribution of invasive wetland species.
   Signs that invasive species are replacing the planted wetland species.
   Percentage of unvegetated standing waters (excluding the deep water areas).

2. Remove any volunteer (not planted by contractor) trees or shrubs growing within one or two feet of the outlet structure.

3. If plants are dead, diseased or dying, determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application to establish the ground cover if a soil test indicates it is necessary.

4. Prune shrubs according to best professional practices.

5. Remove invasive species (particularly cattails): In years 1 and 2, twice a year (spring and fall). From year 2 onward, once a year (spring). If spread of cattails is somewhat

limited, use the glyphosate-wipe method. See attached excerpt from an NC State publication. The site should also be monitored and controlled for phragmites infestation (see page 38 of the NC DOT invasive species publication). The site should be monitored for other invasive species, including aquatic weeds. If a plant is suspected as an invasive species but cannot be identified, consult Kevin Johnson at the Wayne County Agricultural Extension office. His contact information is:

Kevin Johnson
Agriculture Extension Agent
Post Office Box 68
Goldsboro, NC 27533
(919) 731-1521

Do not remove plants without verifying that they are an invasive species. After invasives have been removed, areas significantly devoid of vegetation should be seeded with annual rye or millet grass and replanted with native species per the original planting plan.

6. Contact EEP if Bermuda grass or fescue is preventing the growth and survival of native plants.

Storm Event Monitoring

Frequency: Once a month and within 24 hours after every storm event greater than 1 inch.

Tasks:

1. Inspect the perimeter of the wetland and note where areas of bare soil and/or erosive gullies have formed. Regrade the soil if necessary to remove the gully, and then plant a ground cover (annual rye or millet grass) and water until it is established. Provide lime and a one-time fertilizer application.

2. Inspect outlet and remove any clogs. If shallow land remains flooded more than 5 days after a storm event, this is a sign that the outlet is clogged.

3. Inspect health of plants and follow task #3 under regular maintenance above if significant death or disease is evident.

Note: Unless stated above for a specific situation, do not apply fertilizer or mow the vegetation in the native plant zones (A, B, and C in the drawings).

BOOK 2848 PAGE 179

URBAN Waterways

Maintenance of Stormwater Wetlands and Wet Ponds

This publication presents maintenance guidelines for stormwater wetlands and wet ponds, two stormwater practices that are being constructed across North Carolina.

As its name implies, a *stormwater wetland* is a wetland system designed to treat stormwater runoff. Wetlands typically have shallow water (except for intermittent deep pools) and dense vegetation. A well-functioning stormwater wetland will be a diverse ecosystem that includes many plant and animal species. It will also do an excellent job of removing pollution from stormwater runoff—its intended function. Stormwater wetlands are very efficient at nutrient removal. Recent studies conducted by North Carolina State University researchers indicate that a stormwater wetland removes 40 to 80 percent of all nitrogen and 50 to 70 percent of all phosphorus entering the wetland. Figure 1 depicts some wetlands located across North Carolina. (For more information on stormwater wetlands, see *Designing Stormwater Wetlands for Small Watersheds*, AG-588-02, in the Urban Waterways fact sheet series.)

Wet ponds are typically much deeper than stormwater wetlands—their average depth ranges from 4 to 8 feet. They are designed so that most of the pond is open water. Wet ponds are the most common stormwater management practice in North Carolina and have been constructed since the 1970s in some parts of the state. More recent pond configurations incorporate wetland features, such as an aquatic shelf (or wetland bench) and a forebay.

An *aquatic shelf* is a shallow-water zone of a pond, usually along the bank edges, planted with wetland vegetation. These shelves flood during storms. A *forebay* is a pool where inflow first enters the pond, and heavier pollutants, such as sediment, initially settle there. Research conducted across the United States shows that wet ponds effectively remove sediment and the pollutants associated with it from stormwater. Both wet ponds and stormwater wetlands can

NC STATE UNIVERSITY A&T STATE UNIVERSITY COOPERATIVE EXTENSION Helping People Put Knowledge to Work

Figure 1. Stormwater wetlands across North Carolina: (A) Brevard College in the mountains; (B) Hillandale Golf Course in Durham; (C) Carteret-Craven Electric Cooperative near Morehead City; and (D) Smithfield-Selma Senior High School in Johnston County.

be used for flood control as well. For more information on stormwater practices, see *Urban Stormwater Structural Best Management Practices (BMPs)* in the Urban Waterways series (AG-588-01).

Maintenance of stormwater wetlands and wet ponds is performed to achieve four goals: efficient hydraulic flow and pollutant removal, aesthetic appeal, safety, and mosquito control. Most of the maintenance activities associated with wetlands and wet ponds pertain to two or more of these goals. The following activities should be performed regularly to maintain stormwater wetland and wet pond efficiency:

- Remove sediment and gross solids from forebays.
- Keep the orifice (the drawdown hole) free-flowing.
- Clean away floating trash and debris.
- Remove vegetation along the dam face.
- Remove invasive plant species.
- Mow the perimeter of wet ponds.
- Control pests, such as muskrats and beavers.

Forebays are located at the inlets to stormwater wetlands and wet ponds. They are designed to slow incoming water, dissipating the water's energy, and to provide a location for sediment and other gross solids (such as leaves, other tree debris, cigarette butts, and trash) to settle and accumulate.

A forebay is typically 2 feet deep in a stormwater wetland and sometimes deeper in a wet pond. If the forebay fills with sediment and gross solids, these materials will bypass the forebay and begin to accumulate in other portions of the wetland or wet pond that may be more ecologically sensitive.

To check sediment levels inside the forebay, record the depth of the forebay at the same time each year. Depending on the size of the forebay, a fish finder can be used from a small boat or someone can survey the depth along a grid of the forebay with a rod (Figure 2). If the forebay water is clear, the depth can often be determined visually.

Once the forebay is half full of sediment or the average sediment level is within 1 foot of the water

BOOK 2848 PAGE 181

Figure 2. Inspection (A) of sediment depth and cleaning or "dipping" (B) of forebays. A long boom on the excavator is sometimes essential to access sediment collected in the middle of the forebay.

surface, remove the sediment and gross solids. This task is typically accomplished by a track hoe or backhoe (Figure 2). The water level inside the wet pond or stormwater wetland can be lowered, if needed, to aid excavation of the forebay. Depending upon the size of the forebay, cleaning it can require anywhere from a day to a week.

Once the excavated soil (or *spoils*) from the dredging has begun to dry, either spread it in the watershed away from the banks of the wetland or wet pond and seed it, or take it to a landfill. Consider the location when disposing of the soil. Spoils from wet ponds downstream of industrial facilities may contain pollutants that need to be disposed of in a landfill, while those from a residential wetland or wet pond may not. If there is any concern as to proper disposal, samples of the excavated soil should be sent to a laboratory for chemical analysis. This can be costly.

A recent study by N.C. State researchers indicates that sediment and gross solids from forebays typically need to be removed (also known as *dipped* or *dredged*) once every 5 to 10 years. If wet ponds and stormwater wetlands are located in watersheds with active construction, however, spoils may need to be removed as often as once a year.

Like the forebay, the final *deep pool* of the pond or wetland near the outlet also must be inspected and maintained. The major difference between the two is that the final deep pool takes longer to fill with soil. The drawdown hole (located at the outlet and described in the next section) is where captured stormwater slowly drains from the wetland or wet pond. It must be free of accumulated debris and sediment to work properly. Remove sediment and gross solids from the deep pool near the outlet whenever the material is within 1 vertical foot of the drawdown hole.

What Designers Can Do To Make Forebay Cleanout Easier

Access to older wet ponds and stormwater wetlands is often a problem. New design recommendations can make forebay cleanout easier by improving accessibility:

- Include reinforced paths that give heavy equipment easy access to the forebay (Figure 3). Sometimes the path doubles as a separation between the forebay and the remainder of the pond.
- Make forebays relatively long and narrow. A narrow forebay makes it easier for a trackhoe or backhoe arm to reach at least to the middle of the forebay from either side.

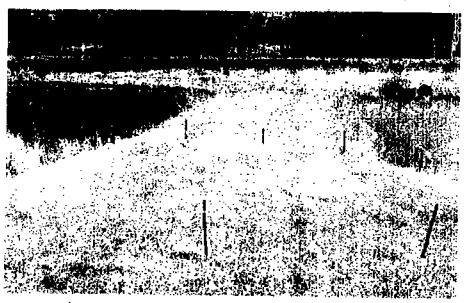

Figure 3. A wide path is provided for heavy equipment to access the forebay (located to the right of the path).

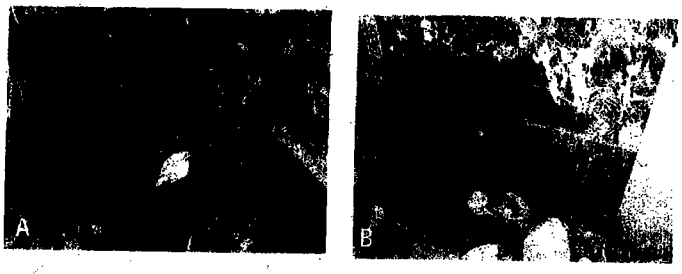

Figure 4. A small orifice allows slow release of captured stormwater (A), but can easily clog due to its size. A clogged orifice can affect plant communities inside the wetland or wet pond (B).

Wetlands and wet ponds are designed to capture and detain stormwater from 2 to 5 days. On smaller ponds and wetlands, a relatively small hole or *orifice* is used to detain water for this period. The diameter of the orifice can be as small as 2 inches, which makes it susceptible to clogging (Figure 4). Because many ponds and all wetlands contain vegetation, dead plants can float to and clog the orifice. Moreover, floating trash and debris (see the next section) will potentially clog the orifice.

A clogged drawdown hole poses several problems, including the loss of storage to capture later storms and flooding of desirable plant species. When water levels remain too deep for the desirable plants to survive, stronger, usually invasive, plant species take over. The aesthetics and performance of the practice can suffer when the plant community changes.

The wetland or wet pond needs to store water between storms to perform its intended function. It cannot store water from the next storm effectively if the orifice is clogged and the wetland is continually full.

Unclogging the orifice is relatively simple. Clean the hole with a stick, a piece of wire, a pole, or your hand. Inspect it regularly—the drawdown hole can clog at any time. Visit the site once a month to make sure water is flowing freely through the orifice, and inspect the outlet after every rainfall event exceeding 2 inches.

WHY SUCH A SMALL HOLE?

A large opening would release the water too quickly and not provide adequate time for treatment. Stormwater wetlands and wet ponds are designed to capture the first flush (or water quality volume) from their upstream drainage areas. The first flush is runoff generated by a 1 to 1.5 inch storm. The total volume of water can range up to several acre-feet. Once the first flush is captured in the wetland or wet pond, it must be slowly released to allow time for sediment and other gross solids to settle. Design standards require that the first-flush volume be kept for at least 2 days, with a recommended 3- to 4-day retention time. To release this water slowly, a small hole is often necessary. When the hole is only 2, 3, or 4 inches in diameter, clogging is a significant concern.

Stormwater wetlands and wet ponds are located in low elevations of the landscape. All water from several acres drains to wetlands and wet ponds. With this water comes trash and other debris, called *floatage*. It must be removed from wetlands and wet ponds for several reasons:

- It is unsightly, particularly when the wetland or wet pond is designed to be an attractive amenity.
- Floating trash, such as cups or plastic bags, often store small amounts of water in a sheltered environment. Studies have shown that mosquito larvae are more likely to be protected inside floating trash than in the exposed pond.
- Trash and other floating debris can clog the drawdown hole (the orifice), which is often used to slowly release captured runoff (Figure 5).

Inspect wet ponds and wetlands for trash regularly and frequently—typically once a month but occasionally once a week. On smaller wetlands and wet ponds, collect trash by simply wading along the edges. With

Figure 5. Trash floats to the drawdown hole, where it can clog the small hole, restricting flow. Removing the trash is often very simple, but essential.

larger facilities, a small boat or vac truck may be required. Because most trash follows the movement of water, it tends to collect near the outlet of the wetland or wet pond. This makes trash easier to collect, but it increases the risk of clogging the drawdown orifice.

Dam inspection officials require earthen dams to be free of large shrubs and trees. Roots can conduct water through the dam from the open pond to the downstream side of the embankment. The movement of water along the roots is called *piping*, which can eventually lead to soil erosion and, if unchecked, dam failure. Piping tends to be a problem for large ponds and wetlands that have a large dam face. Some small wetlands and wet ponds and those with concrete dams do not have this problem. If a dam face is vegetated, it should be grassed exclusively.

Inspect the dam once a year, and remove all shrubs and trees from the dam top and both faces. If the wetland or wet pond has been regularly maintained and any shrubs and trees growing are juvenile, simply mowing the bank is sufficient. Otherwise, a weed wiper, which applies herbicides to plants more than 12 inches tall, can be used along the bank. The weed wiper will kill any plant it touches or scrapes.

If a bank is severely overgrown, trees and shrubs should be cut down and removed. A systemic herbicide can be applied to the freshly cut stumps, which will kill the root systems. This is a laborious process. If the dam face is heavily overgrown, a contractor who specializes in removal should be consulted. Because dams of larger ponds and wetlands are responsible for retaining large volumes of water, dam failure can be catastrophic if homes, businesses, or roads are downstream.

Stormwater wetlands and wet ponds with aquatic shelves can become overgrown with invasive plants. The most common invasive plant is the cattail (*Typha* species, Figure 6). Cattails, while native to North Carolina, crowd out other, more desirable plants. Cattails tolerate a variety of conditions and do a good job of pollutant removal. From this functional standpoint, cattails can be considered good plants to have in a wetland. *However,* cattail monocultures fail to meet two very important design goals: aesthetics and mosquito control.

A wetland or wet pond that is overgrown with cattails is not a diverse ecosystem. Ecosystem diversity is critical for mosquito control. Cattails provide a safe environment for mosquito larvae to mature to adulthood. When cattails go dormant in the fall, some of the fronds will form a protective thicket for mosquitoes. For more information on mosquito control in wetlands and wet ponds, see *Mosquito Control for Stormwater Practice Designers and Managers* (AGW-588-04) in the Urban Waterways series.

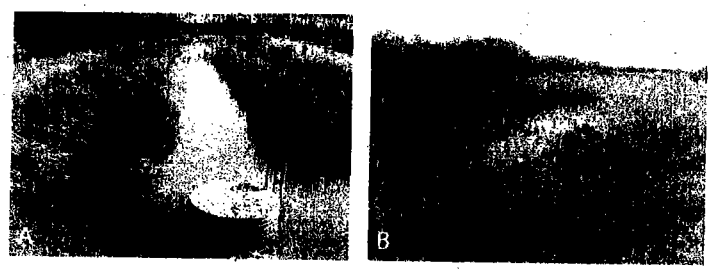

Figure 6. (A) Cattails (*Typha* sp.) and (B) common reeds (*Phragmites* sp.) are very aggressive invasive species. Once established, each plant will crowd out more desirable plant species.

Figure 7. Aquatic glyphosate (herbicide) can be applied via direct contact (a protected hand) or via a small weed-wipe pole (A). Stroking individual cattail fronds sends the herbicide down the shoot and reaches tubers located in the soil (B). Once the herbicide reaches the tubers, the cattails will die within 2-3 days (C). The herbicide can also be applied with a small brush. *(Franklin County Cooperative Extension Center)*

Removing cattails can be challenging. It is almost impossible to remove a mass of cattails by hand. Cattails grow from tubers that spread, and they also spread by seed. If a piece of cattail is left in the wetland or wet pond after removal, the stand will probably re-establish. Use a backhoe for mass cattail removal when a wet pond or wetland is completely overgrown by cattails.

If a wetland or wet pond has a variety of vegetation but cattails are beginning to colonize it, use an alternative form of cattail removal, such as applying an aquatic formulation of the herbicide glyphosate (one trade name for this is Rodeo). Wear a chemical-resistant glove underneath a cloth glove. Soak the cloth glove in 2 percent glyphosate, and stroke the cattail leaves. Or brush the herbicide onto the leaves with a small weed wiper. Not every leaf needs to be touched by the herbicide because many of the cattails are connected by tubers. Within 10 to 12 days, the cattails fronds will wither and die (Figure 7).

The herbicide must be applied by hand rather than by broadcast spray because it will kill every herbaceous plant it touches. Use only aquatic formulations of glyphosate because they do not harm fish and other aquatic species.

The frequency of cattail removal can vary. Several factors influence the need to apply herbicide to cattails: the density at which the wetland is planted with desirable species, the time of year the wetland is planted, and the maturity of the wetland. During the first year or two after wetland construction, remove cattails twice a year. As the wetland matures and desirable species begin to dominate, reduce the maintenance frequency to once a year. The amount of time needed to remove unwanted vegetation (via the glyphosate wipe) varies, but a well-maintained, mature wetland requires visits of about 2 hours per acre of wetland.

Other unwanted plant species include common reed (*Phragmites* species, Figure 6), various noxious floating aquatics (such as parrot feather, *Myriophyllum aquaticum*, and giant salvinia, *Salvina* spp.), and Asiatic dayflower (*Murdannia keisak*). *Phragmites* species can be removed in a manner similar to that described for cattails. Noxious floating aquatics may require careful chemical or physical removal. If you observe these exotic invasive species, contact your county Extension center.

Stormwater wetlands are not mowed to the water's edge and tend to be surrounded by mature grasses. As a result, mowing the perimeter of wetlands is not a typical stormwater wetland maintenance activity. Many wet ponds, however, do have a grassed perimeter that needs to be maintained. Mowing maintenance is almost purely aesthetic. The type of grass used, its growing season, and pond aesthetics dictate the height and frequency of mowing:

- Mow cool-season grasses to a recommended height of 4 inches and no lower than 2.5 inches. Cool-season grasses, such as fescue, tend to be used west of Interstate 95 in North Carolina.
- Mow warm-season grasses to a recommended

height of 2.5 inches and no lower than 1.5 inches. Warm season grasses include centipede, Bermuda, and zoysia, and are principally found in eastern North Carolina.

- Mow every one to three weeks during the growing season when the wet pond is part of an accessible landscape or treated as an amenity.
- Mow wet ponds that are located out-of-sight once or twice a year.

The size and severity of slopes along the wet pond determine the type of mower to use. For small ponds, a standard push mower is often adequate. Larger ponds or ponds with steep banks will probably require a specialized pond mower.

Grass clippings can be left adjacent to the pond to provide organic matter that encourages grass to grow. Do not discharge grass clippings into the water, as this will encourage the growth of algae and could potentially clog the drawdown hole.

Rodents such as muskrats and beavers are attracted to stormwater wetlands and wet ponds (Figure 8). Once there, they can damage the stormwater management practice.

Figure 8. (A) Muskrat *(Ondatra zibethicus)*. (B) Beaver *(Castor canadensis)*. *(U.S. Fish and Wildlife Service)*

Figure 9. Muskrat holes along the perimeter of the wetland or wet pond are a sign of infestation. Destroying the holes is a simple way of forcing muskrats to move, if the population is limited.

Muskrats eat aquatic vegetation and burrow holes in the deeper pools. When muskrats actively burrow near the outlet of a wetland or wet pond, they will add sediment and increase turbidity to the outflow, increasing the release of pollutants from the wetland or wet pond. Moreover, muskrats will sometimes burrow holes around and through dams. These muskrat holes artificially lower the water level inside the pond or wetland, causing some plant species to die. At worst, the holes can lead to dam failure.

Beavers are attracted to the sound of running water. Once a beaver colonizes a wet pond or stormwater wetland, it will remove trees and shrubs surrounding the stormwater practice to build its lodge and dam. Beaver activity will clog or block the drawdown structure, thus raising the height of water inside the pond or wetland. This change in the depth of water inside wet ponds with aquatic shelves and stormwater wetlands will alter the types of vegetation that survive in the practice. Usually this change is undesirable.

Muskrat infestation is a difficult maintenance problem that usually must be addressed only when a pond or wetland has suffered from neglect. If the practice is infested, muskrats can be trapped under water, where they drown. Muskrats frequently escape traps, however, which makes live trapping difficult. Hire a licensed, experienced trapper who takes care to place traps where pets cannot be trapped by mistake. Once muskrats have been removed from the pond, their dwelling holes should be destroyed.

Keep Geese Away from Wet Ponds and Stormwater Wetlands

Canada geese are attracted to an open body of water with good visibility around the perimeter, and they enjoy eating grass. This describes many "old-design" wet ponds that are mowed to the edge, allowing geese easy access in and out of the pond. Designers can include features in a wet pond to prevent Canada geese from taking up residence:

- Build a visual barrier along the pond perimeter—the aquatic shelf. By taking away good visibility, geese will not feel as safe. Most newly designed ponds include some aquatic shelf.
- Place shiny objects, such as silver tape, around the perimeter of the pond if building an aquatic shelf is not feasible.
- Place a grid of string across the wet pond to prevent easy waterfowl water landing. This string can also have shiny tape attached to it (Figure 10).

You can also bring a dog to the pond regularly to scare the geese. Geese do not like certain species of dogs, particularly border collies. If they often encounter a frightening dog, the Canada geese will eventually move elsewhere.

Figure 10. A grid of fishing line adorned with silver tape has been strung across this wet pond to prevent geese from making it their home. The string grid makes water landing more difficult, and geese do not like shiny or flashy objects like wind-blown silver tape.

If the stormwater practice has been regularly maintained, muskrat populations can more easily be controlled. Encourage muskrats to move away from the wetland or wet pond by making it an uncomfortable place to live. If muskrat holes are observed around the perimeter of a wet pond or stormwater wetland, destroy them or fill them with soil (Figure 9). Identify and destroy muskrat holes during any regular maintenance activity: whenever the wetland or pond is being inspected to verify that the drawdown is freely flowing and during mowing and trash removal.

Removing beavers is more difficult that removing muskrats. If a beaver is observed living in or around a stormwater wetland or wet pond, contact a professional trapper who specializes in beaver removal.

Well-designed stormwater wetlands and wet ponds remove pollutants and mitigate floods. To accomplish these goals and remain safe, aesthetically pleasing, and free of mosquitoes, they must be maintained properly to meet their design goals. Most stormwater wetland and wet pond maintenance activities are simple and inexpensive. But without them, the effectiveness of these stormwater management practices will decline.

TABLE 1. STORMWATER WETLAND AND WET POND MAINTENANCE TASKS AND FREQUENCIES

Task	Frequency	Notes
Remove sediment from forebay and deep pool (dredging/ dipping).	Varies. In stable watersheds, once every 5 to10 years is typical.	In unstable watersheds (those with active construction), the frequency increases to once a year, assuming the forebay is correctly sized.
Monitor sediment depth in forebay and deep pools.	Once a year.	In a large pond or wetland, a small boat may be needed.
Maintaining free-flowing orifice (drawdown hole).	Once per month and after every storm exceeding 2 inches.	Perform inspection regularly. Unclogging the hole when needed is simple.
Remove floating trash and debris.	Depends on design aesthetics: once a week to once a month.	Remove trash whenever the drawdown hole is being inspected. Inspect for trash more often if necessary, and remove as needed.
Remove vegetation from dam top and faces.	Once a year.	Dam top and faces should consist of mowed grass, if vegetated.
Remove invasive species (particularly cattails).	In years 1 and 2, twice a year (spring and fall). From year 2 onward, once a year (spring).	If spread of cattails is somewhat limited, use the glyphosate-wipe method.
Mow the wet pond perimeter.	Depends on design aesthetics. Ranges from every 1 to 3 weeks to once a year.	Wet ponds that are a design amenity will require more frequent mowing (every 1 to 3 weeks).
Remove muskrats and beavers.	Muskrat hole inspection and destruction should occur every time the wetland or wet pond is visited (at least once a month).	Contact a professional beaver trapper to remove beavers. Use muskrat traps to remove muskrats, or contact a professional trapper.

Fact sheets in the Urban Waterways series, North Carolina Cooperative Extension, N.C. State University:

Hunt, W. F. *Urban Stormwater Structural Best Management Practices (BMPs)*. AG-588-01. Online: http://www.bae.ncsu.edu/stormwater/PublicationFiles/UrbanBMPs1999.pdf

Hunt, W. F., and B. A. Doll. *Design of Stormwater Wetlands for Small Watersheds.* AG-588-02. Online:http://www.bae.ncsu.edu/stormwater/PublicationFiles/SWwetlands2000.pdf

Hunt, W. F., C. A. Apperson, and W G. Lord. *Mosquito Control for Stormwater Facilities*. AG-588-04. Online: http://www.bae.ncsu.edu/stormwater/PublicationFiles/Mosquitoes2005.pdf

Hunt, W. F., and W.G. Lord. *Bioretention Performance, Design, Construction, and Maintenance.* AGW-588-05. Online: http://www.bae.ncsu.edu/stormwater/PublicationFiles/Bioretention2006.pdf

Rodewald, A. D. *Nuisance Canada Geese: How to Deal with the Problem*. Ohio State University Extension publication no. W-3-2001. Online: http://ohioline.osu.edu/w-fact/003.html

BAE Stormwater Group Web site: www.bae.ncsu.edu/stormwater
Obtain information on upcoming workshops (including BMP Inspection and Maintenance Certification Courses), publications, PowerPoint presentations, images to download, and design and construction specifications.

State of North Carolina Stormwater Web site: www.ncstormwater.org

All photographs were provided by the Department of Biological & Agricultural Engineering at N.C. State University except as noted for Figures 7 and 8.

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina Cooperative Extension nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage reulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension agent.

Prepared by
William F. Hunt, Ph.D., P.E.
Assistant Professor and Extension Specialist
Biological and Agricultural Engineering
North Carolina State University
and
Bill Lord
Area Environmental Agent
North Carolina Cooperative Extension

Published by
NORTH CAROLINA COOPERATIVE EXTENSION SERVICE

COLLEGE OF
AGRICULTURE LIFE SCIENCES
ACADEMICS • RESEARCH • EXTENSION

NC STATE

AGW-588-07

E07-45831
08/2006/bs