Bradley & Hewletts Creek Watershed Restoration Plan
Executive Summary & Proposed Actions

(The entire plan can be found online: www.wilmingtonnc.gov/stormwater)

EXECUTIVE SUMMARY

Bradley and Hewletts Creeks are polluted with unacceptably high levels of fecal bacteria that have resulted in a prohibition on the harvest of shellfish for human consumption. In addition, swimming advisories are issued within the Bradley Creek watershed at Wrightsville Beach due to unacceptable levels of enterococci bacteria.

Shellfish closures and swimming advisories are indicators of poor water quality and result in some of these waters being listed as "impaired" by the US Environmental Protection Agency (EPA). With support from the NC Division of Water Quality (DWQ), the City of Wilmington working with the Town of Wrightsville Beach and its partner the North Carolina Coastal Federation (NCCF) has chosen to develop this comprehensive voluntary watershed restoration plan (Plan) in an effort to reduce pollution in these waterways. This Plan covers these two watersheds for the purposes of qualifying to use EPA Section 319 funding to restore impaired water quality.

Stormwater runoff is the primary cause of water quality impairment in the Bradley and Hewletts Creek watersheds. Intense urbanization in the watersheds of the creeks has hardened the natural landscape, limiting their capacity to infiltrate and store rainfall as they did prior to development. Instead of soaking into the ground and being taken up by vegetation, a much larger proportion of rain now quickly runs over the surface of the urban landscape and into the creeks. This stormwater runoff picks up bacteria and transports them to the creek much like a bus picks up and discharges its passengers.

The City and its partners have developed this Plan that focuses on reducing the amount of surface runoff that transports bacteria into the creeks. Restoring water quality in these creeks will be a long-term, multi-decade effort. Polluted shellfish growing waters are the byproduct of previous development practices that have occurred over the last 50 years that reduced the functional capacity of these two watersheds to infiltrate rainfall. Gradual improvements in water quality will occur as hydrologic restoration efforts are carried out within existing and new land uses.

The City wants to reduce pollutant-laden stormwater runoff so that shellfish growing waters that are classified for shellfish harvest (SA) may eventually reopen to harvest. Within portions of the Bradley Creek watershed, the Town of Wrightsville Beach is also interested in preventing swimming advisories that are posted in waters designated for swimming (SB). Interim goals of this Plan include improving water quality over time so that the existing NC Shellfish Sanitation (SS) shellfish growing water harvest classifications are revised from "Prohibited Area" to "Approved Areas" that can be opened to harvest more and more frequently. Once growing waters are managed as "Approved Areas" they will no longer be listed as "impaired" by EPA. The Plan will also work to reduce the need for swimming advisories within the Bradley Creek watershed, with a goal of removing these waters from being listed as "impaired."

When surface waters no longer comply with assigned water quality classifications and standards, the federal Clean Water Act mandates that steps be taken to remove the water quality impairment and restore water quality to acceptable levels. This normally involves conducting a study called a Total Maximum Daily Load (TMDL) that determines how much pollution loads should be reduced to restore water quality. Once the TMDL is completed, then a watershed restoration plan is devised to accomplish the desired reductions in pollution loads.

TMDL studies typically cost many thousands of dollars and can take several years to complete. For tidal watersheds like Bradley and Hewletts Creeks where most pollution is caused by stormwater runoff and not discharges of industrial or domestic wastewater, the science behind estimating acceptable waste load

allocations through the TMDL process is not precise. However, there has been extensive scientific study in North Carolina over the past several decades as to the causes of shellfish closures in tidal creeks such as Bradley and Hewletts Creeks, and the City and its partners believe this existing information provides a sufficient basis to develop this Plan without spending more time and resources going through the TMDL process. DWQ supported the City's strategy to prepare this Plan without first conducting a TMDL study and provided financial support to develop the Plan through a Section 319 Grant.

Two recent TMDLs and watershed restoration plans approved by DWQ and EPA for the Lockwoods Folly River and White Oak River provided guidance for the City to follow in developing this Plan. These plans documented that restoration of water quality in tidal waters similar to Bradley and Hewletts Creeks depends upon reducing the volume of stormwater shed from existing land uses, as well as controlling the volume of runoff generated by new land uses. The reasons for this are the following:

(1) Sources of fecal bacteria are widespread and will continue to persist. Bacteria come from wildlife, pets, and other warm-blooded animals. While this is a human health problem and such sources should be removed, it is difficult to reduce all of these sources to a level necessary to significantly improve water quality for shellfishing.
(2) Cleaning up shellfish and swimming waters by treating runoff to levels that comply with water quality standards for bacteria is not practical. The tidal waters need almost pristine water quality to allow for the harvest of shellfish and for swimming. While technology is available to properly clean runoff, retrofitting an already developed urban area with such systems can be prohibitively expensive to achieve sufficiently high removal rates necessary to meet shellfishing and swimming standards.
(3) Recontamination of treated runoff is extremely problematic. Even if it were cost effective to comply with water quality standards for shellfishing and swimming by treating runoff to remove bacteria, any "clean" runoff discharged back onto the landscape would then become a vehicle to transport downstream bacteria lessening the overall benefits of treatment.

Instead of attempting to eliminate all sources of bacteria, this Plan seeks to reduce the transport of bacteria by reducing the volume of surface runoff. The Plan has adopted a goal to reduce the volume of runoff from the one-year, 24-hour design storm in both watersheds by the amount that was generated by land uses in 1981, with interim goals based upon stormwater volumes generated from land uses that existed in 2010, 2006, 2002, and 1998. These dates roughly correspond with significant shellfish harvest closures that have occurred in the Hewletts Creek watershed.

These volume reduction goals were selected for both watersheds even though water quality impairments have existed in the Bradley Creek watershed since 1947. Shellfish harvest in Hewletts Creek has become increasingly impaired because of stormwater runoff since 1973, and there are sufficient data to calculate runoff volumes associated with land uses since 1981. The causes of impaired waters in the Bradley Creek watershed are much more complicated. Until the early 1980s, there were discharges of poorly treated sewage into these waters as well as increasing amounts of stormwater runoff. These waters have three classifications (SA, SB, and SC). While water quality in Bradley Creek is more degraded than in Hewletts Creek, there are much fewer legally "impaired" waters because of the extensive areas covered by the SC and SB classifications. The waters classified as "impaired" are only along the shoreline of the Town of Wrightsville Beach in Banks Channel. Thus, it was decided that using the same baseline years for both watersheds for setting stormwater reduction goals should be adequate to address these impairments within the Bradley Creek watershed. The Plan includes on-going evaluations to determine if this decision was correct, and reduction goals can be adjusted in the future if they are found to be too low or too high.

The long-term goal is to approach the pre-closure surface water hydrology for these two watersheds to the maximum extent feasible. In surface water hydrology, a hydrograph is a time record of the discharge of a creek. Rainfall is typically the main input to a watershed and the stream flow is the output of the watershed. A hydrograph is a representation of how creeks within watershed respond to rainfall.

How creeks within a watershed respond to rainfall depends on a variety of factors that affect the shape of a hydrograph. Many of these factors, such as geology, seasons, and weather, cannot be directly influenced by human activities. However, several key factors including land-use, vegetation, and soil compaction can be significantly modified by land uses. By working to restore the functional capacity of soils and vegetation in the watersheds to absorb and use rain, the hydrograph can be altered to begin to approach what it was in earlier years.

The Plan focuses on the use of decentralized stormwater reduction measures that aim to reduce stormwater runoff by infiltrating it back into the landscape where rain falls especially in those locations where low-cost retrofits offer highly effective opportunities. Where feasible, other fecal bacteria reduction practices, such as constructed wetlands that promote increased evapotranspiration, are advocated. Additional benefits of this Plan include reducing suspended solids, nutrients, and other pollutants in the creeks as well as reducing stream channel degradation by erosive forces.

To restore the creeks, the Plan relies on watershed-wide collaborations that integrate the activities, efforts, and resources of various individuals, organizations, and government entities. It recommends six management objectives and 35 specific actions to accomplish the goal of the Plan. While some of these management objectives and actions are currently being used and can be done with existing resources, others will require significant new resources to carry out. Needed resources in the form of staff, funds, partnerships, and time are outlined for each of the management actions contained in the Plan.

This plan incorporates all nine elements of a watershed management plan as required by EPA as necessary to qualify for 319 funding that is used to restore impaired waters. This plan will be used by the City of Wilmington and its partners as their restoration strategy for addressing the bacteria pollution that has caused “impaired” water quality in Bradley and Hewletts Creeks watersheds. The Plan is based on the following assumptions regarding changes in the watersheds:

(1) New development designed to minimum State and City stormwater requirements are assumed to have net-zero impact on the hydrograph of the one year, 24-hour design storm.
(2) New development that goes beyond minimum regulations has a positive effect that can be tracked.
(3) Increases in impervious surfaces without any additional treatment have negative impact that can be measured.
(4) Stormwater quality improvement projects that result in volume reductions have a positive impact that can be measured.
(5) Drainage or flood improvement projects have a neutral impact.
(6) Retrofits for existing developed areas have a positive impact.
(7) Volume assumptions are based upon the one-year, 24-hour event equaling 3.95 inches of rainfall.

In summary, the goal of this plan is to restore shellfish and swimming water quality impaired by unacceptable levels of bacteria in the surface waters within the Bradley Creek and Hewletts Creek watersheds. This will be accomplished by the following management objectives:

(1) Continuing existing programs that address water quality impairments in both watersheds.
(2) Determining appropriate water quality classifications and designated uses where water quality impairment exists.
(3) Reducing the transport of bacteria from land to water by reducing the volume of stormwater runoff.
(4) Focusing stormwater reduction efforts in locations where they yield the greatest and most cost effective stormwater volume reductions.
(5) Forming and maintaining partnerships to carry out the plan.
(6) Evaluating plan success and modifying these strategies and programs as needed.

Table 11. Summary of the Restoration Plan objectives and actions.

Objective	Action #	Specific Action	Timeline	Partners
1. Continue Existing Programs that Address Water Quality Impairments in Both Watersheds	Action 1-1	Implement and enforce existing stormwater requirements for new development and redevelopment	On-going	City of Wilmington – Stormwater Services, Engineering, Development Services; NC DWQ, WB
	Action 1-2	Continue to promote LID designs	On-going	City of Wilmington – Stormwater Services, Engineering, Development Services; NC DWQ, WB
	Action 1-3	Continue to cooperate with CCAP	On-going	City of Wilmington –Engineering, Development Services; NCCF, WB, New Hanover Soil & Water
	Action 1-4	Maintain existing educational programs	On-going	City of Wilmington - Stormwater Services; NCCF, New Hanover Soil & Water, WB
	Action 1-5	Reflect plan in other City plans and NPDES annual permit report	As plans are updated	City of Wilmington – Stormwater Services, Engineering, Development Services: WB, NCCF
	Action 1-6	Continue education and code enforcement programs that reduce and eliminate sources of bacteria and pathogens related to human and pet wastes	On-going	City of Wilmington – Stormwater Services; WB
2. Determine Appropriate Water Quality Classifications and Designated Uses Where Water Quality Impairment Exists	Action 2-1	Work with SS, UNCW, WB and NCCF to conduct preliminary evaluations of water quality to determine where more intensive state (SS) water quality investigations are needed	Year 1, establish preliminary monitoring	City of Wilmington –Stormwater Services; UNCW, SS, WB, NCCF
	Action 2-2	Work with SS to establish new monitoring stations within impaired waters influenced by the Bradley Creek watershed	Year 2 based upon preliminary monitoring	City of Wilmington –Stormwater Services; UNCW, SS, WB, NCCF
	Action 2-3	Work with SS to establish new monitoring stations within impaired waters influenced by the Hewletts Creek watershed	Year 2 based upon preliminary monitoring	City of Wilmington –Stormwater Services; UNCW, SS, WB, NCCF
	Action 2-4	Evaluate the results of bacterial source monitoring in Banks Channel that is being conducted by UNC-CH	Study underway, evaluate results in Year 1	WB, UNC-CH, UNCW, NCCF
	Action 2-5	Request Use Attainability Study on SA waters along Wrightsville Beach shoreline in Banks Channel. These waters are automatically closed to Shellfish Harvest due to marinas, and have been polluted since 1947.	Year 2	WB, NCCF, NC DWQ
	Action 2-6	Request Use Attainability Study on SB waters now “Approved” for shellfish	Year 2	City of Wilmington, WB, NCCF, NC DWQ

(cont'd) 2. Determine Appropriate Water Quality Classifications and Designated Uses Where Water Quality Impairment Exists		harvest in waters influenced by the Bradley Creek Watershed		
	Action 2-7	Determine if there is potential to restore shellfish harvest in any additional waters classified as SB that are influenced by the Bradley Creek watershed	Years 4-5	City of Wilmington –Stormwater Services; UNCW, SS, WB, NCCF
	Action 2-8	Evaluate the status and trends in bacteria contamination within the entire Hewletts Creek watershed based upon more intensive data collected as part of plan implementation	Year 5	City of Wilmington –Stormwater Services; UNCW, SS, NC DWQ, NCCF

3. Track the reduction of the transport of bacteria from land to water	Action 3-1	Secure and budget funds for retrofits in the Bradley Creek watershed, determine volume that can be reduced with funds, and track actual reductions using measurement tools	Secure funds years 1 & 2, design retrofits year 3, install and track reductions years 4 & 5	City of Wilmington –Stormwater Services; UNCW, SS, NC DWQ, NCCF
	Action 3-2	Secure and budget funds for retrofits in the Hewletts Creek watershed, determine volume that can be reduced with funds, and track actual reductions using measurement tools	Secure funds years 1 & 2, design retrofits year 3, install and track reductions years 4 & 5	City of Wilmington –Stormwater Services; UNCW, SS, NC DWQ, NCCF

4. Promote Stormwater Reduction Efforts	Action 4-1	Promote use of GIS web based retrofit Atlas	Each year	City of Wilmington – Stormwater Services, Engineering, Development Services; WB, NCCF
	Action 4-2	Investigate cost effective methods of working with landowners to disconnect impervious surfaces	Year 1 & 2	NCCF, City of Wilmington, WB
	Action 4-3	Promote LID retrofits within private development	Each year	City of Wilmington – Stormwater Services, Engineering, Development Services; WB, NCCF. Use existing educational programs to promote retrofits for volume reduction
	Action 4-4	Promote tree planting and retention	Each year	Wilmington Tree Commission; City of Wilmington - Development Services, Stormwater Services; Keep New Hanover Beautiful, NCCF, Cooperative Extension, WB
	Action 4-5	Promote stormwater reduction measures on City streets in future capital improvement projects	Dependent on Capital Improvement schedule	City of Wilmington - Stormwater Services, Engineering, Streets Divisions, Development Services; WB, NCCF
	Action 4-6	Pursue strategy with NCDOT to incorporate retrofits into highway upgrades	Years 1 – 5	City of Wilmington - Development Services, Stormwater Services; NCDOT, NCCF, WB
	Action 4-7	Promote LID retrofits in future publicly funded	Based upon project schedules	City of Wilmington – Engineering, Stormwater Services, Community

(cont'd) 4. Promote Stormwater Reduction Efforts		maintenance or redevelopment of City owned buildings, parks, parking lots, and drainage systems		Services, Development Services; WB, NCCF
	Action 4-8	Promote and assist with LID retrofits at county schools	Ongoing based upon efforts at schools	NCCF, New Hanover County School System, CCAP
	Action 4-9	Encourage UNC-W to develop campus wide master plan to retrofit to reduce stormwater volume	Year 3	City of Wilmington - Stormwater Services, Development Services; UNCW, NCCF
	Action 4-10	Evaluate properties for retrofit or restoration potential.	Year 2	City of Wilmington - Stormwater Services, Development Services; WB
	Action 4-11	Evaluate existing stormwater ponds on public and private properties for potential volume reductions enhancements, and if feasible, retrofit them to achieve volume reductions	Years 3 - 5	Evaluation potential retrofits, funds to retrofit will come through annual budgeting or from outside grant sources. City of Wilmington - Stormwater Services; WB, NCCF

5. Form and Maintain Partnerships	Action 5-1	Work with partners to educate stakeholders	Years 1 – 5	City of Wilmington - Stormwater Services, Development Services; NCCF, New Hanover Soil & Water, WB
	Action 5-2	Work with government agencies and NGOs to secure grants for retrofits and other programs	Years 1 – 5	City of Wilmington – Stormwater Services; Development Services; NCCF, WB, Cape Fear Public Utilities
	Action 5-3	Provide strategies and policies for city departments to carry out plan by incorporating runoff reduction strategies into the CIP process.	Years 1 – 5	City of Wilmington - Stormwater Services; Development Services, and Finance Depts.; NCCF
	Action 5-4	Promote use of atlas among key City departments in their routine business	Years 1 – 5	City of Wilmington - Stormwater Services, Development Services; NCCF, WB
	Action 5-5	Promote existing technical training opportunities to advance plan	Years 1 – 5	Special training arranged by partners using their own funds and grants, City of Wilmington - Stormwater Services, Development Services; WB, NCCF
	Action 5-6	Work with UNCW on retrofit projects	Years 1 – 5	grants, capital improvements City of Wilmington - Stormwater Services; UNCW, NCCF

6. Measure Success and Adapt Plan Based Upon Results	Action 6-1	Use atlas accounting system to track progress toward watershed goals.	Years 1 – 5	City of Wilmington - Stormwater Services, Development Services; NCCF, WB
	Action 6-2	Work with SS, WB, and UNCW to monitor water quality status and trends	Years 1 – 5	City of Wilmington - Stormwater Services, Development Services; NCCF, WB, UNCW
	Action 6-3	Conduct annual and five year assessment of plan's success and modify plan as needed	Yearly	City of Wilmington - Stormwater Services, Development Services; NCCF, WB, UNCW