

DRAFT- VERSION 4.1
Fiscal Analysis – Alternative Buffer Mitigation Rules (15A NCAC 2B .0295)
Prepared by NC Division of Water Quality staff
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Rule Citation Numbers – 15A NCAC 2B .0295 (Appendix A)

DENR Division - Division of Water Quality

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Impact Summary:

State Government:	Yes
N.C. Department of Transportation:	Yes
Local Governments:	Yes
Federal Government:	Yes
Small Businesses:	Yes
Substantial Impact:	Undetermined

Authorizing Statutes: G.S. 143-214.20

Statement of Necessity: These proposed rule changes will provide mitigation options not currently available to DOT, developers, and private individuals. In addition to providing greater regulatory flexibility, the proposed changes incorporate contemporary technical and operational techniques into the rules. These proposed amendments adhere to the Principles of Executive Order 70 Rules and were developed through a public stakeholder process. The new rules advance the public interest and are designed to achieve their objectives in a cost-effective and timely manner.

I. Executive Summary:

First of all, the proposed rule will consolidated six existing buffer mitigation rules into one buffer mitigation rule. This purpose of this consolidation is to bring consistency to the currently riparian buffer mitigation rules. The current buffer mitigation rules that will be combined include:

- 15A NCAC 02B .0242: Mitigation for Existing Buffers in the Neuse River Basin
- 15A NCAC 02B .0244: Mitigation for Existing Buffers in the Catawba River Basin
- 15A NCAC 02B .0252: Randleman Lake Mitigation for Existing Buffers
- 15A NCAC 02B .0260: Mitigation for Existing Buffers in the Tar-Pamlico River Basin

15A NCAC 02B .0268: Jordan Lake Mitigation for Existing Buffers

15A NCAC 02B .0609: Goose Creek Watershed Buffer Mitigation Rule

The second part of this rulemaking would provide additional mitigation options for the regulated community and allow for the flexibility that has been requested by the various stakeholder groups in these mitigation rules. Stakeholders have expressed concern to the Division of Water Quality (Division) that they are unable to build their projects because they cannot achieve the amount of buffer mitigation required in the current buffer mitigation rules. The proposed rule would address this issue by providing a variety of new mitigation options for those areas where the current buffer mitigation rules are not feasible. An example of this is that in the Tar-Pam 05 8-digit HUC, there are no more viable buffer mitigation sites that would adhere to the current buffer mitigation rules. Stakeholders have stressed the necessity of the consolidated buffer mitigation rule to allow for flexibility in difficult situations such as this. In several instances, if the stakeholders are unable find acceptable buffer mitigation for their proposed or actual permits, then thousands of jobs could potentially be lost. It is important to note that this proposed rule will not expand the area subject to riparian buffer rules

Finally, the rules address related mitigation issues to ensure that the replacement for the unavoidable impacted buffers will reduce future nutrient loading. The proposed rules are authorized by G.S. 143-214.20 which states (in part) "Construction of an alternative measure (of buffer mitigation) that reduces nutrient loading as well as or better than the riparian buffer that is lost."

These options were developed to give regulated parties greater flexibility and potentially lower cost of compliance by providing additional options for buffer mitigation. Other proposed changes to the buffer mitigation rules may reduce the cost of mitigation on a case-by-case basis (for instance the allowance of buffer preservation) depending on the extent to which the regulated community and mitigation providers take advantage of this new provision in the rule. Similarly, the proposed rules on mitigation location may increase cost depending on which option the Environmental Management Commission (EMC) chooses following public hearing. Finally the portion of the rule on accounting for buffer, nutrient offset and stream mitigation credit (.0295 (k)) may or may not increase mitigation cost depending on which option the EMC selects following public hearing and comment. The table below summarizes estimated annual costs and benefits and if it was possible to quantify based on the amount of available information. A more detailed breakdown of cost and benefit estimates is located in Tables 4-8.

Table 1: Estimated Annual Costs and Benefits Presented in this Analysis, Quantified or Un-quantified

	Un-quantified	Quantified
Costs:		
Non-wasting Endowment		\$103,827
Mitigation Location Change		\$0,\$1,730,443
Credit Accounting		0, \$830,613, or \$1,418,964
Benefits:		
Additional Development Potential	X	
Additional Buffer Acreage	X	
Preservation of Stream Buffers		\$144,136

Based on this analysis, the proposed rules will have a net benefit to stakeholders by allowing them to construct projects the current buffer mitigation rules prohibit. General economic theory asserts that if a site developer chooses to use one of these options then, to that individual, the increased cost is lower than the expected project benefits. Projects undertaken using optional mitigation options would result in a net benefit of undetermined value. There also may be public benefit in the form of less water pollution if these proposed rules increase the amount of buffer acreage.

The main source of uncertainty in this analysis is the number of options available for particular choices as well as the inherently variable cost of land and applicability of specific options for specific sites. Through the public hearing process, stakeholders will comment on the options presented in this analysis to assist the EMC in selecting final rule language. The fiscal note has investigated the potential cost and benefits associated with different options and the division will amend the note after the public comment period to reflect any policy changes.

II. Background and Description of Proposed Rules:

This fiscal analysis was prepared to assist members of the EMC and the public in their review of the proposed Alternative Buffer Mitigation Rules (15A NCAC 2B .0295). Requests from the regulated community for more flexibility to achieve mitigation prompted this rulemaking. The division developed these rules with extensive input from stakeholders meetings held on February 9, 2009, December 9, 2009 and April 6 and 19, 2010. The draft rules were presented to the Water Quality Committee of the EMC on September 2009, November 2009, November 2010, January 2011, July 2011 and January 2012. The EMC requested consideration of three different alternatives for calculating the amount of required mitigation based on location considerations and for the accounting of buffer, stream and nutrient offset credits.

Several stakeholders have expressed concerns about the lack of buffer mitigation options. Presently the two options are payment into a mitigation bank or planting a buffer along a stream that currently is not planted. This issue is important to address because in some areas of the Tar-Pamlico basin, there are no more viable buffer mitigation sites for compliance with the current buffer mitigation rules. Stakeholders,

including companies and professional site developers, are unable to proceed with projects if they need to mitigate for buffers in that area. Potentially thousands of jobs could be lost if alternative buffer mitigation measures are not allowed.

These proposed rule amendments adhere to the Principles of Executive Order 70 Rules and seek to reduce the impact on regulated parties by allowing more mitigation options. The proposed rules serve the public interest and are designed to achieve their objectives in a cost-effective and timely manner. None of these alternative mitigation options would be required. Rather, stakeholders and mitigation providers would pursue these options on a case-by-case basis. These rules also are intended to protect the applicable estuaries and increase the water quality in these estuaries. Other proposed rule changes would update standard practices, scientific information, and the information provided during the stakeholder process outlined above. An analysis of each of the main rule provisions follows in the next section of this fiscal analysis. This analysis uses the present practice of buffer mitigation based on the average requirements for buffer mitigation from 2005 thru 2010 from the Division's Basinwide Management System (BIMS) permit tracking system as a baseline. The main proposed rule provisions are:

- A. New provisions in the rules that apply to all buffer mitigation options;
- B. Approaches in the rules that would apply to all mitigation proposals; and
- C. Optional methods of buffer mitigation allowed in the proposed rules.

A. New buffer mitigation provisions

Three new provisions in the rules would apply to any proposed approach for buffer mitigation. These are:

- a. Conservation easements;
- b. Completion bonds; and
- c. Non-wasting endowments for long term operation and maintenance.

Conservation easements are in the current buffer mitigation rules. Completion bonds and non-wasting endowments are standard requirements of compensatory mitigation for wetland and stream mitigation for 404/401 permitting under the Clean Water Act for many years, but have not been required consistently to buffer mitigation requirements for the state's riparian buffer protection programs. As such, these requirements may or may not increase the cost of buffer mitigation compared to the present cost of mitigation as outlined in Section III below. The proposed rules require that these new measures provide equivalent types and levels of protection.

B. Approaches in the rules that would apply to all unavoidable mitigation proposals

- a. **Mitigation Location.** The present rules require location of the mitigation to be as close or closer to the impact "as feasible". The division and the mitigation banking community have long interpreted this rule to mean that mitigation will be required in the standard 8-digit Hydrologic Unit (HUC) as used for the 404/401 permitting

programs.¹ A HUC's number is inversely related to the size of its watershed. The larger the HUC number, the smaller its watershed.

The present rules require an impact multiplier to the area of impact in the buffers. If Zone 1 of the buffers is impacted, a multiplier of 3 is applied to the area of impact; if Zone 2 of the buffers is impacted, a multiplier of 1.5 is applied to the area of impact prior to the proposed location multipliers below. The impact multipliers (for Zone 1 and Zone 2) are not new to the proposed rule. For intermittent and perennial streams, Zone 1 begins at the most landward limit of the top of the bank or the rooted herbaceous vegetation and extend landward a distance of 30 feet on all sides of the surface water, measured horizontally on a line perpendicular to a vertical line marking the edge of the top of the bank. For ponds, lakes and reservoirs located within a natural drainage way, Zone 1 begins at the most landward limit of the normal water level or the rooted herbaceous vegetation and extend landward a distance of 30 feet, measured horizontally on a line perpendicular to a vertical line marking the edge of the surface water or rooted herbaceous vegetation. Zone 2 starts at the outer edge of Zone 1 and extend landward 20 feet as measured horizontally on a line perpendicular to the surface water.

The proposed rules have three options for location as follows:

- i. Mitigation within the 8-digit HUC and then at a higher multiplier (2.0) in the adjacent HUC.

Example: If mitigation is done in an adjacent HUC (option i) and assume 200 square feet of Zone 1 buffer impacts [200sqft of impact x 3 impact multiplier is required for Zone 1 impacts x 2 for an adjacent HUC multiplier= 1,200 sq ft.

- ii. Mitigation on-site at a reduced (0.75) multiplier, within the 12-digit HUC, at the subwatershed level (using the Zone 1 and Zone 2 multipliers), within the 8-digit HUC at a higher (1.5) multiplier, and then within the adjacent 8-digit HUC at a higher (2) multiplier.

Table 2: Mitigation Option ii

Adjacent 8-digit HUC	Within 8 digit HUC	Within 12 digit HUC	Mitigation option
n/a	n/a	0.75	1) On site mitigation
2.0	1.5	1	2) All other types of

¹ Note that a single 8-digit HUC occupies a larger area than a single 12-digit HUC. For instance, there are four 8-digit HUC's in the Neuse basin and seventy-five 12-digit HUCs in the same river basin.

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Example: If mitigation is done within the 12-digit HUC with on site mitigation (option ii) and assume 200 sq feet of Zone 1 buffer impacts [200sqft of buffer impact x 3 impact multiplier is required for Zone 1 impacts x 0.75 for the 12 digit HUC multiplier= 450 sq ft.

- iii. Mitigation on-site at a reduced (0.75) ratio, within the 12-digit HUC (1.0) multiplier, within the 8-digit HUC at a higher (1.5) multiplier and then within the adjacent 8-digit HUC at a higher (2.0) multiplier.

Table 3: Mitigation Option iii

Adjacent 8-digit HUC	Within 8-digit HUC	Within 12-digit HUC	Mitigation option
n/a	n/a	0.75	1) On site mitigation
2.0	1.0	0.75	2) All other types of mitigation

Example: If mitigation is done in an adjacent 8-digit HUC with coastal headwater stream mitigation (option iii) and assume 200 square feet of Zone 1 buffer impacts [200 sqft of impact x 3 impact multiplier is required for Zone 1 impacts x 2 for an adjacent 8-digit HUC multiplier for all other types of mitigation= 1,200 sq ft.

- b. **Accounting for buffer, nutrient offset and stream mitigation credit.** The rules propose three options to address this issue. The current rules do not address accounting for buffer, nutrient and stream mitigation credit. The division currently use the first alternative outlined below but this issue has generated considerable controversy. Comparing these different proposals will give the EMC, regulated community and others more information about the benefits and drawbacks to each option.
 - i. Option 1 - Buffer (or nutrient offset) and stream mitigation credits can be counted for both sets of credits on a particular mitigation site. However, buffer and nutrient offset credits cannot be provided at the same location on the same site nor can sites that are offering wetland mitigation also provide buffer or nutrient offset credit. The division presently uses this option for the existing rules.
 - ii. Option 2 - Buffer (or nutrient offset) and stream mitigation credits could only be counted for both sets of credits if the impact also was to both streams and buffers. This option would require the division to determine if impacts were to buffers only (impacts which are parallel to streams) rather than to both streams and buffers (impacts which cross streams). Presently the division makes no such distinction. The type of required mitigation would then be matched up with the type of mitigation (stream and buffer versus buffer only). This would complicate the tracking of buffer

and stream mitigation for mitigation providers and may result in some stream mitigation credits being unusable for compensatory mitigation in instances where only buffer mitigation is required. The potential benefit is that stakeholders would have more opportunity to obtain buffer mitigation credits since more buffer mitigation opportunities would exist.

- iii. Option 3 – Buffer (or nutrient offset) and stream mitigation would not overlap at all in this option. In this case, the buffers planted next to stream mitigation sites could not be used for buffer credit unless the mitigation provider was willing to completely forego stream credit at the site. In many cases, stream mitigation is needed to have an effective buffer mitigation project. This means that there would be unrecoverable costs for the stream channel work with this option, which would have to be offset by higher mitigation fees as outlined below in Section III.

C. Optional methods of buffer mitigation allowed in the proposed rules

There are several optional measures to the traditional buffer mitigation of planting trees in non-wooded buffer adjacent to streams. **None of these options would be required.** Rather, stakeholders and mitigation providers would pursue these options on a case-by-case basis. These additional options are being proposed to give the regulated community more flexibility in achieving the required mitigation. These options will enable developers to have projects in otherwise undevelopable areas. These options may cost more than traditional mitigation and if the developers chose to use these options it is in indication that they expect to make a net profit from the project even with increased cost. Based on the stakeholder input these are the proposed non-structural options:

- a. Non-structural options
 - i. Coastal Headwater Stream Mitigation – This involves a relatively new way of conducting stream mitigation in subtle stream valleys in the outer coastal plain where extensive earth moving and engineering design are limited to filling of any existing ditches and planting appropriate trees. This practice has been done at about ten sites in the past five years with good success in replacing functioning riparian wetland buffers while minimizing mitigation cost.
 - ii. Restoration of buffers along unmapped streams – Presently the division interprets the existing rules such that acceptable mitigation sites must be along streams shown on the most current version of the 1:24,000 United States Geological Survey (USGS) topographic map or published County Soil Survey. The division estimates about 95 percent of the stream length in any given area is captured by the use of these maps. However, the remaining approximate 5 percent of the stream length cannot be used as mitigation sites. The proposed rules would allow buffer mitigation along streams not depicted on these maps, thereby providing additional sites for buffer mitigation.
 - iii. Preservation of stream buffers along mapped streams – The proposed rules would allow mitigation credit for preservation of wooded buffers along streams shown on the USGS or County Soils Survey maps at a 10:1 ratio. There would still be a requirement for 1:1 restoration or enhancement in order to make certain that the amount of buffers along

streams in these watersheds is at least stable. For example, if you impact 100 linear feet of stream, you would have to restore or enhance 100 linear feet of stream with a 50-foot buffer along both sides of the stream and preserve 1,000 linear feet of stream that is currently buffered. Since protection of these buffers would be determined on a case-by-case basis, it is not clear how much this alternative would be used by stakeholders in these watersheds.

- iv. Preservation of stream buffers along unmapped streams – The proposed rules would allow mitigation credit for preservation of wooded buffers along unmapped streams in these watersheds at a 5:1 ratio. Again, there would still be a requirement for 1:1 restoration or enhancement to ensure the amount of buffers along streams in these watersheds is not diminished. Once again, since protection of these buffers would be determined on a case-by-case basis, it is not clear how much this alternative would be used by developers in these watersheds. However, given the more favorable ratio it is likely that stakeholders would pursue this option more frequently than the option which allows preservation of buffers along mapped streams in the approximately 5 percent of the stream length in these watersheds that are not depicted on these maps.
- v. Restoration of narrower buffers along urban streams– This option allows restoration of 30-foot wide buffers along urban streams rather than the required 50-foot wide buffer if appropriate on-site stormwater management is provided. Municipalities that desire to develop a mitigation bank for their own impacts and NC Ecosystem Enhancement Program (EEP) projects in public parks will probably be the major users of this option.
- vi. Enhancement of grazing areas – The present rules do not provide buffer mitigation credit for excluding grazing livestock from erodible stream banks. The proposed rules would allow buffer mitigation credit to be given for exclusion of livestock from areas with limited tree planting. This option would provide credit for selected sites that today are ineligible for buffer mitigation credit. Although these sites are not widespread throughout watersheds, this option could potentially have a significant impact on reducing livestock nutrient input (pollution) into streams.
- b. Structural options - Stormwater Best Management Practices (BMPs). The proposed rules allow engineered solutions to nutrient removal including constructed wetlands, bio-retention areas, infiltration devices and sand filters, as well as wet ponds followed by measures for diffuse flow. These practices may be proposed in areas where other options are limited since these engineered approaches tend to be more expensive than planting trees along non-wooded streams. SBMPs are standard designs with which the engineering and regulatory communities are very familiar based on several decades of experience in designing, reviewing, constructing and maintaining these facilities especially in urban areas.
- c. Other options as approved by the EMC. The rules contain a provision for stakeholders or mitigation providers to develop other alternative approaches for nutrient reduction and propose them to the EMC for buffer credit. The proposed method of mitigation would have to be placed out to public notice and comment by the division before presentation to the EMC for formal approval.

III. Potential Economic Impact Associated with 15A NCAC 2B .0295 – Alternative Buffer Mitigation Rules

Baseline cost of buffer mitigation – The baseline cost for buffer mitigation was determined by searching the division’s Basinwide Management System (BIMS) database, which tracks buffer impacts and corresponding buffer mitigation requirements. The division has complied the mitigation requirements for 2005 through 2010 (see Table 4).

Table 4: Buffer impacts and mitigation required from 2005 to 2010

	Amount of buffer impact approved (square feet)*	Amount of buffer mitigation required (square feet)
2005 (7/1 to 12/31)	3,192,513	1,320,759
2006	6,269,646	10,014,325
2007	4,005,858	585,160
2008	6,506,069	7,511,487
2009	4,927,865	1,407,728
2010 (1/1 to 6/30)	1,439,789	135,617
Average	4,390,290	3,495,846

*These impacts include allowable, allowable with mitigation and prohibited uses in the buffer rules. Only allowable with mitigation and prohibited uses require mitigation.

As of January 31, 2011, the cost of buffer mitigation increased from 96 cents to 99 cents per square foot per Rule 02B .0269. The division used the \$0.99 per square foot rate to estimate the average buffer mitigation costs associated with the proposed mitigation rule to be \$3,460,888. Session Law 2011-394 (HB 119) makes a change in the provision for requiring buffer mitigation that could affect these calculations. The Session Law essentially states that mitigation will not be required for construction of a single family residence located on a lot adjacent to salt marsh. To determine the effect of this provision on the amount of mitigation required, BIMS was searched for all projects in this timeframe (July 2005 thru June 2010) which were adjacent to SA,SB or SC waters which we assume could have salt marsh buffers. A total of 35 projects (from a total of 343 projects adjacent to these waters which required buffer mitigation) were identified which required a total of 40,882 square feet of buffer mitigation. In general, these impacts are relatively small with correspondingly small buffer mitigation requirements. Since this amount is a very small percentage of the total mitigation required over this timeframe (0.2 percent), this analysis was not adjusted to reflect this policy change.

The cost derived from Table 4 was used in the following analysis to determine the potential additional cost of other options.

DWQ queried BIMS for the same timeframe to identify what groups are providing buffer mitigation across the state. This analysis shown in Table 5 below shows DOT and private land developers were required to provide the vast majority of buffer mitigation.

Table 5- Applicants and percentage of total square feet of buffer mitigation from 2005 to 2010

Applicant	Percentage of Buffer Mitigation
NCDOT	54.73
Private Development	35.48
Local Government	4.52
Federal Government	4.15
Single Family Residential Lots	1.11
State Government Other Than DOT	0.01

Additional cost for various provisions in proposed rules

The rules contain three provisions that would apply to all mitigation proposals - conservation easements, completion bonds, and non-wasting endowments for long- term operation and maintenance. Conservation easements and completion bonds are payable to the division to ensure land purchase, construction, monitoring and maintenance are completed on a buffer mitigation site. Conservation easements and completion bonds are already required on all mitigation sites. Therefore, these two provisions will have no additional cost compared to the present cost of buffer mitigation.

- a. **Non-wasting endowments** (or equivalent measures) are funds that generate enough interest each year to cover the cost of long term monitoring and maintenance. These measures are becoming more common for mitigation sites but are not universally required for buffer mitigation. The purpose of non-wasting endowments is to make certain that funds are available to hire staff for periodic visits to sites in the future to make certain that the buffers functioning to remove nutrients from urban and rural stormwater runoff. The cost of non-wasting endowments varies from location to location with the level of oversight required so it is difficult to find one number to represent the cost of the non-wasting endowment. Based on estimates from the NC EEP and discussions with private mitigation bankers in North Carolina, an average of no more than about 3-percent of the overall cost of mitigation seems reasonable. Therefore requiring non-wasting endowments (or equivalent measures) could add about \$103,827 annually to the cost of buffer mitigation. The division derived the number by taking 3 percent of the average annual buffer mitigation cost (\$3,460,888).

b. Mitigation Location

The proposed rules have three options as follows:

- i. Mitigation within the 8 digit HUC and then at a higher multiplier (2.0) in the adjacent HUC.
- ii. Mitigation on-site at a reduced (0.75) multiplier, within the 12-digit HUC, at the subwatershed level (using the standard multipliers), within the 8-digit HUC at a higher (1.5) multiplier, and then within the adjacent 8-digit HUC at a higher (2) multiplier.

- iii. Mitigation on-site at a reduced (0.75) multiplier, within the 12-digit HUC (1.0) multiplier, within the 8-digit HUC at a higher (1.5) multiplier and then within the adjacent 8-digit HUC at a higher (2.0) multiplier.

The first option (mitigation within the 8-digit HUC) is similar to the present process so would have no additional cost. Option ii (on-site or 12-or-8-digit HUC) would only require 75 percent of the mitigation if it is done on site, the present amount of mitigation would be required in the 12-digit HUC and then 50 percent more mitigation would be required if the mitigation was in the 8-digit HUC but not in the 12-digit HUC where the impact occurred. Option iii would be similar but would be less costly since the new multipliers are lower than Option ii. Data on the availability of mitigation sites are not readily available so the following analysis is based on division staff's professional judgment and experience on buffer projects. On-site mitigation is usually very limited since most streams have existing wooded buffers. In addition, data on the location of impact sites relative to the location of mitigation sites are limited. However, the small size and relatively large number of 12-digit HUC units (for instance, there are about seventy-five, 12-digit HUC's in the Neuse and Tar-Pamlico basins in contrast to the four 8-digit HUC's in those basins) leads to staff to use best professional judgment to estimate that mitigation in the 8-digit HUC would still be the norm with a few exceptions of on-site mitigation and mitigation within the 12-digit HUC. Therefore the division believes that Option i and iii would have no increase in costs, but Option ii would increase by \$1,730,443 (half the cost of buffer required) X 99 cents = \$1,730,443 annually.

c. Accounting for buffer, nutrient offset and stream mitigation credit.

Three credit accounting options are presented in the proposed rules. These options were developed during a stakeholder meeting held in Raleigh on December 9, 2009. The division and EEP staff reviewed these options in January 2011 and estimated the additional cost associated with the options. The cost varied depending on whether stream restoration is needed on any particular site or whether simply planting trees would suffice. For option two, the accounting that would be required by the division and mitigation providers (including private bankers and the EEP) would be complex but possible. The following costs were estimated for each option compared to the present approach that the division uses.

Option 1- would allow the counting of both buffer and stream mitigation credits on a site. Nutrient offset credits and buffer credits could not occur on the same site. Similarly, wetland mitigation credit could not also be counted as buffer or nutrient offset credit. All of these procedures are consistent with the process currently followed by the division so there is no additional cost associated with this option.

Option 2 is an option that is a compromise between the way the division does business now with buffer and stream mitigation (Option 1) and how some private mitigation bankers have voiced how they would like to see buffer and stream mitigation done now (Option 3). Option 2 would allow buffer and stream mitigation at the same site if the impact was to both streams and buffers. For instance, an impact from the construction of a road crossing of a stream channel could do mitigation at a stream and buffer mitigation site. However, if the impact was to buffers only (for instance for a sewer line that runs parallel to a stream rather than crossing the stream), then mitigation would be at a buffer only site. Any

stream mitigation credit associated with that site would not be available for 401 Certification (the permit). This option could be more expensive since many buffer mitigation sites also require grading of the landscape to create a stream channel and this cost could not be recovered from the site. The higher cost also reflects the fact that the site costs could not be used to support stream mitigation credit. Based on division and EEP staff estimates of the cost of mitigation and what percent of buffer projects also require channel work, the division believes that this option would increase costs at least 24 percent for a stable channel and 41 percent for an unstable channel. These cost increases are based on staff's professional knowledge of these practices. Of the 39 buffer and nutrient offset mitigation projects done by the EEP, only two (5 percent) required streambank work in addition to tree planting. Therefore, the actual cost would be closer to the 24 percent increase rather than the 41 percent increase, and the 24 percent cost increase assumption is used in this analysis.

Option 3 would not allow buffer mitigation to occur on sites where stream mitigation credits are generated. This is a rather simple option to track with existing accounting systems but would greatly increase the cost of mitigation. Division and EEP staff estimates that this option would increase costs by about 41 percent for stable streams and 99 percent for unstable streams since any work done on the channel could not be covered without raising mitigation fees.

Since only 5 percent of the 39 buffer and nutrient offset mitigation projects done by the EEP required streambank work in addition to tree planting, the actual cost increase would be closer to the 41 percent rather than 99 percent, and the 41 percent cost increase assumption is used in this analysis.

The proposed rules also would create optional methods of buffer mitigation to allow the regulated community greater flexibility and potentially lower the cost of compliance. The three categories of methods include non-structural options, structural options and other options as approved by EMC.

d. Non-structural options:

Coastal Headwater Wetland mitigation – This type of mitigation is somewhat cheaper than standard stream mitigation since less engineering and site manipulation is needed. The EEP has restored about five of these streams and a private developer has restored about five of these streams. Compared to traditional mitigation, coastal headwater mitigation costs about 10 percent less according to these sources.

Restoration of buffers along unmapped streams – The cost of this mitigation would be the same as mitigation along mapped streams since the costs of design, land acquisition, planting, stream work, and monitoring would be exactly the same. The advantage of this option is that it would expand the possible number of buffer mitigation sites. However, since the use of the two maps covers about 95 percent of the stream length, the number of additional sites would be limited. The USGS topographic maps underestimate streams on the coast but overestimate streams in the piedmont. Soil survey maps from NRCS overestimate streams on the coast, but underestimate streams in the piedmont. Based on division research, taking these two maps together as the current buffer rules require will provide a 95 percent accuracy in locations of buffered streams in the buffered basins in North Carolina. With only 5 percent of the overall streams in the buffered basins not being accurately shown on one of the two maps, the

division staff thinks very few streams will be able to utilize the restoration of unmapped streams option in the proposed rules.

Preservation of stream buffers along mapped streams – This option would allow mitigation credit at a 10:1 ratio for preservation for non-urban streams, but at a rate of 3:1 for urban streams. There would also be the requirement for a 1:1 buffer restoration or enhancement. The practicality of this option varies widely depending on the site but it could be a valuable option for large, private developments that will preserve the remaining streams on a site or for urban projects where locating a large preservation site could be very problematic. Preserving a smaller area of stream buffer in urban areas would have a positive effect on the water quality in the applicable basins. In these cases, the costs for preservation will be the conservation easement and non-wasting endowment along with the required 1:1 restoration or enhancement. This option could reduce the cost of mitigation for large developments with sufficient amounts of stream to preserve. For the purpose of this analysis, staff attempted to estimate the savings for buffer mitigation from preservation. We assume that preservation will only be a viable option for residential developments (since only those developments are likely to contain large amounts of buffers to preserve) and possibly for public projects such as sewer lines and greenway since the municipalities that pursue these projects often own land along streams. Projects such as road crossings and commercial development were not considered as likely to utilize this option since the NC Department of Transportation typically only purchases rights-of-way for the road itself and commercial development typically is on a relatively small parcel which would be unlikely to have significant amounts of streams.

From the BIMS database from July 2005 to June 2010 (the same timeframe used above), the division located residential subdivision and mixed use projects and water/wastewater and utility projects that required buffer mitigation. This amounted to 107 projects (out of 343 projects) and 1,286,929 square feet of mitigation. The division then assumed that the project could satisfy the 10:1 preservation requirement in the proposed rules. There would still be conservation easement and non-wasting endowment costs associated with this preservation that would amount to about an additional 4 percent (2 percent for the conservation easement and 2 percent for the non-wasting endowment) of the total cost according to EEP staff and these costs would be incurred regardless of the mitigation method. These calculations yielded a possible decrease in buffer mitigation cost by the inclusion of the preservation option of \$144,136 per year, which is reflected in Table 6 below.

Preservation of stream buffers along unmapped streams –This option would allow the preservation of buffers along unmapped streams at a 5:1 ratio along with 1:1 buffer restoration. This option would again only be useful for stakeholders with large amounts of unmapped streams on their property which is a rare occurrence. A smaller number of streams would need to have a conservation easement and non-wasting endowment since only 5 percent of the overall streams in the buffered basins could potentially be captured in this option. The overall cost of this option would only be a little less than the preservation of stream buffers along mapped streams. Based on the cost of conservation easements and non-wasting endowments, the division estimates that this option would cost less than traditional mitigation but anticipates that it could only rarely be utilized. The USGS topographic maps underestimate streams on the coast but overestimate streams in the piedmont. Soil survey maps from

NRCS overestimate streams on the coast, but underestimate streams in the piedmont. Based on division research, taking these two maps together as the current buffer rules require provides a 95 percent accuracy in locations of buffered streams in the buffered basins in North Carolina. With only 5 percent of the overall streams in the buffered basins not being accurately shown on one of the two maps, DWQ thinks very few streams will be able to utilize the preservation of unmapped streams option in the proposed rules.

Restoration of narrower buffers along urban streams – This option would allow 30-foot wide buffers (rather than 50-foot wide buffers) along urban streams. The cost of the buffers would be 40 percent less (1 minus 30/50) but this would probably be more than offset by the requirement for on-site stormwater management. This cost varies tremendously by site and cannot be generally estimated. However, the division believes that any savings of buffer planting will be more than offset by the cost for construction of on-site stormwater Best Management Practices. The practical benefit of this option is that it would increase the number of potential mitigation sites greatly in urban areas. This option will also allow stakeholders to gain credit on streams that are highly eroding due to larger stormwater inputs from the development around the streams that would greatly benefit from a restored buffer that is narrower than what is currently allowed in the buffer mitigation rules. Overall, the division thinks this option would not be cheaper than traditional mitigation. Stakeholders have stated during the policy development process that having this option is necessary for areas where this may be the only option for obtaining buffer mitigation credit. This is an indication that stakeholders value the benefit of having a greater number of developable sites more than the potential increase in cost.

Enhancement of grazing areas – This option would allow grazed areas with scattered trees to be counted as buffer restoration or enhancement at a 2:1 ratio. The cost of this option would be about double the cost of traditional mitigation since the only cost that would not have to be borne by the mitigation would be to lower the cost of planting depending on the site. Fencing would be the notable extra cost associated with this use. However, this option would again increase the number of potential mitigation sites.

e. Structural options

Structural options allowed by this proposed rule include constructed wetlands, bio-retention facilities, infiltration devices and wet ponds followed by wooded filter strips. The costs of these facilities are (in general) much higher than the simple planting of trees along un-wooded stream channels. In addition, the cost of designing, constructing and operating constructed wetlands can be highly variable (Hathaway and Hunt 2007, Virginia Water Resources Research Center 2011). It is not clear how large a constructed wetland would have to be to be used in place of planting a wooded buffer along streams since the rules require that the proponent get EMC approval for the calculation method for the particular site. In general, the division thinks that structural options would likely be more expensive than traditional buffer mitigation but that the exact cost would vary from site to site. The main advantage of this option is that it would increase the number of potential mitigation options in locations where such choices may become limited (such as in urban areas or locations such as Tar-Pamlico 04 where stream densities are naturally low). Therefore, there would be a time savings to the stakeholders due to the increased mitigation options. The division asked several stakeholders to place a value on this option. Several

developers stated that having this as an option could greatly cut planning costs on larger projects where the amount of available buffer mitigation could be very limited or scarce. In situations where this option is used, stakeholders are willing to pay for structural options and anticipate this option's benefits are equal to or greater than the costs.

Other options as approved by the EMC – This provision in the rule would allow a stakeholder or mitigation provider to propose another type of buffer mitigation that neither the division nor the stakeholders have anticipated to date. Since this option is so broad, an estimate of the cost of this option is not possible until the exact option is proposed to the EMC. Presumably, a stakeholder or mitigation provider would only propose a less expensive option when compared to traditional mitigation if traditional mitigation options were still available in a certain area.

IV. Water Quality Benefits of Riparian Buffers

Riparian buffers have been well documented to provide crucial water quality benefits including transformation and removal of nutrients, removal of sediment, removal of toxicants such as heavy metals, removal of pathogens such as bacteria and viruses, provision of shade for in-stream temperature control, stabilization of stream banks, and provision of leaves and woody material to stream channels for aquatic life support. The extensive scientific research done in North Carolina and across the world has made it clear that a wooded buffer is essential to the health of the aquatic ecosystem of the adjacent water. Some of this research is summarized below. Because the water quality benefits of buffers vary greatly from site to site, quantification of these benefits into dollar values is challenging. In addition, these benefits will only be realized in instances when the proposed rule change increases the total amount of buffers.

Nutrient transformation and removal – Riparian buffers can remove significant amounts of nitrogen and phosphorus and thereby protect downstream waters from eutrophication. For instance, Mayer, *et al.* (2007) conducted an extensive review of the scientific literature on the removal of nitrogen by riparian buffers and provided a regression equation to predict the removal of total nitrogen by various widths of riparian buffers. His work found that a 50-foot wide buffer removed about 70 percent of the total nitrogen entering the buffer through stormwater. Similarly, for phosphorus, research has shown riparian buffers have significant reductions in phosphorus levels in stormwater runoff (Wenger 1999) with a 9 meter (30-foot) wide buffer removing 46 to 79 percent of total phosphorus.

Sediment removal – Riparian buffers can remove significant amounts of sediment. For instance, Dillaha, *et al.* (1988) found that even a fairly narrow buffer of 15 feet was able to remove 76 to 87 percent of sediment. Wider buffers (30 feet) were more effective and removed from 88 to 95 percent of sediment depending on slope. On steeper slopes, wider buffers are probably needed but in general, the 50-foot buffer required by state riparian buffer rules will remove the vast majority of sediment.

Toxicant removal – Buffers remove significant amounts of toxicants such as heavy metals or organic pollutants found in stormwater runoff. Wenger (1999) summarized various publications and based on the limited data available in the scientific literature, concluded that buffers at least 50-feet wide are needed with wider buffers on steeper slopes.

Pathogen removal – Buffers can remove significant amounts of these pathogens – bacteria and viruses from stormwater. For instance, Trask, et al (2004) reported that buffers were very effective in removing *Cryptosporidium parvum* from simulated runoff. Similarly, Collins, *et.al.* (2004) found that fecal bacteria (*Escherichia coli* and *Campylobacter*) were removed by buffer strips and concluded that buffers of at least 15-feet in width were needed to markedly reduce the levels of fecal bacteria in simulated runoff. Finally, Stout, *et al.* (2005) examined runoff transport of fecal coliforms from manure and concluded that buffers can remove significant amounts of these pollutants. In general, it is clear that buffers such as those required by the state’s riparian buffer rules can remove significant amounts of bacteria from stormwater runoff.

Provision of shade – Wooded riparian buffers can significantly reduce stream temperatures during the hot, summer months. Wenger (1999) that a width of at least 30-feet was important for temperature control. Researchers in Georgia (Jones, et al 2006) examined the importance of wooded buffers to trout populations in the Appalachian Mountains in Georgia. They concluded that streams with 50-foot wide buffers had higher temperatures than those with 100-foot wide buffers with a predicted 66 to 97 percent reduction in trout populations in streams with the narrower buffers.

Stabilization of stream banks – Wooded buffers have significant effect on stabilizing stream banks and preventing their erosion and impact on downstream waters. Wenger (1999) concluded that buffer widths sufficient for other purposes should also be sufficient to prevent stream bank erosion. Therefore, the 50-foot state riparian buffer width should have significant benefits in stabilizing streambanks.

Provision of leaves and woody debris- Woody debris and trees leaves are essential inputs of energy and nutrients into streams since they (and the bacteria and fungi growing on them) provide food for aquatic insects which are the base of the aquatic food chain. Little research has been done on the width needed to provide this essential function but research reported from the piedmont of North Carolina (Dorney, personal communication, September 23, 2011) showed that about 95 percent of tree leaves in forested riparian buffers fall within 50-feet of the stream channel. Therefore once again, the 50-foot state riparian buffer width should have significant benefits in providing leaves to stream ecosystems

It is clear that wooded riparian buffers are essential to healthy streams and provide essential and highly beneficial effects on water quality. In fact, it can be stated from this work that without wooded buffers along streams, water quality will dramatically decrease. A study done concerning lake water quality in the United States (Kramer, *et al.* 2006) concluded that riparian buffers were a more cost effective way than retrofitting a stormwater best management practice to address phosphorus which resulted in decreased lake water quality in 24 of the 25 lakes studied. Protection and restoration of wooded buffers provides a significant economic benefit to water quality since they can be used in place of more expensive water treatment measures.

Information from the NCEEP program allows us the ability to estimate some of these benefits in monetary terms.

The North Carolina EEP nutrient offset credit rate is \$18.49/lb for nitrogen and \$142.02/lb for phosphorus. NCEEP Estimates that over a 30-year period, one acre of forested riparian buffer prevents 2,273 lbs---N and 146.4 lbs---P from reaching surface waters. Therefore, one acre of forested riparian buffer has a value of: \$18.49/lb X 2,273 lbs---N---30 years = \$42,027.77 \$142.02/lb X 146.4 lbs---P---30 years = \$20,793.19

Wooded riparian buffers provide both ecosystem services through different mechanisms. The combined nutrient removal value for one acre of restored forested riparian buffer over a 30-year period is \$62,820.96.

The price for a riparian buffer mitigation credit through North Carolina EEP Is \$0.99/square foot, which translates to \$43,124/acre.

V. Summary of Costs and Benefits for Proposed Rules.

The impacts of various options outlined in the rules are described above. These costs are summarized in Tables 6 through 8 below.

The overall cost and benefit of these flexible buffer mitigation rules will vary across the state depending on construction and land costs as well as the availability of traditional buffer mitigation sites. Perhaps the area of the state where these options will be most useful is in coastal plain locations such as Tar-Pamlico 04. This 8-digit HUC is centered on the Washington, NC area and (as is typical of coastal plain areas) is naturally characterized by few streams. In addition, these streams usually have wooded buffers since the buffer areas are often riparian wetlands and too wet for agriculture. For these reasons, locating traditional buffer mitigation sites in this area has become problematic. The availability of these options will provide an expanded list of buffer mitigation possibilities needed to compensate for unavoidable buffer impact for important development activities such as roadway improvements.

Table 6 – Summary of Annual Costs of Various Options in the Proposed Rules compared to the 2006 – 2010 Baseline: New Provisions that would apply to all buffer mitigation options

Item	Description of option	Percent increase in cost	Estimated additional annual cost or benefit
Conservation easement	Agreement that limits use of land	0 percent	Zero additional cost- already standard practice for mitigation sites
Completion bonds	Financial agreement that insures a project has the money to be completed	0 percent	Zero additional cost- already standard practice for mitigation sites
Non-wasting endowment	Agreement so funds are available for	3 percent	\$103,827 estimated annual cost- not universally required for buffer

	periodic site visits to insure buffers are functioning		mitigation sites
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Table 7 - Summary of Annual Costs of Various Options in the Proposed Rules compared to the 2006 – 2010 Baseline: Approaches in the Rules which would apply to all mitigation proposals.

Item	Description of option	Percent increase in cost	Estimated additional annual cost or benefit
Mitigation Location	8-digit HUC	0 percent	Zero additional cost
	On-site followed by 12-digit HUC as standard area and 8-digit HUC with 1.5 multiplier	Up to 50 percent increase	\$1,730,443 of additional annual cost
	On-site followed by 12-digit HUC as standard area and 8-digit HUC with 1.0 multiplier	0 percent	Zero additional cost
Accounting for buffer, nutrient offset and stream mitigation credit	Option 1 – No restriction on accounting	0 percent	Zero additional cost or savings. This option is currently how division handles buffer and stream mitigation
	Option 2 – align impacts with mitigation	24 percent annual increase	\$ 830,613 of additional annual cost
	Option 3 – not allow buffer and stream mitigation on same area	41 percent annual increase	\$1,418,964 or additional annual cost

Table 8 - Summary of Annual Costs of Various Options in the Proposed Rules compared to the 2006 – 2010 Baseline: Optional methods of buffer mitigation allowed in the proposed rules

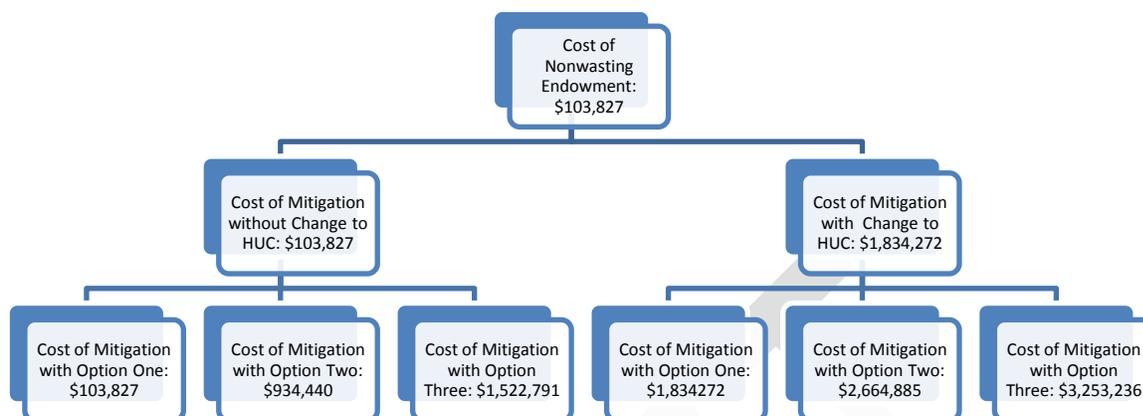
Item	Description of option	Percent increase in cost	Estimated additional annual cost or benefit
Non-structural options	Coastal headwater stream mitigation	-10 percent	10 percent cheaper than current methods
	Restoration of buffers along unmapped streams	0 percent	There will be no additional costs and more sites will be available for mitigation. There is a time savings by stakeholders being able to gain credit for restoring buffers on streams not mapped on their property
	Preservation of buffers along mapped streams	Less costly than traditional mitigation.	Staff estimate that a savings of approximately \$144,136 would have been possible per year if this provision had been in effect since 2005.
	Preservation of buffers along unmapped streams	The cost would be lower than traditional mitigation.	This option will lower costs but can seldom be used since unmapped streams (5 percent of total) could use this option.
	Restoration of narrower buffers along urban streams	Variable and cannot be determined since the higher cost of the required on-site stormwater management may or may not offset the lower cost associated with a narrower buffer.	Overall cost implications will be site specific and this option will increase the number of sites available for mitigation
	Enhancement of grazed areas	100 percent more costly	This method would be double the cost of traditional methods but would increase the number of available sites.
Structural options	Various options including	Cost of structural	This method is more costly but will increase the

	constructed wetlands, bioretention, and infiltration devices	options are substantially higher than standard buffer mitigation.	number of mitigation sites. These solutions may work in situations where projects would be unable to proceed otherwise.
Other options as approved by the EMC		Any such option would be proposed by stakeholders or mitigation providers and presumably would only be proposed if it were less expensive than traditional mitigation.	NA

Based on this analysis, staff thinks these proposed rules will not be cost prohibitive and will have a net benefit to stakeholders by allowing them to construct projects the current buffer mitigation rules prohibit.

VI. Threshold Decision After Preliminary Rules Evaluation

The total cost of this rule package depends on the specific options selected by the EMC and the actions of future applications. With certainty, annual costs will increase by \$103,827 for the creation of non-wasting endowments. These costs will be proportional to the number of mitigation credits each project needs to purchase. One action the EMC is considering would be to reduce the mitigation area from an 8-digit HUC to the 12-digit HUC. The division estimates that this change would increase costs by \$1,834,272. There are three different options for buffer mitigation accounting. If Option One is selected, costs will not increase. Selection of Option Two would result in additional estimated costs between \$934,440 and \$2,664,885 each year. Option Three would be the most costly option and result in a range of annual estimated cost increase between \$1,522,791 to \$3253,236. The following chart depicts the flow of decisions and known costs.



We do not know if stakeholders will use these methods, the frequency of use or the scope of future projects. However, general economic theory asserts that if a site developer chooses to use one of these options, then to that individual, the increased cost is lower than the expected project benefits. Projects undertaken using optional mitigation options would result in a net benefit of undetermined value.

Some of the benefits from these proposed rule changes are quantifiable and other benefits have values that we are unable to estimate. The greatest benefit of these rule changes is that they will give land developers, local governments, and state agencies such as DOT, more ways to perform mitigation and to find acceptable mitigation sites closer to the impacted site. Projects that may not have been possible to develop in the past will now be more feasible. DENR has been able to estimate that if the mitigation along mapped stream method had been allowable in the past, annual benefits would have been \$144,136. In general, these options will provide valuable options for stakeholders and mitigation providers in situations where traditional mitigation options are scarce or exhausted. In those instances, the provision of these options would allow important development to proceed which otherwise would be prevented from occurring by the lack of compensatory mitigation. If these options lead to an increase in buffer preservation, the public will experience some or all of the benefits presented in section IV.

VII. Uncertainties in Analysis – The main source of uncertainty in this analysis is the number of options available for particular choices as well as the inherently variable cost of land and applicability of specific options for specific sites. Once the EMC conducts public hearings and then narrows the options, there will be more information to inform a more precise estimate of the cost of these rules. Through the public hearing process, stakeholder will comment on the options presented in this analysis to assist the EMC in selecting final rule language. This rule package was designed with several different alternative courses of action. This fiscal note has investigated the potential cost and benefits associated with

different options. The Environmental Management Commission will make a final determination on the actual proposed rule language after these alternatives are taken out for public comment.

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