

ATTACHMENT A

**RESOLUTION RECEIVING REPORT ON
TOWN'S SURFACE WATER MANAGEMENT PROGRAM
Draft Resolution No. 138/2010-11**

WHEREAS, the North Carolina General Assembly, Environmental Management Commission and Division of Water Quality have adopted and are implementing rules to limit nitrogen and phosphorus inputs to Jordan Lake, and

WHEREAS, these Rules adopted for Jordan Lake in 2009 are unprecedented in the state in mandating that the Town of Carrboro and a few other local governments reduce nitrogen from "existing development", and

WHEREAS, the Town of Carrboro and its citizens have been leaders over the years in protecting the environment in water quality, land use regulation, stream buffer protection, open space preservation, and stormwater management, and

WHEREAS, the financial impact of the existing development provisions in the rules will likely be significant, and

WHEREAS, the Division of Water Quality will also be reissuing an NPDES stormwater permit in the spring of 2011 to the Town which could require additional local resources to implement;

**HEREBY BE IT RESOLVED BY THE CARRBORO BOARD OF ALDERMEN
THAT**

The Board accepts the staff report "Update on Surface Water Protection and Restoration Activities"



TOWN OF CARRBORO

NORTH CAROLINA

TRANSMITTAL PLANNING DEPARTMENT

DELIVERED VIA: ☒ HAND ☐ MAIL ☐ FAX ☐ EMAIL

To: Steve Stewart, Town Manager
 Department Heads
 Mayor and Board of Aldermen

From: Randy Dodd, Environmental Planner

Cc: Michael Brough, Town Attorney
 Martin Roupe, Development Review Administrator
 Henry Wells, Sungate Engineering
 Environmental Advisory Board
 Greenways Commission

Date: June 14, 2011

Subject: Activities Related to Surface Water Protection and Restoration

Background and Summary

Town staff continue to be involved in both regulatory and nonregulatory activities related to surface water management. These efforts are associated with ongoing monitoring of creek biota, current and potential grants through the Bolin Creek Watershed Restoration Team (BCWRT), reissuance of the Town's National Pollution Discharge Elimination System (NPDES) stormwater permit, and implementation of state rules passed in 2009 to restore Jordan Lake. Benthic monitoring of creeks in Carrboro is continuing and lending insight into creek health and management needs. Staff have continued to work with the BCWRT to: complete construction and pursue outreach for projects at McDougle Middle School and Baldwin Park; plan for a restoration project on Dry Gulch; monitor runoff from Pacifica; and prepare to draft a watershed restoration plan. Town staff are partnering with the Watershed Education for Community Officials (WECO) staff at North Carolina State University with education and outreach through a Section 319 grant submittal. With regard to the reissuance of the NPDES permit, staff have submitted comments to the Division of Water Quality (DWQ), and are expecting DWQ to issue a new permit this spring. The first step in permit compliance will be the drafting of a Stormwater Management Plan. The North Carolina Environmental Management Commission (EMC) and DWQ adopted regulations in 2009 (15A NCAC 02B.0262-.0273 and Session Laws 2009-216 and 2009-484) to reduce nitrogen and phosphorus inputs to Jordan Lake. The Town has adopted regulations pertaining to stream buffers and fertilizer applications as required by these rules; stormwater management requirements for

new and existing development and other actions are pending. This report includes an update on required Town compliance activities.

Information

To help organize the presentation, this update is presented in two sections: non-regulatory (monitoring and watershed restoration) and regulatory (NPDES permit and Jordan Lake rules compliance).

Non regulatory Activities

Benthic Monitoring

The most recent round of benthic sampling, was completed in March, 2011, and revealed concerns that warrant close attention. Biological sampling on Bolin Creek since 2001 has consistently indicated Good-Fair water quality in upper Bolin Creek, especially upstream of Homestead Road. Areas further downstream have fluctuated between a Good-Fair and a Fair rating, with a Fair rating at all 3 downstream sites in 2011. ("Fair" is the threshold which triggers listing on the State's impaired streams list.) Declining water quality moving downstream along Bolin Creek is supported by the observation that the control site at Morgan Creek and the most upstream site on Bolin Creek (above Winmore) continue to retain higher biotic ratings (Good or Good-Fair) relative to downstream sites. Summer/drought low-flow conditions (including the absence of water in the channel) continue to contribute to reduced biotic diversity in Bolin Creek. Samples collected in 2008, following a period of higher summer flow, showed some recovery from drought conditions, while samples in 2010 and 2011 following droughts showed declines in biotic ratings. Dave Lenat, the macroinvertebrate expert working with the Town, recommends that the Town continue to monitor both following droughts and following periods of higher flows to further evaluate the relative contributions of urban runoff and flow interruptions to the pattern of declining aquatic communities moving downstream along Bolin Creek.

The latest round of sampling indicates that stream fauna immediately above Homestead Road have been impacted by recent stresses that could include drought, nonpoint source runoff and habitat impacts. Comparison of Bolin sites 1 and 2 (which bracket some of the newer development) showed a decline in the diversity of the aquatic fauna, particularly in the abundance of more intolerant species. Changes in abundance for 2 key indicator groups of intolerant taxa: a philopotamid caddisfly (*Chimarra*), and two perlid stoneflies (*Acroneuria abnormis/Eccoptura xanthenes*) are worth continued tracking. *Chimarra* showed the most significant decline in 2011, being abundant only at the upstream site on Bolin Creek. *Acroneuria* has almost disappeared from Bolin Creek, with only a single specimen collected in 2011. This pattern is consistent with a more extensive list of intolerant species, showing a decline at and downstream of the site at Homestead Road relative to the site upstream of the Winmore development. The Homestead Road site was also characterized in 2011 by extremely abundant growths of bright-green filamentous algae, producing floating mats along the edges. This occurrence may lead to low dissolved oxygen as a result of nighttime respiration by this algae. High levels of attached algae are often observed in streams as temperatures rise in spring, but excessive growths are likely associated with nutrient (nitrogen and phosphorus) inputs, along with losses in tree canopy that allow more light to reach the creek. In 2009 and 2010, there was some recovery at the next site moving downstream (near Spring Valley), but this recovery was not observed in 2011. The probability that some of the decline in benthic communities moving downstream is not drought-related is supported by the continued higher rating at the most upstream (and therefore, presumably, most drought susceptible site) on Bolin Creek (#1).

Much of Bolin Creek has been functioning at times in the past decade as an intermittent (rather than perennial) stream and may be difficult to evaluate using DWQ criteria for perennial streams. Taxa typical of intermittent/smaller streams are increasing along Bolin Creek, especially the caddisflies *Rhyacophila*

fenestra and *Isonychia punctatissima*. Conversely some components of a perennial stream fauna (esp. hydropschid and philopotamid caddisflies) are declining in abundance at both Morgan Creek and upper Bolin Creek. The latter species are filter-feeders and they are highly dependent on the presence of flowing water. This pattern suggests that the continuing droughts are having an impact on the composition of the invertebrate fauna in Carrboro streams. The degree to which recent droughts and associated low flow are associated with climate change and/or development induced changes in the hydrological regime is very difficult to discern without more involved analyses. Qualitatively, it is a reasonable hypothesis to consider that more sections of the creek may be drying up more frequently because of increased impervious surfaces and a resulting change in streamflow and groundwater recharge in the Bolin Creek watershed (a pattern not occurring, however, in upper Morgan Creek). It is also reasonable to assert that changing precipitation patterns and possibly temperature and evapotranspiration rates are changing and impacting baseflow. The Carolina Slate Belt is known to be a geologic area that does not support high levels of baseflow, as well; creek fauna in the Slate Belt may be more sensitive to climatic perturbations than other geologic provinces.

Although much of Bolin Creek is exhibiting reduced benthic diversity, several tributary sites appear to support more intolerant aquatic communities. Excellent water quality (as indicated by the benthos) was demonstrated in unnamed tributaries at Seawell School Road and Hornehollow Road, and Good-Fair water quality was observed in Jolly Branch.

In summary:

- 1) The main stem of Bolin Creek from immediately above Homestead Road downstream is demonstrating reduced benthic macroinvertebrate diversity
- 2) The relative impact from drought stresses and non-drought stresses is difficult to determine; additional monitoring will be required.
- 3) The monitoring record for the macroinvertebrates seems to suggest that the past decade of drought stresses may be contributing to a shift in the aquatic community to one more representative of intermittent streams relative to a perennial stream aquatic community
- 4) There is new information from the latest round of monitoring suggesting that conditions favoring filamentous blue green algae growth (abundant nitrogen and phosphorus, disturbed riparian areas) may be a contributing stress to the benthos.
- 5) New monitoring on tributary streams has indicated more diverse communities on several sites relative to the main stem of Bolin Creek. Continued study is warranted to determine why this may be occurring.

Staff will carefully consider benthic monitoring results in the drafting of a watershed restoration plan in the coming months (a deliverable under a 319 grant with the North Carolina Department of Environment and Natural Resources). The most recent benthic assessment report, along with all benthic reports sponsored by Carrboro since 2000, can be found at <http://www.townofcarrboro.org/pzi/Env/Water/bcmonitor.htm>

Bolin Creek Watershed Restoration Team Activities

In 2005, Local, State and EPA staff joined to form the Bolin Creek Watershed Restoration Team (BCWRT). The BCWRT has been working to improve conditions in Bolin Creek, and ultimately to remove the creek from the federal 303(d) list of Impaired Waters. The objective of this multi-year effort is to restore biological health and a more natural hydrology to the Bolin Creek watershed as a whole. The first project completed by the BCWRT was the completion of a geomorphic analysis in 2007 that resulted in a watershed inventory and prioritization of restoration project opportunities. This report provides an update on subsequent efforts being pursued by the Town through two grants funded by the EPA 319 grant program. (More detailed information from previous staff reports related to these grants on November 10, 2010, February 10, 2009 and January 15, 2008 is for the most part not repeated in this report.) Both grant projects are moving forward, with milestones for construction for Baldwin Park restoration efforts recently completed. These grant funded projects are the current emphasis in what is envisioned as a continuing long term effort

Table 1: Summary of 319 Grant Status for Carrboro Activities

319 Grant	Activity	Status	Upcoming
<u>2008</u>	Baldwin Park Restoration	Construction, first round of invasive plant management complete	Signage to be installed; plant maintenance; continue monitoring
	Water Quality/Benthic Monitoring	Preconstruction project site monitoring complete or being pursued	Long term watershed monitoring plan being developed. Post construction monitoring to be pursued for restoration sites.
	Bolin Creek Watershed Restoration Plan	To be completed	Drafts for review by BCWRT, public, and elected officials in 2011-2012.
<u>2009</u>	McDougle Rain Garden and Cistern	Installation, workshops, video complete	Signage, rain gauge to be installed; plant maintenance/landscaping
	Dry Gulch Restoration	Preliminary concept plan complete. Monitoring initiated.	Permits and landowner agreements; design/engineering/construction; monitoring
	Pacifica Monitoring	Post construction project site monitoring.	Complete post construction project site monitoring in 2011.
<u>2011</u>	Outreach and Education Grant	Grant has been submitted by WECO	Support from NCSU Watershed Education for Communities and Officials (WECO) for a situation assessment to be pursued through 2008 grant with additional support being sought through new 319 grant application.

Members of the BCWRT are in the early stages of developing a Watershed Restoration Plan. The plan will include: identifying causes and sources of impairment, identifying and locating management measures to achieve impairment source reductions, estimating reductions in loads/sources, estimating technical and financial assistance needed, creating an implementation schedule and milestones, defining criteria to measure effectiveness, and monitoring to evaluate effectiveness. It is anticipated that the plan will take about 15 months to complete. One recent development is that BCWRT members are seeking support from the Watershed Education for Communities and Officials (WECO) program at NC State

University. This program has specialized expertise in watershed based outreach, education, and consensus building. WECO staff will be assisting with interviews of watershed stakeholders and preparation of a situation assessment. Additional information about WECO is available at <http://www.ces.ncsu.edu/depts/agecon/WECO/>.

Regulatory Activities

Jordan Lake Rules

Jordan Lake was impounded in 1983 by damming the Haw River near its confluence with the Deep River. It was created to provide flood control, water supply, protection of water quality downstream, fish and wildlife conservation, and recreation. The lake has had water quality issues from the beginning, with the North Carolina Environmental Management Commission declaring it as nutrient-sensitive waters (NSW) the same year it was impounded. Since that time, Jordan Lake has consistently rated as eutrophic or hyper-eutrophic, with excessive levels of nutrients present. The Jordan Lake Rules were adopted in 2009 to reduce the amount of pollution entering the lake. Preservation and protection of the lake is essential not only for aquatic life protection but because the lake serves as a water supply for several communities, and recreation area for more than one million visitors each year. The rules were developed over several years through a process that involved extensive meetings, public hearings and negotiations between residents, environmental groups, local and state government agencies and other stakeholders in the watershed. Specific issues addressed by the rules include reducing pollution from wastewater discharges, and establishes standards for stormwater runoff from new and existing development, agriculture and fertilizer application. Detailed information about the rules, including a history of the strategy as well as the dam construction and lake, an implementation timeline, rule-making archives, and a stakeholder project, is available at <http://www.jordanlake.org>.

The most active areas of focus for Town staff with regard to the Jordan rules currently are planning efforts to identify retrofit opportunities to comply with the Existing Development provisions of the rule, and the drafting of ordinance provisions to address new development requirements in the rules. More details on the Existing Development requirements are included in Table 2 and Appendix A. Of particular policy interest is the fiscal impact associated with costs for implementation of retrofits beginning in 2014, with the potential for a significant retrofit requirement in 2023 to achieve potential 35% nitrogen reduction requirements. Also, a section of Morgan Creek along with University Lake is on the most recently released draft impaired waters list, available at http://h2o.enr.state.nc.us/tmdl/documents/draft_2010_Cat_5.pdf due to indicators of eutrophication (nitrogen, and chlorophyll a; some additional information available at http://www.esb.enr.state.nc.us/documents/CAPEFEARRIVERBASIN2008_000.pdf and <http://portal.ncdenr.org/web/wq/ess/reports>). Town staff have been in contact with DWQ staff to determine if this listing could result in requirements above and beyond requirements for Jordan Lake; because of the complexities of the impaired waters regulatory process, the Jordan Rules, and the NPDES permit reissuance, it is premature to provide a definitive determination. With regard to new development requirements under the rules, a draft ordinance has been prepared. The major purpose of the ordinance is to require new development to comply with rule requirements to limit nitrogen and phosphorus in stormwater runoff from new development to 2.2 lbs/ac/yr and 0.8 lbs/ac/yr respectively. The process for ordinance review is: 1) receive feedback from NC Division of Water Quality staff this summer; 2) hold a public hearing in the fall; 3) finalize the ordinance for NC Environmental Commission final review and approval in 2012.

NPDES Permit Renewal

The Town has been operating under a federal stormwater permit administered by the State for the past five years. The permit has expired and is in the process of being reissued. The North Carolina Division of Water Quality has issued a draft renewal of the Town's NPDES Phase II Stormwater Permit, and will be issuing the final permit in the near future. A fact sheet and the draft permit is available by visiting http://portal.ncdenr.org/web/wq/ws/su/current-notices/-/journal_content/56_INSTANCE_y9Oq/38364/2301550. One requirement of the permit for the Town will be to seek public input on a Stormwater Management Plan that implements the provisions of the permit. Town staff anticipate drafting this plan for review in the fall of 2011. Staff anticipate some fiscal and staffing impacts associated with additional requirements under the reissued permit, and will be working in the coming months to plan for these impacts.

Town Required Response for Jordan Lake Rules and NPDES Permit

A compliance activity and timeline is provided in Table 1 for sections of the Jordan rules that apply to the Town, and for the new NPDES permit. The Jordan rules require a Town response to address three sections of the rules: riparian buffers; stormwater management for new development; and stormwater management from existing development. The rules also include a provision for nutrient offsets, which allow new development to treat to less than the required nitrogen and phosphorus loading requirements in exchange for offset payments. This section of the rules also allows for a market based trading program to be established.

Town staff submitted in 2010 a Stage 1 Existing Development program plan (Appendix 1). This plan includes: 1) a public education program; 2) a stormwater mapping program; 3) a program to identify and remove illegal discharges; 4) a program to ensure maintenance of best management practices implemented by the local government; and 5) a program to identify opportunities for retrofits and other projects to reduce nutrient loading from existing developed lands. The Town has been pursuing activities under items 1-4 as part of the previous NPDES permit, although it appears as if additional requirements will be included in the new permit for these four items. The Town's efforts with the Bolin Creek Watershed Restoration Team and State efforts for watershed management in the Little Creek watershed (which includes Morgan Creek) will help in retrofit identification under item 5. However, it is important to note that no capital funds have been set aside or are planned for to date for implementing retrofits which could be required as early as 2014. Substantial additional retrofit requirements to meet additional nutrient reductions in 2023 may be needed. The Town's draft submittal for potential retrofits is included in Appendix 1. Before 2014, the Town is required to identify and submit to DWQ 2 retrofits per year to consider for Stage 2 program implementation. In 2014, the Town will need to submit to DWQ a program plan to satisfy the requirements for Stage 2 program implementation. In the interim, DWQ and a newly formed Scientific Advisory Board (50% of the membership being local government representatives) will be working to quantify local government load reduction requirements. This process does not change the reduction goals for nutrient loads reaching the lake, but rather the technical process by which this total load reduction goal is allocated to the different local governments.

Table 2: Jordan Rule Provisions and NPDES Permit Reissuance With Town Compliance Implications

<u>Provision/Activity</u>	<u>Notes</u>	<u>Compliance Date</u>
Jordan Rules Existing Development: Stage 1 Adaptive Management Program (Session Law 2009-216)	Appendix 1 details staff response. These efforts essentially build on NPDES Phase II efforts.	2009
	Appendix 1 details staff response. The Town is required to identify, each year, two specific planned retrofits	Summer, 2011 (repeats annually, through 2014)
Jordan Rules Comply with State Buffer Requirements (Session Law 2009-484; 15A NCAC 02B.0267)	Town has developed new buffer ordinances provisions that have been approved by the State. Note: Rules delegate responsibility to DWQ to implement buffer requirements for state, federal and local government lands	2010
Jordan Rules Stormwater Management for New Development (Session Law 2009-484; 15A NCAC 02B.0265)	The Town is required to adopt stormwater program (including ordinance) for new development to reduce nitrogen and phosphorus (N= 2.2 lbs/ac/yr; P= 0.82 lbs/ac/yr). Model Ordinance has been released.**	
	Draft ordinance prepared	
	Deadline for submittal of local stormwater programs/draft ordinance to DWQ	September, 2011
	Public hearing on new Land Use Ordinance provisions scheduled	Winter/spring, 2012
	DWQ to bring recommendations on all local programs to EMC for final approval	May, 2012
Jordan Rules Fertilizer Management* (15A NCAC 02B.0272)	State begins enforcing rules for nutrients applied to 5 acres or more	Summer, 2012
Jordan Rules Existing Development: Stage 2 Adaptive Management Program (Session Law 2009-216)	If 2014 monitoring report indicates water quality standards not being met, Stage 2 program established to achieve 8% N and 5% P reduction	2014
	If 2023 monitoring report indicates water quality standards not being met, Stage 2 program modified to achieve 35% N reduction	2023
	Notes: 1. Accounting tool has been developed to guide work; 2.Town has not identified sustaining revenue source to implement retrofits and/or participate in trading program if needed in 2014, with greater requirements possible in 2023	
Jordan Rules Nutrient offsets ((Session Law 2009-484; 15A NCAC 02B.0273)	Before pursuing, must meet minimum onsite reductions. Market-based trading system allowed.	

*Town passed provision in Town Code in 2009 for lands within municipal limit (2 acres or more)

** Public road projects undertaken by local governments deemed compliant if meet riparian buffer rule requirements

Table 3: NPDES Permit Reissuance With Town Compliance/Impact Implications

New Provision/Activity	Notes	Compliance Date
Administrative: annual analysis of the capital and operation and maintenance expenditures and staff resources; new annual reporting requirements	Additional staff time anticipated	Annually beginning in FY11/12
Public Education, Outreach, Participation: annual evaluation of program effectiveness via interviews, surveys, and outreach tracking systems; new requirements for Stormwater Advisory Board; local nonprofits and others recruited to monitor construction sites, watershed hot spots, and streams and participate in programs such as Muddy Water Watch and Riverwatch on an ongoing basis and report to the Town; perform outreach to major economic and ethnic groups, to participate in program development and implementation	Additional staff time anticipated	Annually beginning in FY11/12
Illicit Discharge Detection and Elimination: detect dry weather flows; investigations into the source of all identified illicit discharges; employee training; public reporting mechanism; procedures to identify and eliminate failed septic systems; Enforcement Response Plan (ERP); enforcement tracking	Additional staff time anticipated	Annually beginning in FY11/12
Post Construction Runoff Control: More detailed inventory of post-construction structural stormwater control measures; recordation of maintenance responsibility; fully implement program for long-term operation and maintenance of structural BMPs, including verification of maintenance and inspections; provide educational materials and training for developers; may also consider establishing incentives and/or requirements such that development projects design, install, implement, and maintain stormwater control measures that promote infiltration of flows and groundwater recharge for the purpose of maintaining stream base flow, evapotranspire, harvest, and use stormwater discharges; more fully implement Enforcement Response Plan (ERP), including recordkeeping and follow-up associated with enforcement actions; post-construction requirements for public transportation;	Considerable additional staff time anticipated	Annually beginning in FY11/12
Pollution Prevention and Good Housekeeping: related to Town facilities and operations, including streets and public parking lot, stormwater conveyance system, landscaping. (Note Public Works building/yard has a separate NPDES stormwater permit)	Being reviewed by Public Works	Annually beginning in FY11/12
Impaired Waters: New requirements for Morgan Creek and University Lake due to nutrient impairment. Staff have recommended to DWQ that compliance not go beyond requirements for Jordan Lake rules. Requirements include developing a Water Quality Improvement Plan, monitoring, identify nitrogen reduction retrofits, implement nitrogen reduction retrofits	Uncertain impact; it is possible that final permit will not include this section.	

Cost Implications for NPDES and Jordan Rules Compliance

The following provides a summary of important points in considering fiscal and staff impacts that the Town will likely face with these new regulatory initiatives in coming years. It is beyond the scope of this memo to fully detail these costs; future efforts will be necessary to do so.

Staff intend to develop a five year Stormwater Management Plan in early FY 11-12 as required under the NPDES permit. This plan will clarify and specify staffing and budget impacts under the new permit. Expected impacts will be quantified for activities included in the plan.

Qualitatively, it is apparent from a review of the draft NPDES permit (as summarized in Table 3) that staff time needed to administer and comply with permit provisions will increase. New costs are also possible in association with pending requirements under Section 303(d) due to impairments in the Morgan Creek watershed. These costs could essentially overlap with the costs associated with compliance with the Jordan Lake Rules Existing Development provisions, pending the Town's implementation strategy for complying with the Jordan rules. The exact compliance dates for detailed elements of the permits will be drafted (and then reviewed by Carrboro citizens, and then DWQ) as part of the Stormwater Management Plan later in 2011.

With regard to compliance costs for the Jordan rules, in general, the rules have required and will continue to require staff time to draft and implement new regulatory provisions, as summarized in Table 2. A significant cost to the Town, both in the next several years, and conceivably in the next 10-20 years, will be costs associated with complying with the Existing Development provisions of the rules. New development will also face higher costs to meet the stormwater management requirements in the rules. The information presented in Table 4 provides a context for the likely scope of the impacts. Note that the rules (Session Law 2009-216) explicitly state that DWQ will determine the total load reduction required (with input from the Scientific Advisory Board). Until that happens, and in recognition of substantial uncertainties in the details of the approach for achieving the required reductions, it is difficult at best to quantify an anticipated cost. Anticipated costs will be associated with planning, land acquisition, legal, permitting, engineering (including surveying), construction, and reporting/compliance activities. The Center for Watershed Protection recommends estimating surveying, engineering, and legal costs for stormwater wetlands as 35% of planned construction costs. Forty percent of construction costs are recommended where retrofitting involves environmental permitting. Stormwater wetlands are the most cost effective eligible stormwater retrofit practice; however, siting these in Carrboro is expected to be difficult. Riparian restoration is very cost effective, but also extremely difficult to achieve in more developed areas. Staff have not identified significant opportunities for riparian restoration to date. The Center for Watershed Protection percentage estimates do not include land acquisition; clearly, the need to acquire land for any of these improvements would add substantially to costs. Appendix 2 compiles several engineering retrofit studies completed in Carrboro that include cost estimates. These studies are somewhat dated and cost estimates will need to be updated if these sites are further explored.

Table 4: Existing Development Provisions of Jordan Rules Fiscal Impacts

Impact	Notes	Reference
Durham previously estimated compliance costs of \$334 M, or \$6,750/household. This would be single largest debt financed municipal investment in Durham's history	Durham's estimates were more than 3.5 times the estimates shown in State's fiscal analysis.	See url*
The Urban Water Consortium is funding a retrofit study of selected watersheds, roughly 1 square mile in size, in various parts of the state. That study should produce results in the near future. For the one watershed that has preliminary results, it will cost \$2 million to achieve 7 percent reduction – to achieve an additional 2-1/2 percent reduction will cost another \$15 million.		Personal Communication, John Cox (City of Durham)
Unit Construction costs		
\$40K-\$60k construction cost per retrofitted acre for bioretention. \$2000 to \$15000k construction cost per retrofitted acre for stormwater wetlands	Site for which there were minimal utility issues	Bill Hunt
\$40k-\$42k construction cost per retrofitted acre for bioretention LID retrofit costs were \$100,000 to \$200,000 per acre.		John Cox

* http://www.ci.durham.nc.us/departments/wm/pdf/jordan_sw_comments0209.pdf

Based on the above information, a very preliminary and conservative (low end) estimate of costs for Carrboro (municipal limits) to meet an 8% nitrogen reduction has been completed using these assumptions: 4100 developed acres subject to the rules; all construction costs are for new stormwater wetlands (40% nitrogen removal efficiency applied to 5% of the developed acres; assume \$10,000 construction and \$3500 engineering per retrofitted acre); costs besides construction and engineering costs will be minimal. This results in an estimate of a minimum of about \$3M in costs to be met by 2023. An attempt to estimate the cost to comply with the 35% reduction threshold beginning in 2023 has not been attempted to date. However, it would be reasonable to assume that costs will be proportionally greater since the more cost effective projects will in all likelihood be pursued initially. This estimate is provided as a very rough and conservative estimate of costs that could be incurred by the Town. It is intended solely to initiate further planning and consideration of strategies for Carrboro to pursue; it is not recommended for uses beyond this.

Appendix 1

Carrboro's Program to Identify Opportunities for Retrofits to Reduce Nutrient Loading from Existing Developed Lands to Comply with Jordan Rules

The following provides a summary of Carrboro's approach to establish a program to identify and prioritize opportunities for retrofits or other nutrient load-reducing activities.

1) Carrboro has applied for and received 319 funds to pursue retrofits in the Tanbark Branch and Dry Gulch watersheds. These funds also include establishment of demonstration rain gardens. These projects will be completed by 2012. (Carrboro intends to also document the voluntary installation of rain gardens and other BMPs [e.g., impervious disconnection, lawn conversion, rainwater harvesting] by local residents and businesses that stem from increased awareness of the need to treat stormwater at its source). Carrboro intends to continue to pursue 319 and other State and Federal funds to help with efforts of the Bolin Creek Watershed Restoration Team that will also reduce nutrient runoff.

2) For retrofit identification, Carrboro will utilize as a foundation the following studies:

NCDWQ, 2003. Assessment Report: Biological Impairment in the Little Creek Watershed. North Carolina Department of Environment and Natural Resources, Division of Water Quality, April, 2003.

Morgan Creek Local Watershed Plan. Targeting of Management Report. Prepared by: Tetra Tech, Inc. with support from Soil & Environmental Consultants, Inc. September, 2004.

Carrboro & Chapel Hill BMP Sites, Orange County, North Carolina. Prepared for: North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Prepared by Ward Consulting Engineers, January 2007.

Bolin Creek Watershed Geomorphic Analysis and Potential Site Identification for Stormwater Structures and Retrofits. Prepared by Earth Tech. November, 2007.

Opportunities for Water Quality Credit Trading in the Jordan Lake Watershed. Prepared for: Mid-Carolina Council of Governments, Cape Fear River Assembly. Prepared by CH2M Hill, December, 2007.

- 3) Carrboro will supplement this information by looking at stormwater BMP retrofit opportunities at the 173 stormwater BMPs installed in Carrboro. Many of these BMPs are dry detention facilities. Some of these may be good candidates for retrofits to wet detention ponds or stormwater wetlands that have higher nutrient removal efficiencies.
- 4) As a part of routine stormwater management and watershed restoration efforts, Carrboro will identify other retrofit opportunities

- 5) Retrofit opportunities will be considered acceptable if the following conditions are met:
- ☐ The retrofit clearly has the potential to reduce nitrogen or phosphorus loading.
 - ☐ The watershed is clearly contributing nitrogen or phosphorus above background levels.
 - ☐ There is adequate space and access for the retrofit.
 - ☐ It is technically practical to install a retrofit at that location.

Carrboro will continue to contact landowners of land with retrofit opportunities to pursue approval of retrofits. Until a project is ready for development of construction documents, Carrboro believes it is premature to pursue more than verbal agreement. Prior to construction document preparation, Carrboro will obtain written landowner approval.

- 6) Carrboro will fully document (as outlined in DWQ guidance below) all retrofit opportunities identified beginning in 2010, and update this list annually.
- 7) Carrboro intends to explore establishment of mechanisms for funding of retrofits.

Data Collection and Notification

- ☐ Each retrofit opportunity shall include information on: location; type of retrofit; property owner; watershed/receiving water. Table 1 shows the format for presentation. Carrboro will maintain a spreadsheet or database and GIS data to manage retrofit opportunity data.

Table 1: Retrofit Opportunity Information for Each Retrofit Identified

Location description, including directions from a major highway
Type and description of retrofit opportunity
Current property owner
Is the property owner willing to cooperate?
Land area available for retrofit (sq. ft)
Accessibility to retrofit site
Drainage area size (acres)
Land use in drainage area (percent of each type of land use)
Average slope in drainage area (%)
Environmentally sensitive areas in drainage area
Approximate annual nitrogen and phosphorus loading from drainage area (lbs/acre/year)
Potential nitrogen reduction (lbs/ac/yr)
Potential phosphorus reduction (lbs/ac/yr)
Estimated cost of retrofit
Receiving water
DWQ classification of receiving water
Use support rating for receiving water
Other important information

Mapping Requirements

For GIS data, Carrboro will maintain GIS data that show the locations of retrofit opportunities. This data will include the following information:

- ☐ Drainage area to retrofit opportunity sites
- ☐ Land uses within the drainage area
- ☐ Locations of retrofit opportunities
- ☐ Property boundaries in the vicinity of the retrofit opportunities
- ☐ Significant hydrography (as depicted on U.S.G.S. topographic maps and USDA-NRCS Soil Survey maps)
- ☐ Roads
- ☐ Environmentally-sensitive areas (e.g., steep slopes, wetlands, riparian buffers, endangered/ threatened species habitat, where available)
- ☐ Publicly-owned parks, recreational areas, and other open lands

For Bolin Creek, Carrboro will publish these data as part of a watershed restoration plan currently under development.

Data Collection and Notification

- ☐ Each retrofit opportunity that is identified shall be accompanied by information to describe the location of the retrofit, the type of retrofit being proposed, the property owner, as well as basic information about the watershed and the receiving water. Table 2 shows a suggested format for presenting this information for each retrofit opportunity.

Stormwater Retrofit Opportunities Sorted by General Priority

<u>Site</u>	<u>Retrofit Opportunity</u>	<u>Preliminary Engineering?</u>	<u>Landowner</u>	<u>Cost Estimate</u>
Jones Ferry Park and Ride	Ephemeral stream stabilization	No	UNC	?
Morgan Creek Greenway	Stormwater wetland(s)	No	Town (& Canterbury?)	?
Carrboro Plaza	Malfunctioning detention basin retrofit to functioning dry detention, wet detention, or wetland	CH2M Hill, 2008; Tetra Tech, 2004	Carrboro Shopping LLC	\$92,483 (Tetra Tech); \$106,300(CH2M Hill)
McDougle School	Retrofit detention basin(s); LID retrofit opportunities	No	CHCCS	No
Tar Heel Manor	Detention basin retrofit to stormwater wetland	Tetra Tech, 2004	Carrboro II LLC	\$13,065
Anderson Park	Bioretention, stormwater wetland, potential stream restoration on adjacent lot	No	Town	?
Downtown public parking lots	Bioretention	No	Town	?
Private residence-Homestead Rd	Riparian restoration	No	Szostak	?
Winmore	Retrofit pocket wetlands	Yes (Earth Tech, 2007)	Winmore	\$57,700
Lake Hogan Farms	Detention basin retrofit to stormwater wetland	Yes (Earth Tech, 2007)	LHF HOA,	\$44k
Lake Hogan Farms	Pocket wetland	Tetra Tech, 2004	LHF HOA,	\$11,271
Lake Hogan Farms	Stormwater wetland	Tetra Tech, 2004	LHF HOA,	\$15,418
Lake Hogan Farms	Bioretention	Tetra Tech, 2004	LHF HOA	\$36,170
Lake Hogan Farms	Pocket Wetland	Tetra Tech, 2004	LHF HOA	\$12,157
Lake Hogan Farms	Stormwater wetland (Turtleback Crossing)	Yes (Earth Tech, 2007)	LHF HOA,	\$19,017
Roy Lloyd Estate	Stormwater wetland	Tetra Tech, 2004	Roy Lloyd Estate	\$15,107
Carrboro Elem School	Stormwater wetland	Tetra Tech, 2004	CHCCS	\$20k
Sunset Creek	Outfall retrofit	Earth Tech, 2007	Sunset Creek HOA	\$73,500
Toms Creek at Main Street (Lieth)	Stormwater wetland	Tetra Tech, 2004	A & A Lieth	\$19,663

Cobblestone/Carolina North	Stormwater wetland	Earth Tech, 2007	Cobblestone residences, UNC	\$48,336
Roberson Site	Pocket wetland	Becky Ward, 2007	Roberson Place HOA	\$95k
USPS	Bioretention	Tetra Tech, 2004	USPS/Roy Lloyd Estate	\$31,152
Carrboro Tracks	Wet detention	Tetra Tech, 2004; Becky Ward, 2007	Town	
Wilson Park	Stormwater wetland	Tetra Tech, 2004	Town	
Cedar Court Condos	Stormwater BMPs	No	K. Tucker	?
Duke Forest	Stream restoration	Earth Tech, 2007	Duke Univ	
Cobblestone	Bank stabilization	Earth Tech, 2007	Cobblestone properties	\$18,200
Hillcrest Apts	Stream stabilization	Earth Tech, 2007	B&W Davis	\$75k

Stage 2 Adaptive Management Program to Control Nutrient Loading From Existing Development. –

a. If the March 1, 2014 monitoring report or any subsequent monitoring report for the Upper New Hope Creek Arm of Jordan Reservoir required under Section 3(c) of this act shows that nutrient-related water quality standards are not being achieved, a municipality or county located in whole or in part in the subwatershed of that arm of Jordan Reservoir shall develop and implement a Stage 2 adaptive management program to control nutrient loading from existing development within the subwatershed, as provided in this act. If the March 1, 2017 monitoring report or any subsequent monitoring report for the Haw River Arm or the Lower New Hope Creek Arm of Jordan Reservoir required under Section 3(c) of this act shows that nutrient-related water quality standards are not being achieved, a municipality or county located in whole or in part in the subwatershed of that arm of Jordan Reservoir shall develop and implement a Stage 2 adaptive management program to control nutrient loading from existing development within the subwatershed, as provided in this act. The Department shall defer development and implementation of Stage 2 adaptive management programs to control nutrient loading from existing development required in a subwatershed by this subdivision if it determines that additional reductions in nutrient loading from existing development in that subwatershed will not be necessary to achieve nutrient-related water quality standards. In making this determination, the Department shall consider the anticipated effect of measures implemented or scheduled to be implemented to reduce nutrient loading from sources in the subwatershed other than existing development. If any subsequent monitoring report for an arm of Jordan Reservoir required under Section 3(c) of this act shows that nutrient-related water quality standards have not been achieved, the Department shall notify the municipalities and counties located in whole or in part in the subwatershed of that arm of Jordan Reservoir and the municipalities and counties shall develop and implement a Stage 2 adaptive management program as provided in this subdivision.

b. The Department shall establish a load reduction goal for existing development for each municipality and county required to implement a Stage 2 adaptive management program to control nutrient loading from existing development. The load reduction goal shall be designed to achieve, relative to the baseline period 1997 through 2001, an eight percent (8%) reduction in nitrogen loading and a five percent (5%) reduction in phosphorus loading reaching Jordan Reservoir from existing developed lands within the police power jurisdiction of the local government. The baseline load shall be calculated by applying the Tar-Pamlico Nutrient Export Calculation Worksheet, Piedmont Version, dated October 2004, to acreages of different types of existing development within the police power jurisdiction of the local government during the baseline period. The baseline load may also be calculated using an equivalent or more accurate method acceptable to the Department and recommended by the Scientific Advisory Board established pursuant to Section 4(a) of this act. The baseline load for a municipality or county shall not include nutrient loading from lands under State or federal control or lands in agriculture or forestry. The load reduction goal shall be adjusted to account for nutrient loading increases from lands developed subsequent to the baseline period but prior to implementation of new development stormwater programs.

c. Based on findings under sub-subdivision a. of this subdivision, the Department shall notify the local governments in each subwatershed that either: 1. Implementation of a Stage 2 adaptive management program to control nutrient loading from existing development will be necessary to achieve water quality standards in an arm of the reservoir and direct the municipalities and counties in the subwatershed to develop a load reduction program in compliance with this section. 2. Implementation of a Stage 2 adaptive management program to control nutrient loading from existing development is not necessary at that time but will be reevaluated in three years based on the most recent water quality monitoring information.

d. A local government receiving notice of the requirement to develop and implement a Stage 2 adaptive management program to control nutrient loading from existing development under this section shall not be required to submit a program if the local government demonstrates that it has already achieved the reductions in nutrient loadings required by sub-subdivision b. of this subdivision.

e. Within six months after receiving notice to develop and implement a Stage 2 adaptive management program to control nutrient loading from existing development, each local government shall submit to the Commission a program that is designed to achieve the reductions in nutrient loadings established by the Department pursuant to sub-subdivision b. of this subdivision. A local government program may include nutrient management strategies that are not included in the model program developed pursuant to Section 3(e) of this act in addition to or in place of any component of the model program. In addition, a local government may satisfy the requirements of this subdivision through reductions in nutrient loadings from other sources in the same subwatershed to the extent those reductions go beyond measures otherwise required by statute or rule. A local government may also work with other local governments within the same subwatershed to collectively meet the required reductions in nutrient loadings from existing development within their combined jurisdictions. Any credit for reductions achieved or obtained outside of the police power jurisdiction of a local government shall be adjusted based on transport factors established by the Department document Nitrogen and Phosphorus Delivery from Small Watersheds to Jordan Lake, dated June 30, 2002.

f. Within six months following submission of a local government's Stage 2 adaptive management program to control nutrient loading from existing development, the Department shall recommend that the Commission approve or disapprove the program. The Commission shall approve the program if it meets the requirements of this subdivision, unless the Commission finds that the local government can, through the implementation of reasonable and cost-effective measures not included in the proposed program, meet the reductions in nutrient loading established by the Department pursuant to sub-subdivision b. of this subdivision by a date earlier than that proposed by the local government. If the Commission finds that there are additional or alternative reasonable and cost-effective measures, the Commission may require the local government to modify its proposed program to include such measures to achieve the required reductions by the earlier date. If the Commission requires such modifications, the local government shall submit a modified program within two months. The Department shall recommend that the Commission approve or disapprove the modified program within three months after receiving the local government's modified program. In determining whether additional or alternative load reduction measures are reasonable and cost

effective, the Commission shall consider factors including, but not limited to, the increase in the per capita cost of a local government's stormwater management program that would be required to implement such measures and the cost per pound of nitrogen and phosphorus removed by such measures. The Commission shall not require additional or alternative measures that would require a local government to: 1. Install or require installation of a new stormwater collection system in an area of existing development unless the area is being redeveloped. 2. Acquire developed private property. 3. Reduce or require the reduction of impervious surfaces within an area of existing development unless the area is being redeveloped.

g. Within three months after the Commission's approval of a Stage 2 adaptive management program to control nutrient loading from existing development, the local government shall complete adoption and begin implementation of its program.

h. Each local government implementing a Stage 2 adaptive management program to control nutrient loading from existing development shall submit an annual report to the Department summarizing its activities in implementing its program.

i. If at any time the Department finds, based on water quality monitoring, that an arm of the Jordan Reservoir has achieved compliance with water quality standards, the Department shall notify the local governments in the subwatershed. Subject to the approval of the Commission, a local government may modify its Stage 2 adaptive management program to control nutrient loading from existing development to maintain only those measures necessary to prevent increases in nutrient loading from existing development.