

North Carolina Association of Environmental Professionals

State Chapter of the National Association of Environmental Professionals

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Determining the Set Back Distance of a Borrow Pit to Avoid Hydrologic Impact of Adjacent Wetlands

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The construction of highways often requires soil to fill low areas and to build overpasses and ramps. When the required fill is unavailable from cuts made during construction, it is usually obtained from borrow pits located in the vicinity of the highway. Due to the relatively low elevations and flat topography, borrow pits in eastern North Carolina are often near or adjacent to wetlands. There is concern that the borrow pit may serve as a long-term drainage sink and that after closure of the pit, the wetland hydrology of a strip of land adjacent to the pit will be affected. An objective of this research is to determine the distance that a borrow pit should be set back from adjacent wetlands to avoid impacts on the hydrology of that wetland.



Photo courtesy of John Jamison

An approximate method was developed in a previous NCDOT sponsored research project to estimate the lateral effect of a roadside drainage ditch on adjacent wetland hydrology. The lateral effect is defined as the width of a strip of land drained such that it no longer meets the wetland hydrologic criterion. It was determined that, for poorly drained soils in North Carolina, sites that barely satisfied the wetland hydrologic criterion had characteristic water table drawdown rates that depended on local weather conditions and surface depressional storage, but were relatively independent of soil type. The characteristic drawdown rates can be quantified as the threshold time, T_{25} , required for the water table to be lowered by drainage from the surface to a depth of 10 inches (25 cm). T_{25} was found to depend moderately on ditch depth but was nearly constant among soils having a wide range of profile transmissivities and drainable porosities. T_{25} was found to depend strongly on surface depressional storage, decreasing as surface storage increased. T_{25} also depended strongly on location, which affects both the growing season and weather variables. Now that T_{25} values have been determined for every county in North Carolina, published solutions for water table drawdown due to a single ditch can be used to estimate the lateral effect of a drainage ditch on wetland hydrology. The reader is referred to the following website for articles discussing the development of the approximate method as well as a table listing T_{25} values for all North Carolina counties: http://www.bae.ncsu.edu/soil_water/projects_lateral_effect.htm.

We believe that the approximate method developed for estimating the lateral effect of a roadside ditch can also be applied to determine the appropriate set back distance for a borrow pit. For drainage ditches, the lateral effect was used to calculate an area of required mitigation. For borrow pits, the goal is to prevent impacts on adjacent wetlands. Because the approximate method calculates the distance that will be drained such that it no longer satisfies the wetland hydrologic criterion, applying the method to borrow pits will allow prediction of the required setback for a pit to prevent hydrologic degradation of an adjacent wetland system. The NCDOT requires the use of our method in calculation of the required set back distance for a proposed borrow pit if the boundary of the pit will be within 400 feet of a stream or wetland. Information regarding NCDOT procedures for applying the method can be found at the following: http://www.ncdot.org/doh/operations/dp_chief_eng/roadside/fieldops/downloads/Files/SkaggsMethodBuffers.pdf.

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Chapter News

UPCOMING MEETING

Our next dinner meeting is now scheduled! On **December 7**, John Dorney (NCDWQ) and LeiLani Paugh (NCDOT) will speak on the proposed NC Wetland Assessment Method (NCWAM) and the NC Stream Assessment Method (NCSAM). NCWAM is being finalized for public comment this month and should be out on public notice prior to the meeting date. NCSAM is in development and scheduled for release sometime next year. We will also hold elections for next year's Board members.



NOMINATIONS FOR 2007 OFFICERS

We would love to have you involved "behind the scenes" in NCAEP. Please contact Kim Leight at 919-461-1515 or kim_leight@urscorp.com for further details or nominations. The 2007 NCAEP board elections will be held at our December 7 dinner meeting. Be part of the exciting new year with the NC chapter of NAEP.

SUMMER CHARLOTTE MEETING

On August 17, NCAEP held our first dinner meeting in Charlotte this century. The speakers, Rusty Rozelle, Program Manager for Mecklenburg County Water Quality Services, and Daryl Hammock, City of Charlotte Water Quality Team, gave an excellent presentation on the new Charlotte-Mecklenburg Post-Construction Stormwater Ordinance. The presentation covered the goals, development process, and standards of the proposed ordinance as well as the status of adoption in the County and Charlotte. For more details, please refer to the presentation, available on our newly renovated website (www.ncaep.org). For a copy of the proposed ordinance developed by the stakeholder group, please refer to <http://stormwater.charmeck.org> (select "Developers, Contractors, Engineers & Regulators", then select "Post-Construction Controls Ordinance"). (Photos from the meeting are at left.)



The meeting was well attended (in fact we had to turn people away) and enjoyed by all. Several Board members and other members traveled from Raleigh to attend, and were very impressed with the turnout. Based on the high attendance and the number of people asking us when our next Charlotte meeting will be held, we are planning to do this again next year. Thanks to all who attended (and those turned away) and a special thanks to Mike Iagnacco for putting this together. If there is anyone in Charlotte interested in becoming more active with the NCAEP, please contact a Board member. Mike will certainly be appreciative of any help in organizing future events.



SCHOLARSHIP COMMITTEE

The scholarship committee is working on developing criteria for the screening of applicants and a draft application. They are planning on meeting toward the end of October to finalize the criteria. A working draft of the scholarship application will then be finalized and sent to the Board for review. We are on schedule to have scholarships starting by mid-2007.

BASINWIDE PLANNING COMMITTEE

The NCAEP Basinwide Planning Committee reviews and comments on draft DWQ basinwide water quality plans and periodically meets to discuss statewide issues. Over the past year, we met with Darlene Kucken, supervisor of the DWQ Basinwide Planning Unit, to discuss the plan development process and how the committee could contribute more effectively. We reviewed the Roanoke River Basinwide Plan in July 2006 and we are currently reviewing the Watauga Basinwide Plan (comments are due November 10).

We are looking for new members. A number of basinwide plans are slated for public review in 2007, including the Neuse River Basin plan. Please contact Heather Fisher (heather.fisher@tetrattech.com) if you are interested in joining the committee or would like more information. The DWQ basinwide planning unit always appreciates our comments, and we gain knowledge of each basin and the current issues as we review the plans.

NAEP NEWS

The 2007 NAEP Conference will be held April 22-25 in Orlando, Florida. For more information visit www.naep.org.

Environmental Careers

W.K. Dickson has the following career opportunities to expand their Watershed Sciences Team. Company offers a competitive benefits package. Interested candidates may respond in confidence with resume to hrdept@wkdickson.com or fax to 704-334-0078.

Senior Scientist/Project Manager (Wilmington, NC)

Position requires a minimum of 5 years experience, preferably with at least 3 years in the private sector. The work includes management and performance on natural resources consulting and design projects including wetland delineations, EA's, stream assessments, listed species surveys, mitigation design and monitoring. Marketing duties include maintaining existing clients and prospecting for new business. Strong technical writing, botany and soil science skills are required.

Stream Restoration Specialist/Project Manager (Raleigh, NC)

Position requires a minimum of 7 years professional experience, preferably with at least 3 years in the private sector. The work includes project management and technical performance focused on stream restoration. Experience in assessment, design, construction oversight and monitoring required. Project management experience in marketing, budgets and scheduling also required.

Staff Scientist (Raleigh, NC)

The Staff Scientist serves as a technical resource for the organization, and should have 3 to 7 years of professional experience. Work includes all manner of environmental studies and natural resource assessments including wetland delineations, EA's, stream assessments, listed species surveys, mitigation design and monitoring. Must be competent with GPS, GIS and 404/401 permitting process.

Mulkey Engineers & Consultants has an opening for a Senior Planner in our Metro-Atlanta, GA office. Job responsibilities include assisting with the tasks associated with the preparation of NEPA documents (CEs, EAs, and EISs) for transportation projects. A Bachelor's degree in geography, environmental science, planning or related experience is required. For more information about Mulkey Engineers & Consultants or to submit your resume please visit our website at www.mulkeyinc.com. EOE

Ecoscience Corporation, a Raleigh-based environmental, engineering, and land planning firm has a position available in its Raleigh office for a **Water Resources Engineer** with environmental or civil engineering background. Hydrologic/hydraulic analyses, construction plans for stream/wetland restoration projects, stormwater planning & design, and watershed modeling. Ability to operate in an innovative environment. PE or advanced EI and 3+ years experience. Send resumes to: www.ecosciencenc.com or fax to 919-828-33518.



Check Out the New Website

It's official...the new North Carolina Association of Environmental Professionals website is now up and running! The website is full of useful information including upcoming chapter news, job announcements, meetings of interest, NCAEP committee activities, and much, much more. Check it out at www.ncaep.org. A big "thanks" goes out to our Board members and especially to Phil May for coordinating the effort to makeover the site. If you have any suggestions for the website, please send them to Phil (phil.may@carolinaeco.com).

Workshops, Seminars, and Training Opportunities

Southeast Stormwater Association Annual Conference

November 1-3, 2006 in Charlotte

The Conference will provide engineers, managers and administrators with the solutions to many of the day-to-day challenges that you face in stormwater management. From the NPDES permitting program, to Resolving Drainage Complaints, Stormwater Utilities and TMDLs, the Conference will give you the answers and the opportunity to network with your peers from across the region for the "Best Management Practice" that you can apply to your community. Visit

<http://www.seswa.org/Pages/Meetings.htm> for registration information.

NCAWWA-WEA 86th Annual Conference

November 12-15, 2006 in Greensboro

The conference includes technical sessions, exhibitors, special events such as a golf tournament and clay shooting tournament, activities for spouses, social events and more. Visit <http://www.ncawwa-wea.org/> for more information.

NCWRA Forum: Future Conditions Floodplain Mapping

December 4, 2006 in Raleigh

The City of Raleigh Stormwater Management Division is currently mapping FEMA future conditions in floodplains. The project will include detailed hydrologic and hydraulic modeling of all FEMA studied streams in the City's Jurisdiction, including modeling and mapping the 100-year storm for future development conditions. The modeling will consist of detailed hydrologic modeling of approximately 175 square miles of drainage area including analyzing proposed future conditions land use from the Raleigh Comprehensive Plan and zoning coverage. The modeling also includes the hydraulic analysis (HEC-RAS) of approximately 140 linear miles of stream. The final product will be updated FEMA Digital Flood Insurance Rate Maps (DFIRMs) for the entire City. The resulting DFIRMs will be submitted to FEMA as a physical map revision to ensure the City has up-to-date Flood Insurance Rate Maps. The updated maps provide representation of areas that are at risk of flooding for both current conditions and projected future land use conditions. For registration visit <http://www.ncsu.edu/wrri/events/index.html#wrriseminars>.

North Carolina Fire Council Meeting

December 6, 2006 in Asheboro

This first meeting of the prescribed fire council at large will be an opportunity for prescribed burners to meet, share their experiences, and participate in council to create a voice for prescribed burning in North Carolina. They will share the latest information on smoke management and air quality and training opportunities with you, but mainly the meeting is for you to have a voice for prescribed fire. The meeting agenda and registration information is posted at the NC Prescribed Fire Council's Website www.ncprescribedfirecouncil.org.

International Conference on Ecology and Transportation: Bridging the Gaps, Naturally

May 20-25, 2007 in Little Rock, Arkansas

The mission of the ICOET is to identify and share quality research applications and best management practices that address wildlife, habitat, and ecosystem issues related to the delivery of surface transportation systems. ICOET is the primary forum for an international gathering of the foremost experts in the field of transportation development, related scientific study, and administrative processes that can enhance both the project development process and the ecological sustainability of transportation systems. Learn more at www.icoet.net.

Duke Environmental Leadership Program

The University is offering a variety of intensive courses, including "Current and Emerging Issues in NEPA" and "Ecological Risk Assessment" among others. Visit the website at

<http://www.nicholas.duke.edu/del/continuinged/courses.html> for more information.

NCSU Biological and Agricultural Engineering Workshops, Training and Continuing Education

NCSU BAE will be offering several stormwater, sediment and erosion control, and irrigation training opportunities in the near future. See <http://www.bae.ncsu.edu/workshops/> for more information.



Regulatory News

NCDWQ Public Notice: Solicitation for Water Quality Information

In accordance with Section 303(d) of the Federal Clean Water Act, the North Carolina Department of Environment and Natural Resources, Division of Water Quality invites all interested parties to submit water quality information for inclusion in the 2008 Integrated Report. Submitted information will be used to assess the status of the State's surface waters, which will then be reported to the United States Environmental Protection Agency.



All information must be postmarked by January 15, 2007. Please mail information to NCDWQ Planning Section, Attn: Chris Wu, 1617 Mail Service Center, Raleigh, NC 27699-1617, or email information to chris.wu@ncmail.net, subject: Data Solicitation. For more details regarding submittal details and requirements please reference our website at: http://h2o.enr.state.nc.us/tmdl/General_303d.htm, or call Chris Wu at (919) 733-5083 ext. 592.

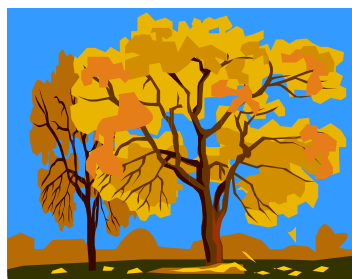
NCDWQ Solicits Public Comment on Watauga River Basinwide Water Quality Plan

The DRAFT Watauga River Basinwide Water Quality Plan is now available for public review and comment. The press release can be viewed at <http://h2o.enr.state.nc.us/admin/pubinfo/documents/DraftWataugaPlan.doc>. The entire draft Watauga Basinwide Water Quality Plan can be viewed on the DWQ Web site at: <http://www.ncwaterquality.org/basinwide>. Those who wish to comment on the plan are asked to mail written comments to: Michelle Raquet, Basinwide Planning Unit, Division of Water Quality, 1617 Mail Service Center, Raleigh, N.C. 27699-1617 or by e-mail to: Michelle.Raquet@ncmail.net. Please send comments before the close of business on Nov. 10.

USACE Proposed Re-Issuance and New Nationwide Permits

The US Army Corps of Engineers has released a draft version of their proposed new Nationwide Permits (NWP) for public review and comment. The new permits and conditions can be found at the web link below. These new NWPs are scheduled to be finalized by March 18, 2007, when the current ones expire. There are many minor text edits and changes in the way a lot of the information is presented in order to clarify some of the conditions. In addition, there are several major changes including the use of ephemeral stream channels counting toward the 300' threshold for NWPs, moving all residential (single family homes and residential developments) under one permit - NWP 29, simplifying PCN requirements for many of the NWPs, and six new permit categories including: Emergency Repair Activities, Discharges in Ditches and Canals, Pipeline Safety Program Inspection and Repairs, Commercial Shellfish Aquaculture, Coal Remaining, and Underground Coal Mining. The comment period is open until November 27, 2006. In addition, the Wilmington District has released their regional conditions which are available on the same link below.

<http://www.saw.usace.army.mil/WETLANDS/index.html>



Are you working on a project that may be of interest to other environmental professionals? We would like to feature an article in each newsletter, written by our members, that may be of interest to all NCAEP members. If you or your company are interested in submitting an article for consideration, please contact Heather Renninger (hrenninger@hwlochner.com) or Mark Reep (mreep@koassociates.com).

BORROW PIT *Continued from page 1*

Required input parameters for the approximate method include the following:

Location – county of borrow pit

Depth of water in pit below surface of wetland

Surface storage conditions

Effective hydraulic conductivity – of the soil profile adjacent to the pit extending from soil surface to impermeable or restrictive layer

Drainable porosity – for top 1 foot of the profile

Depth to impermeable or restrictive layer

T₂₅ value – from table based on location, depth of water in pit, surface storage

Boussinesq parameter – from nondimensional solution plot (available at the above http address).

An example application of the approximate method is presented below. A pit located in Beaufort County, North Carolina is to be excavated in a Goldsboro soil adjacent to a wetland. The depth of the pit will be 17 feet with the bottom 15 feet below the surface of the wetland. A graphical schematic of this borrow pit is shown in Figure 1. The hydraulic conductivity, *K*, of the soil is 2 in/hr, the drainable porosity, *f*, is 0.035, and the average surface storage depth in the wetland is 2 inches. It is assumed that sandy soil in the borrow pit will be excavated down to a clayey impermeable layer. After closure, the water level in the pit is assumed to be 2 feet below the surface of the wetland.

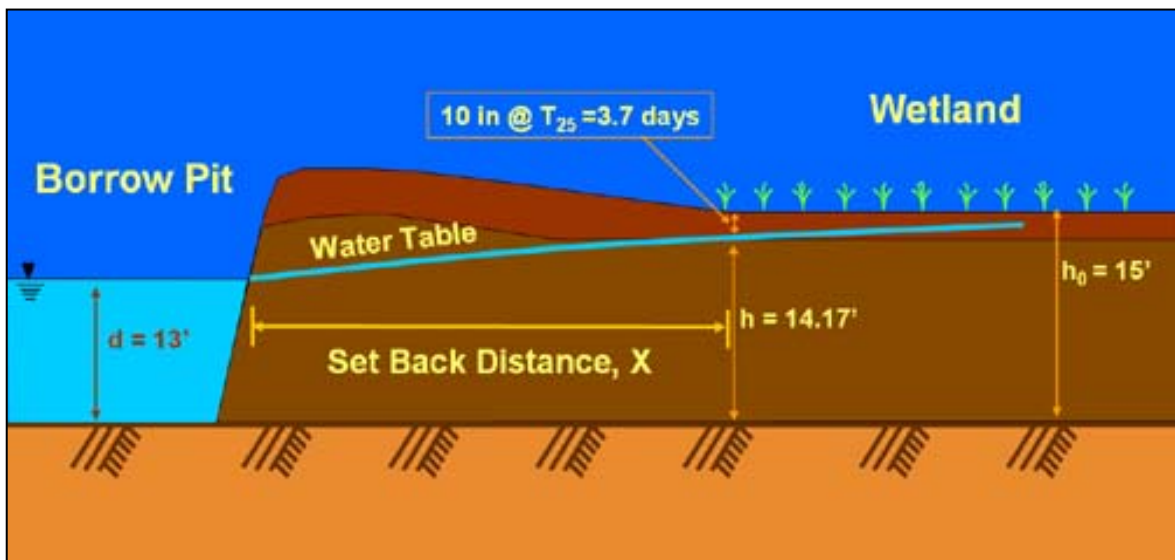


Figure 1. Schematic of borrow pit showing the required set back distance of the pit.

Two values are required to determine the Boussinesq parameter. Those values are

$H = h/h_0$, where *h* is the water table elevation above the impermeable layer in the wetland at the *T₂₅* time (i.e. depth to the impermeable layer – 10 inches), and *h₀* is the depth to the impermeable layer in the wetland, and

$D = d/h_0$, where *d* is the elevation of the water level in the pit above the impermeable layer.

For this example *H* and *D* are,

$$H = \frac{15 - 0.83}{15} = 0.94 \qquad D = \frac{15 - 2}{15} = 0.87$$

From the nondimensional solution plot, Figure 2, with these values of H and D, the value for the Boussinesq parameter, l/η , is approximately **1.08**.

As listed in the referenced T_{25} table, for a pit located in Beaufort county with surface storage conditions of 2 inches and a depth of the water in the pit 2 feet below the surface of the wetland, the T_{25} value is **3.7 days**.

The lateral effect, x, is then solved as,

$$x = \frac{\sqrt{\left[\frac{K}{f}\right] * h_o * T_{25}}}{\frac{1}{\eta}}$$

Substituting in the given soil properties, the lateral effect is calculated as follows.

$$x = \frac{\sqrt{[(4 \text{ ft / day}) / 0.035] * 15 \text{ ft} * 3.7 \text{ days}}}{1.08} = \mathbf{73 \text{ ft}}$$

The required setback for the example pit is approximately 73 feet from the wetland. A computer program has been developed for calculation of the setback distance of a borrow pit. The program is scheduled for release in July of 2006.

Field-testing of the method is being conducted at eight borrow pit sites in eastern North Carolina. Half of the pits have been closed for more than two years, and the other half have been closed recently. Continuous water level recorders are installed in the pits and in a transect (3 to 5 wells) leading from the pit to adjacent wetlands. Both recording and manual rain gauges have been installed at each site. By recording the water levels for a 2 – 3 year period, we will be able to observe the water level fluctuations on a day-to day and seasonal basis. These data will be used to test the validity of the method and to develop a water balance model to predict water levels in the pits and their changes with time. The water balance model will consider rainfall, evapotranspiration, and seepage to and from the pit. This will enable us to predict on a continuous basis the water level in the pit, including the period when it rises immediately after cessation of pumping when the pit is closed. It could also be used to predict the effect of pumping water from the pit for irrigation and other purposes, and the consequent effect on seepage to or from wetlands.

The work reported herein is a product of the North Carolina Agricultural Research Service, N.C. State University, Raleigh. It was supported by a contract with the North Carolina Department of Transportation (CTE/NC DOT project No. HWY-2005-24).

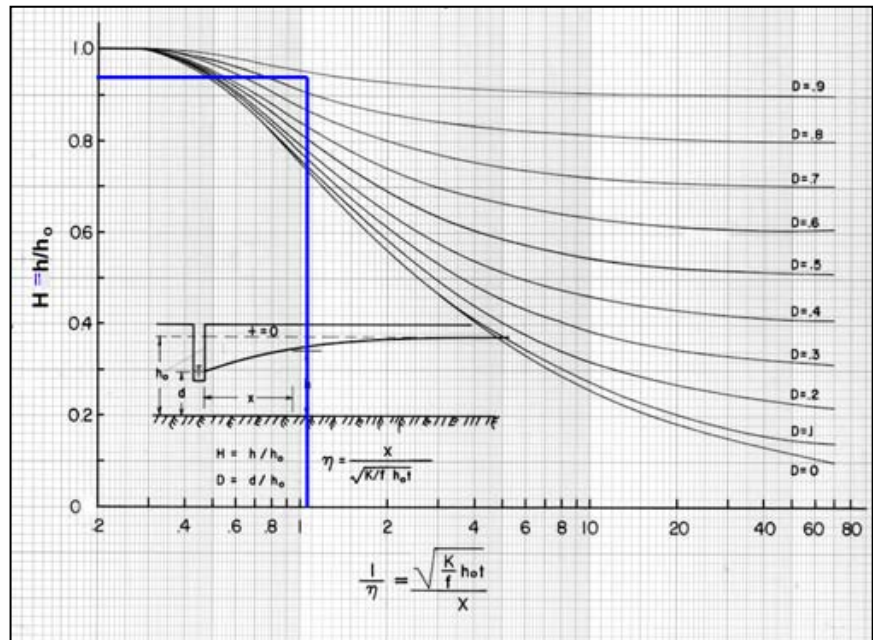


Figure 2. Nondimensional solutions to the Boussinesq equation for water table draw-down due to drainage to a single ditch.

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www.ncaep.org



Thanks to Our Corporate Sponsors

We extend our appreciation to the 2006 corporate sponsors. Your generous contributions are used in many ways, including workshops and conference sponsorships, NAEP Board travel costs, scholarship funding, Chapter events such as the Pig Pickin' and many other activities as well as basic operations of the Association.



NCAEP Membership Information

NCAEP is the largest multi-disciplinary professional organization of its kind in the State. Formed in 1989 by ten environmental consultants, the association has grown to over 175 members. Researchers, consultants, educators, attorneys, engineers, geologists, and students involved in any and all aspects of environmental management are eligible for membership.

Our purpose is to promote environmental standards and ethics, exchange ideas among professionals, and recognize environmental achievements.

For information about NCAEP, please contact any of our 2006 officers:

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