

Lockwoods Folly River Fecal Coliform TMDL Implementation Plan

9-Element Watershed Restoration Plan

North Carolina Coastal Federation

1. Identify the cause of impairment and pollutant sources along with existing loads that need to be controlled to achieve load reductions. **Section 2.4**

The Shellfish Sanitation and Recreational Water Quality Branch of the NCDEH is responsible for classifying shellfish harvesting waters to ensure oysters and clams are safe for human consumption. There are nine monitoring sites sampled by Shellfish Sanitation (DEHSS) which are located within the modeled Lockwoods Folly estuary (Figure 1). The observed data indicate that as of 2007, water quality standards were being violated at five of the nine sites (Table 2). Fecal coliform levels began to drop after 2007, possibly due to a statewide drought highlighting the effect of stormwater runoff on fecal coliform levels. As precipitation levels have increased since the drought, fecal coliform levels in the estuary have also increased.

There are no point sources of fecal coliform in the watershed. However, there are many types of nonpoint sources contributing fecal loads to the restricted shellfish harvesting areas. Fecal coliform bacteria from non-human sources originate from excretions from pets, livestock, and wildlife. Bacteria from these sources are delivered to waterbodies via stormwater runoff. As the amount of development and impervious cover has increased in the watershed, so have stormwater runoff and the fecal loading from these sources. Nonpoint source contributions to the bacterial levels from human activities generally arise from malfunctioning or improperly-sited septic systems or illicit connections of sanitary sewage to the stormwater conveyance system. Approximately 92% of the watershed has soils that are unsuitable for septic systems. Sewage discharge from boats is another human source of fecal bacteria.

A source assessment was conducted as part of the TMDL report. This assessment estimated the relative amount of bacteria that is available for runoff from each fecal bacteria source in the watershed. The source assessment did not determine the actual loads to the estuary from each nonpoint source category. Loads from boat discharge were not included in the source assessment as these are difficult to quantify. Boat discharges are not allowed; however, it is likely that they occur and it is unclear how many boaters violate this regulation or how often.

The assessment estimated that the available fecal bacteria can be attributed mainly to wildlife (about 52%). Pets contribute about 30% of the available bacteria while livestock contribute approximately 15%. The analysis estimated that humans may only contribute about 3% of the available bacteria via septic systems. However, this analysis estimated available fecal bacteria on the land surface throughout the watershed, but not actual loads to the estuary. The actual relative contribution from the sources is likely different. For example, while wildlife has a high percentage of available bacteria, most occurs in the undeveloped areas of the watershed where waste occurs primarily in developed areas with higher levels of impervious surface. These impervious surfaces convey stormwater and pollutants quickly and directly to surface waters, increasing the contribution of fecal bacteria loads from developed areas than undeveloped areas. Therefore, loads from sources which occur in developed areas, such as pets, livestock and human sources, may be higher than determined by the source assessment.

2. Estimate the load reductions expected from management measures. **Section 2.4 and 3.1**

The TMDL model used land use, soils, stream, precipitation, and water quality data to determine the current load of fecal coliform bacteria being delivered from the watershed to the estuary. The model was then used to determine the reduction of fecal bacteria loads needed to meet North Carolina water quality standards for fecal coliform. The load reduction needed in the Lockwoods Folly River watershed was estimated to be 86%. The TMDL is divided into a wasteload allocation (WLA) which represents point sources, a load allocation (LA) which represents nonpoint sources, and a margin of safety (MOS) which is added in recognition of the many uncertainties in the understanding and simulation of water quality in natural systems. While WLA generally pertain to point sources, EPA policy now requires that permitted stormwater sources also be included in the WLA.

There are currently two permitted stormwater dischargers in the watershed: NCDOT and the Town of Oak Island. However, Oak Island's contribution to the pollutant load to the Lockwoods Folly estuary could not be calculated. Stormwater runoff from Oak Island flows into Montgomery Slough and the ICWW. These waters are impaired however they were not included in the TMDL model process as the hydrodynamics of this system were not conducive to modeling. The 86% reduction is not applicable to these areas. However, the reduction strategies described in this plan are applicable to these areas. NCDOT's contribution to fecal bacteria loading in the watershed was tracked separately in the model from other land use types in order to calculate their wasteload allocation and load reduction requirements.

Stormwater runoff reduction practices intercept stormwater and associated pollutants prior to delivery to a waterbody. This can be achieved through the use of stormwater best management practices (BMPs) by capturing the runoff, treating it and then releasing it, or permanently keeping it from surface water or ground water resources. Fecal bacteria removal can be achieved through drying, sun exposure, sedimentation, and filtration. However, the conditions found in some BMPs are ideal for fecal bacteria growth instead of removal, including moist soils and readily available nutrients. Other times BMPs are a source of fecal bacteria as they attract animals that then defecate in and around them.

The best BMPs to reduce fecal coliform bacteria are those that substantially limit the volume of water that leaves the BMP since that is what carries any untreated pollutants to surface waters. Reducing high flows is important as they can cause erosion and mixing of bottom sediments where fecal coliform bacteria thrive.

Instead of using BMP removal efficiencies that vary greatly depending on the study, this plan puts into place a simple accounting system based on historic land use conditions and water quality data. According to historic data, waters in the estuary started to close to shellfishing after 1% of the watershed (excluding Oak Island) was developed. When the 86% reduction specified in the TMDL was calculated, 17% of the watershed was developed. In order to restore water quality to a state that will allow for shellfishing, enough stormwater must be captured and infiltrated/treated to mimic conditions found when just 1% of the area was developed. The difference between acres of pre-impaired development (approximately 1182 acres) and acres of existing development (16,885 acres) is 15,703 acres. This equates to treating roughly 94% of the developed land. The 1-inch, 24-hour storm or 3.8 inches should be used when calculating BMP size. This measure supports Roundtable strategy 7 that called for the identification of sites for water quality retrofit to reduce or eliminate unwanted runoff.

3. Describe the nonpoint source management measures that will need to be implemented to achieve the load reductions in 2 and the critical areas in which those measures will be needed to implement this plan. **Section 3.0**

In order to reach the TMDL, major reductions in fecal bacteria loading are necessary. Pollutants such as fecal bacteria can be transported from the land to surface water by a variety of means including stormwater runoff and indirectly, ground water infiltration. All fecal bacteria sources in the Lockwoods Folly River watershed are effectively nonpoint sources (stormwater behaves as a nonpoint source). There are two main types of management measures that can be used to reduce fecal bacteria loading from nonpoint sources: stormwater runoff reduction and source control. Education along with policies and programs are essential for the effective implementation of these management measures.

Measure 1: Reduce stormwater runoff from 94% of existing development

Measure 2: Prevent stormwater runoff from all new development

Measure 3: Control and reduce sources of fecal coliform bacteria

Stormwater:

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Fecal Coliform:

Human contributions to fecal bacteria loading can occur due to wastewater facility discharges or the failure of septic systems. Septic systems are located throughout the watershed, except in the Town of Oak Island, St. James, and the Winding River neighborhood. Septic systems can

fail especially when not properly maintained or when they are located in an area with unsuitable soils. Obvious signs of failure are sewage backing up into the house, slowly draining fixtures, and smell of raw sewage accompanied by extremely soggy ground. However, failing septic systems are not always easy to identify if the failure involves untreated sewage entering a stream via groundwater. When the groundwater table is near the ground surface, partially treated sewage exits the drainfield and enters into the groundwater. The contaminated groundwater drains into nearby surface waters leading to high levels of fecal bacteria and other bacteria.

Many of the septic systems in the watershed are located in areas with soils that are likely unsuitable. Regulations have changed over the decades and it is likely that many systems permitted in the past would not have received permits today. Extending sewer service to existing developed areas is one way to eliminate the possibility of septic failure. The Town of Oak Island is installing sewer connections throughout the island during 2010. This effort will eliminate approximately 4,300 septic systems that drain to the Intracoastal Waterway and Montgomery Slough. That leaves approximately 6,800 septic systems in the watershed. A percentage of these are not performing properly. Continuing to reduce the number of septic systems in the watershed is an important step in eliminating human contributions of fecal bacteria.

Livestock animal waste:

NCDEH Shellfish Sanitation Shoreline Survey (Division of Environmental Health, Shellfish Sanitation and Recreational Water Quality, North Carolina Department of Environment and Natural Resources, 2007). There may be additional farms that house animals that were not part of the Shoreline Survey. Regulations and inspections are in place to govern the activity on the single hog farm in the watershed. The remaining farms are small and unregulated. All farms with livestock, regardless of size, can be environmental risks.

Wildlife:

Wildlife is one of the main sources of fecal coliform bacteria in the watershed. Since it is so widespread, managing it through stormwater runoff reduction as described in Section 3.1 is the most effective manner to reduce impacts on water quality. Reducing the source contribution of fecal bacteria from wildlife is an important second measure. Concentrations of wildlife in urban areas can be of particular concern because 1) stormwater runoff is higher due to the extent of impervious surfaces, and 2) they often deposit their waste directly into surface waters. Therefore, they can be major sources of fecal coliform bacteria, particularly in lakes and ponds where large resident populations have become established near beaches (Center for Watershed Protection 1999). The following are actions aimed specifically at reducing the wildlife source of fecal coliform in developed areas by discouraging resident goose populations.

4. Estimate the amount of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan. **Section 4.0**

The total costs associated with implementing this plan vary depending on which management measures are implemented and in how many locations. Instead of a total cost, this section contains information on the cost of individual measures (Table 7). Some of the stormwater runoff reduction measures are more costly than others but may be more effective. Stormwater runoff reduction strategies are listed in order of effectiveness for fecal bacteria removal. The effectiveness of other measures such as education programs or source control cannot easily be compared to stormwater runoff reduction measures.

To place some of these unit costs into context, costs have been calculated for different practices and combination of practices for a 0.5 acre lot, with an assumed roof surface area of 1,200 square feet, and a driveway area of 1,000 square feet. In order to use most of these practices the driveways must be graded in such a way that stormwater runoff flows over an unpaved stalled before entering the stormdrain to be installed to capture runoff from the (lawn or mulched surface) area where the BMP can be in system. Otherwise, permeable pavement would have driveway. For rain gardens, a range is given as cost depends on the installer – a lower cost if the homeowner installs it and a higher cost if done by a landscape professional or other contractor.

There are several sources of technical assistance for the implementation measures proposed in this implementation plan. Additional assistance is available from various organizations including at the State level, the North Carolina Department of Natural Resources. They offer technical assistance to businesses, farmers, local governments, and the public through education programs provided by DENR staff. There are also several local sources for technical assistance. These include the County Health Department, the local Cooperative Extension, the Brunswick County Soil and Water Conservation District, the Town of Oak Island, and the North Carolina Coastal Federation. Following is a description of each of the local sources and how they may be able to assist in plan implementation.

The methods available for financing retrofit projects are based upon county and municipal powers for taxing, making special assessments, borrowing, issuing bonds, receiving public and private grants and donations, charging user fees, establishing special funds, and receiving revenue sharing funds (Golgowski, 1985). The Stormwater Utility in the Town of Oak Island charges fees which are used to maintain its stormwater management services in order to meet the existing and future stormwater needs of the Town. A stormwater utility does not exist for the county areas or municipalities in the remainder of the watershed. A dedicated funding source for land protection activities, such as a utility, could be used for both non point source reduction and for landowner meetings, education, and purchase of conservation easements and fee title purchases to further the Lockwood Folly Strategies. Roundtable strategy 5B called for seeking Wild and Scenic River designation for the Lockwoods Folly River. While this designation does not protect the river from development pressures, it may increase opportunities for access to public money available for land purchase or easements from willing property owners.

5. Include an information and educational component to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measure that will be implemented. **Section 3.3**

One of the key elements for implementing a watershed plan according to the EPA Nine Key Elements is an information and education program that includes a comprehensive strategy to educate both the public and participating agencies in the implementation of nonpoint source measures to effectively reduce the bacterial pollution. While this document contains a variety of ideas with something for virtually every landowner in the watershed, it is unlikely the majority of people will have access to it. Information and educational outreach efforts such as those that have already occurred in the watershed are vital for ensuring people understand what is happening with water quality and how they can use the strategies included in this document to help improve it.

A number of individuals and groups have been actively working on public education and will

continue to do so. For example, during the TMDL development as well as during other projects that have occurred with the watershed, the North Carolina Coastal Federation has worked to inform the public by maintaining a website with information about the watershed and writing press releases for the local newspapers. More importantly, volunteers who live in the watershed have worked with NCCF to collect data used in developing the TMDL and to implement best management practices. These volunteers can help spread the information contained in this implementation plan. NCCF will produce a tabloid summarizing the implementation plan and distribute it to the public.

6. Provide a schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious. **Section 5.0**

The goal of this implementation plan is to meet the established water quality standards for shellfishing waters.

“Organisms of coliform group: fecal coliform group not to exceed a median MF of 14/100 ml and not more than 10 percent of the samples shall exceed an MF count of 43/100 ml in those areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.” 15A NCAC 02B.0021 (Tidal Salt Water Quality Standards for Class SA Waters) (MF is an abbreviate filter procedure for bacteriological analysis).

Implementation measures need to start as soon as possible and should continue indefinitely into the future. While measures that apply to currently developed land may one day be achieved, new construction is likely to occur for many decades. Working towards completing as many of the action items from the four management measures is important. The following presents a milestone for each measure, as well as information on what actions should be the top priorities for each measure. Interested parties can take responsibility for the different actions listed under each management measure and determine the appropriate start date/

7. Describe the interim milestones for determining whether nonpoint source management measures or other control actions are being implemented. **Section 5.0**

The management measures eluded to in element 6 are as follows:

Measure 1: Reduce stormwater runoff from 94% of existing development

Milestone: After five years use water quality data and the acres of developed land that have stormwater reduction practices in place to determine if the number of retrofits is resulting in a decrease of fecal bacteria levels.

Priority: Actions have been recommended for developed lands throughout the watershed for a variety of parties. Normally, projects would be prioritized by selecting those that treat the greatest area for the lowest price. However, this method is not appropriate for the Lockwoods Folly watershed. There are few areas where large scale projects will lead to a large reduction in fecal coliform bacteria. Since the developed areas are largely residential, projects will need to be implemented on a lot by lot basis. When space and drainage patterns allow, projects may be constructed to treat a group of houses. Since projects are needed in almost all of the developed areas, a method of prioritization is needed. Factors to consider for prioritization are landowner willingness to participate, funding, and how effective projects will be based on soils, depth to water table, and space available.

Measure 2: Prevent stormwater runoff from all new development

Milestone: In 2015, compare existing parcel data with data from 2010 to determine areas with new growth that are conventional developments or low impact developments. If conventional developments are more common than LID, efforts should be increased.

Priority: Currently, development is not occurring at a rapid pace however many lots have been subdivided for conventional development. It is important to work with these developers in order to minimize impacts from these areas. If these projects are successful, other developers may choose to design neighborhoods using LID techniques.

Measure 3: Control and reduce sources of fecal coliform bacteria

Milestone: In five years, review the source reduction actions that have been completed. Survey those that initially participated in specific actions to determine if they are continuing source control efforts (i.e. If 5 horse owners came to a workshop about manure and pasture management, conduct a survey to determine if the owners carried out the activities they were taught).

Priority: Efforts should focus first on the largest source that is easily managed and then work through the smaller sources. Pet waste is the second largest source but is easier to manage than wildlife therefore pet waste controls should be the primary focus. This is followed by source controls for septic system owners, boaters, and livestock owners. Limited source control actions have been proposed for wildlife as wildlife sources will primarily be addressed through stormwater runoff reduction.

Measure 4: Education/Outreach/Training

Milestone: In five years, review the education/outreach/training actions that have occurred. Survey the participants to determine if they have taken actions to improve water quality or have changed habits (i.e. If 100 dog owners received information on the impacts of pet waste, conduct a survey to determine how many currently collect their pets waste).

Priority: In order to get the public to participate, implementing the education strategies is key. Focusing on organized groups of homeowners such as HOAs and POAs should be the top priority as a larger number of people can be reached that will potentially install stormwater runoff reduction practices on their lots.

8. Provide a set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

Section 5.0

One of the action items outlined in this implementation plan is the creation of an accounting system to track the BMP retrofits which are installed in the watershed. The accounting system will track the number of BMPs installed, the area treated by each BMP, and the size of the storm each BMP is designed to treat (e.g. the 1.5 inch versus the 3.8 inch storm). This system will assist in tracking progress toward meeting the measure of capturing runoff for the 1-year 24-hour storm from 94% of the developed land in the watershed.

9. Monitor to evaluate the effectiveness of the implementation efforts over time, measured against criteria established under item 8 above. **Section 5.0**

Data collection and analysis of bacteria at the nine monitoring stations in the estuary will

continue to be performed by the Shellfish Sanitation Section of DEH (DEHSS). DEHSS also performs sampling at five monitoring sites in the ICWW and Montgomery Slough. DEHSS conducts sampling at least six times per year at these sites. The system is well-suited for monitoring and classifying shellfish waters and it can serve to track the effectiveness of TMDL implementation and water quality improvements. Continued monitoring allows for adaptive management of this implementation plan. The need for changes to implementation measures can be assessed according to improvements or degradation in water quality as determined by monitoring.