

Pender County Planning and Community Development

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AGENDA Pender County Planning Board Tuesday, November 7, 2017 7:00 p.m. Pender County Public Assembly Room 805 S. Walker Street, Burgaw, North Carolina

Call to Order: Chairman Williams

Roll Call: Chairman Williams

Pender County Planning Board Members:

Williams: ___ Fullerton: ___ Baker: ___ Carter: ___ Jordan: ___ McClammy: ___ Nalee: ___

1. Adoption of the Agenda:

2. Adoption of the Minutes: (October 3, 2017 Meeting)

3. Public Comment:

4. Presentation:

Lauren Kolodij, Deputy Director, and Markio Polk, GIS Watershed Specialist, of the North Carolina Coastal Federation will present findings from the Draft Stump Sound Watershed Restoration Plan for portions of Onslow and Pender Counties.

(Public Hearings Opened)

5. Zoning Map Amendment:

Michael Nadeau, applicant, on behalf of Pratishtha Garg, owner, is requesting approval of a Zoning Map Amendment for one (1) tract totaling approximately ±3.52 acres from PD, Planned Development zoning district to OI, Office & Institutional zoning district. The subject property is located at 18676 US HWY 17, in the Topsail Township, along the east side of US HWY 17, approximately 200 feet north of the intersection of US HWY 17 and Long Leaf Drive (SR 1675) and may be further identified by Pender County PIN: 4204-41-2676-0000.

Anyone wishing to address the **Pender County Planning Board** shall make a request on the "Public Comment" sign-up sheet. Please provide the information requested.

If you wish to speak on *a specific public hearing item*, please sign-in on the appropriate "Public Hearing" sign-up sheet. Speakers will be allowed to speak *prior* to any action/vote taken by the Board.

*A time limit of **two** minutes per speaker or up to **ten** minutes for groups of five or more, with a designated speaker will be imposed.

6. Zoning Text Amendment:

Trask Land Company, applicant, is requesting the approval of a Zoning Text Amendment to the Pender County Unified Development Ordinance. Specifically, the request is to amend Section 8.3.2 'Interior Parking Islands' to revise the current requirements for parking terminals and landscape strips.

(Public Hearings Closed)

7. Discussion Items:

a. Planning Staff Items:

- i. Comprehensive Plan Update
- ii. Technical Review Committee Project Update
- iii. Stormwater Ordinance Update

b. Planning Board Members Items:

8. Next Meeting: December 5, 2017, Work Session at 6:00pm.

9. Adjournment:

Stump Sound Watershed Restoration Plan

The Town of Surf City, Onslow County, Pender County and the North Carolina Coastal Federation have partnered to develop a voluntary Watershed Restoration Plan for **Stump Sound**. This plan highlights water quality impairments in the watersheds and proposes voluntary strategies to reduce the volume of stormwater runoff to improve water quality. Having a plan better positions the town to receive grant funding for stormwater reduction projects. This plan is the result of a nearly two-year long process lead by the partners. The plan seeks to:

1. Restore and maintain water quality
2. Reduce instances of localized flooding
3. Prioritize cost effective stormwater retrofits

What is going on in the watersheds?

Water quality monitoring by the N.C. Division of Marine Fisheries indicates that local shellfishing and swimming waters are impaired because of stormwater pollution.

Proposed Solutions

The draft Watershed Restoration Plan includes strategies to restore hydrology and reduce polluted runoff. These include cost effective retrofits that direct stormwater to infiltrate into the ground or collect it for later use. The goal of the plan is to:

- “Turn back the clock” on water pollution
- Reduce instances of flooding
- Align future capital improvements with stormwater retrofits
- Increase community awareness
- Position the town for future funding opportunities

Sample Solutions and Plan

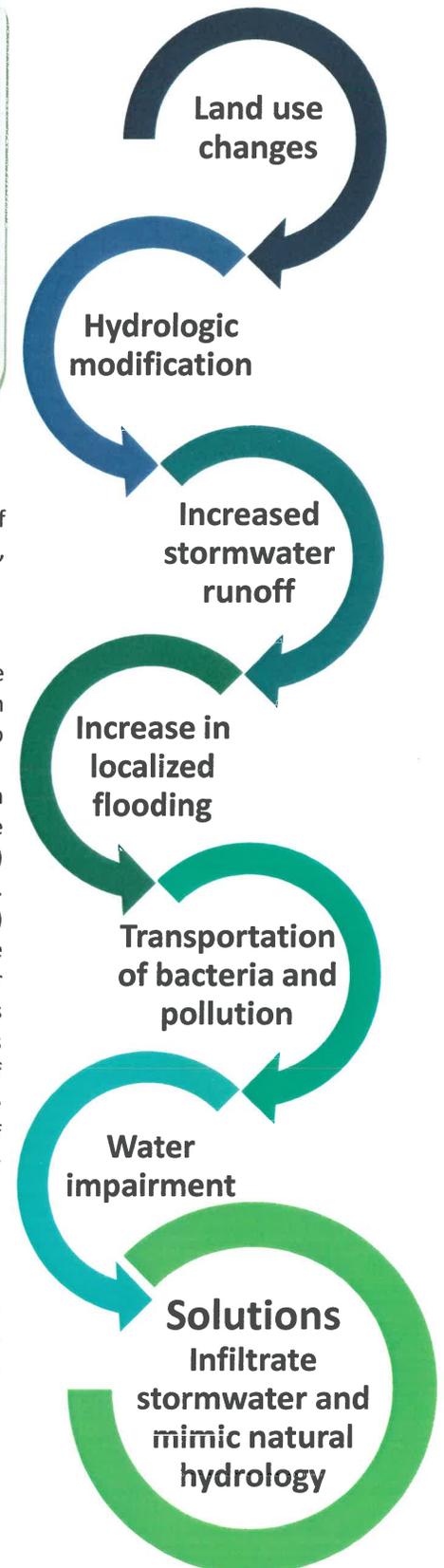
The region has several examples of successful stormwater reduction projects, including:

- Cisterns at Surf City Town Hall
 - Rain Gardens at Sneads Ferry Library
- These projects direct rain water to infiltrate into the ground instead of it flowing through ditches, pipes and stormwater systems into our local waters.

The Stump Sound Watershed Restoration Plan was prepared to meet the Environmental Protection Agency (EPA) Nine Minimum Elements and the N.C. Department of Environmental Quality (DEQ) Section 319 guidelines. Once approved, the partners will be positioned to apply for grants to implement the plan. The partners are committed to working with non-profits and state agencies, like N.C. Department of Transportation (DOT), to encourage projects to reduce the amount of stormwater runoff and improve local water quality.

What you can do

Stump Sound’s waters are an important economic resource for fishing, recreation and tourism. Ensuring this valuable resource has a healthy future will take community support. Help in the efforts by making your yard or business a Smart Yard. See the *Smart Yard* guide for simple solutions.



North Carolina
Coastal Federation
Working Together for a Healthy Coast

STUMP SOUND

DRAFT

NINE MINIMUM ELEMENTS WATERSHED RESTORATION PLAN

2017

Last Updated October 2017

Contributing Partners

Pender County
Onslow County
Town of Surf City
North Carolina Coastal Federation

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Acknowledgements

Kyle Breuer *Pender County*
Matthew Stuart *Onslow County*
Patrick O'Mahony *Pender County*
Todd Rademacher *Town of Surf City*
Lauren Kolodij *North Carolina Coastal Federation*
Mariko Polk *North Carolina Coastal Federation*
Caitlin Lashbrook *Graduate Intern, North Carolina Coastal Federation*
Michelle Shreve *Graduate Intern, North Carolina Coastal Federation*

Table of Contents

Table of Contents	2
Guide to Nine Minimum Elements	4
Introduction	5
1.1 Plan Rationale	5
2 Watershed Characterization	7
3 Volume Reduction Target	12
3.1 Stormwater Volume Reduction Calculation Methodology	12
3.2 Stormwater runoff Reduction load summary	13
4 Goals	15
4.1 Primary Goal	15
4.2 Objectives	16
5 Management Strategies	18
5.1 Funding Cost and Technical Needs	19
5.2 Education and Outreach	21
5.3 Monitoring	22
5.4 Milestones	24
5.5 Evaluation	25
5.6 Implementation Schedule	25
Acronyms and Definitions	30
Reference	33
Appendix A Watershed Description	35
Physical and Natural Features	35
Soils	36
Strategic Habitat Area Region 3	38
Biodiversity and Wildlife Habitat Assessment	39
Land Use	40
N.C. Coastal Federation Properties and Project Sites	41
Onslow Service Area	42
Pender Service Areas	42
Projected Growth	42
	2

Source Assessment	45
Nonpoint Source Pollution	45
Appendix B Regulatory	55
Water Quality Standards	57
Appendix C Runoff Volume Reduction	67
Batts Mill Creek Watershed	67
Everett Bay and Sound Watershed	68
Goose Bay and Sound Watershed	69
King Creek—Spicer Bay Watershed	70
Mill Creek—Alligator Bay Watershed	72
Morris Landing Watershed	73
Old Mill Creek Watershed	74
South Morris Landing Watershed	76
Permuda and Sound Watershed	77
Waters Bay-Surf City Watershed	78
Turkey Creek Watershed	79
Appendix D Potential Stormwater Incentive Strategies	81
Appendix E Green Street Stormwater Management Devices	94

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Guide to Nine Minimum Elements

This table serves as a quick reference guide to where the Environmental Protection Agency (EPA) Nine Minimum Elements within this watershed management plan.

	EPA Nine Minimum Elements	Section of Plan
1	Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan.	Section 1 Introduction, pp. 5-6 Section 2 Watershed Characterization, pp. 5-7 Appendix A: Source Assessment
2	An estimate of the load reductions expected from management measures.	Section 2 Reduction Load Target, p. 13-15 Appendix C Runoff Volume Reduction
3	A description of the nonpoint source management measures that will need to be implemented to achieve load reductions, and a description of the critical areas in which those measures will be needed to implement this plan.	Section 3 Goals, pp. 16-17 Section 4 Management Strategies, pp. 19-27
4	Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.	Section 4.1 Funding Cost and Technical Needs, pp. 19-20
5	An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.	Section 3 Goals: Goal 5 Section 4.2 Education and Outreach Program, p. 22
6	Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.	Section 4.6 Implementation Program, p. 27
7	A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.	Section 4.4 Milestones, p. 26
8	A set of criteria that can be used to determine whether load reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.	Section 4.5 Evaluation, p. 27
9	A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the established criteria.	Section 4.4 Monitoring, p. 24

Introduction

The Stump Sound Watershed Restoration Plan provides a voluntary management framework to address water quality impairments in 11 watersheds. The watersheds have experienced increased volumes of stormwater runoff from land use activities. This increased runoff transports bacteria and other pollutants causing surface water quality impairments. This plan includes strategies for restoring or mimicking the natural, pre-development hydrology of the watersheds prior to water quality impairment. Mimicking natural drainage processes can reduce runoff and nuisance flooding and help restore water quantity and quality requirements of receiving water bodies.

This restoration plan will be the beginning of a multi-year process to implement and maintain, manage, and mitigate stormwater runoff pollution. This plan combines low-cost, high-yield strategies such as community outreach initiatives and targeted retrofit projects aimed at reducing the impact of impervious surface by mimicking natural hydrology to reduce flooding, protect water quality, and provide the community with clean, usable waters. The nonregulatory *Stump Sound Watershed Restoration Plan* includes all Nine Minimum Elements of a watershed management plan as recommended by the EPA to qualify to be eligible to apply for federal 319 Grant funding opportunities. The information provided in this plan enables the participating partners to easily source technical information necessary to apply for other state and national grant opportunities.

1.1 PLAN RATIONALE

Conventional management approaches rely on peak flow storage and attempt to manage onsite flooding by removing stormwater from the site as quickly as possible. In this approach, stormwater is often directed to curb and gutter systems, where the untreated runoff is conveyed to the nearest receiving water. This approach can deter onsite, localized flooding but the downstream effects result in an increase in the magnitude and frequency of flooding. Conventional efforts to manage runoff throughout the coast have failed to prevent polluted stormwater from discharging contaminants into waterways. Shellfish closures and swimming advisories are a result of increased surface runoff. Restoration of water quality in tidal waters depends upon reducing the volume of stormwater.

A volume reduction strategy is necessary and it is important to recognize:

- (1) Sources of fecal bacteria are widespread. 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 not feasible to reduce all sources significantly enough to improve degraded water quality.
- (2) Improving shellfish and swimming waters by treating runoff to levels that comply with water quality standards for bacteria is not practical. While technology is available to treat stormwater runoff, tying in an already developed urban area with a stormwater treatment facility can be cost prohibitive to achieve sufficiently high removal rates necessary to meet designated water quality standards.
- (3) Recontamination of treated runoff is extremely problematic. Even if it were cost effective to treat 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.

Additionally, conventional stormwater control systems are often designed to manage peak flow during a singular major designed storm event, such as flood prone areas. These systems are often designed with the intent that large amounts of stormwater is quickly moved downstream into the receiving waterways slowing the impact of flooding in major storm events. Conventional stormwater control systems can degrade natural stream systems by causing bank erosion. Control systems that focus on larger storms are often oversized and do not address the management of runoff caused by smaller storm events or water quality. The proactive use of LID and stormwater retrofits throughout an area has been shown to control both small and larger storms by restoring an area's natural hydrology. LID and stormwater retrofits can be used in tandem with conventional control systems.

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2 Watershed Characterization

The Stump Sound Watershed encompasses the following local governments: unincorporated Sneads Ferry, the Town of North Topsail Beach, the Town of Holly Ridge and the Town of Surf City in Pender and Onslow County, North Carolina (Figure 2-1). Stump Sound Watershed is comprised of 11 smaller watersheds. These watersheds span across 28,689.07 acres. Land use over the past two decades has resulted in an increase in impervious surfaces throughout the watershed, which has increased the amount of polluted stormwater runoff that is transported to Stump Sound waters, part of the Intracoastal Waterway. Good water quality helps support the local economy that depends on recreation, tourism, commercial and recreational fishing and shellfishing.

Stump Sound Watersheds

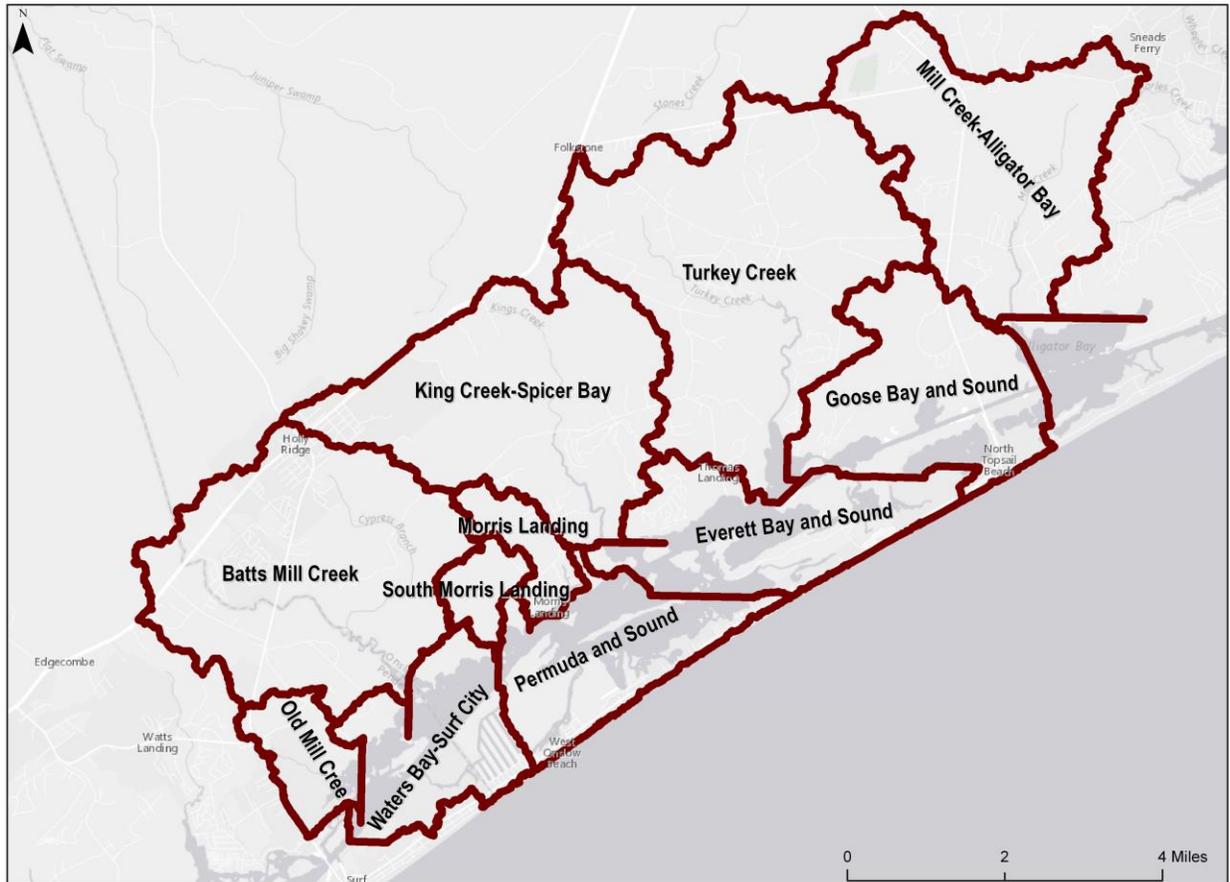


Figure 2-1. Map of the Stump Sound Watersheds.

The watersheds are part of the **White Oak River Basin** (see more in Appendix A). The Stump Sound Watershed is within the Ashe Island-Stump Sound **12-HUC 030203020301** watershed. The following is a summary table of water quality in the watersheds (Table 2-1). The Stump Sound waters listed below are considered Conditionally Approved Open, which means that direct contact and shellfishing is safe. Additional watershed characterization information can be found in Appendix A, including information on shellfish growing area boundaries, habitat biodiversity, area land uses, and more.

Table 2-1.

Summary of Water Quality in Stump Sound Watersheds.

<i>Watershed</i>	<i>Total Acres</i>	<i>Shellfish Closure Year (Specific Location)</i>	<i>Overall Shellfish Growing Area Status</i>
Waters Bay-Surf City	2,565.65	1992 (Old Settlers Canal); 2004 (Sears Landing, Waters Bay)	Conditionally Approved Open
South Morris Landing	423.61	--	Conditionally Approved Open
Old Mill Creek	699.77	--	Conditionally Approved Open
Goose Bay and Sound	2,365.34	--	Conditionally Approved Open
Morris Landing	534.15	--	Conditionally Approved Open
Everett Bay and Sound	1,541.51	1996 (Rogers Bay)	Conditionally Approved Open
Turkey Creek	5,643.19	1992 (prohibited)	Conditionally Approved Closed
Mill Creek-Alligator Bay	3,896.18	1965 (Mill Creek Prohibited)	Alligator Bay: Conditionally Approved Open
King Creek-Spicer Bay	4,155.21	1965 (Prohibited King Creek and Spicer Bay)	Conditionally Approved Closed (Spicer Reopened in 1984 then Conditionally Approved closed in 1996)
Batts Mill Creek	4,683.87	2004	Conditionally Approved Closed
Permuda and Sound	833.08	--	Conditionally Approved Open

The EPA Waterbody Quality Assessment Report 303(d) List identifies that nearly all Stump Sound water bodies are impaired waters for their designated uses (Figure 2-2, Table 2-2; see Appendix B for water quality regulation).

Water Quality Assessment

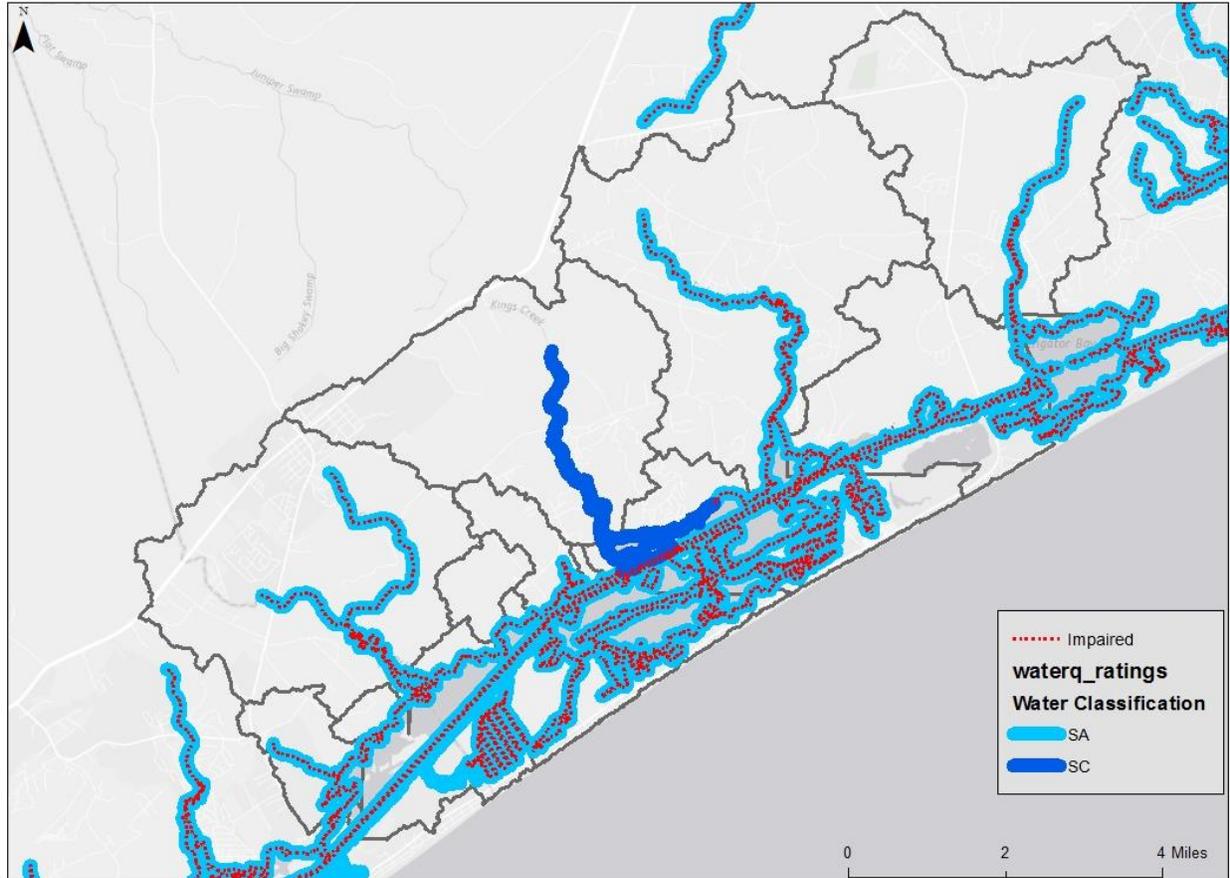


Figure 2-2. Map of Water Quality Assessment of Stump Sound (see Appendix B for description of regulation categories).

Table 2-2.

List of Category 5 Impaired Waters in Stump Sound from 2014 Water Quality Assessment 303(d) List from North Carolina DEQ.

Assessment Unit Number	Name	Description	Acres	Classification	Year Placed on 303(d)	Cause
18-87	Intracoastal Waterway	From southern edge of White Oak River Basin to Morris Landing	76.17	SA; HQW	2010	Fecal
18-87-(5.5)	Intracoastal Waterway	From Morris Landing to the eastern mouth of Old Topsail Creek	159.6	SA; HQW	2006	Fecal

		Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)				
18-87.11.7e	Topsail Sound and Middle Sound ORW Area	Prohibited area at mouth of Mill Creek. Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2.7	SA; HQW	2006	Fecal
18-87-0.5	Stump Sound ORW Area	All waters between the s edge of the White Oak RB to the western end of Permuda Is. exclusive of the restricted area. Shellfish Conditionally Approved Open (Fecal, SH, SA)	939.9	SA; ORW	2006; 2014	Fecal; Enterococcus
18-87-10a2	Topsail Sound	Sound south of ICWW and east of NC50 Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	88.9	SA; HQW	2014	Fecal
18-87-10a3	Topsail Sound	Prohibited area around 210 bridge Shellfish Growing Area-Prohibited (Fecal, SH, SA)	3.2	SA; HQW	2014	Fecal
18-87-10a5	Topsail Sound	Surf City Marina. Shellfish Growing Area-Prohibited (Fecal, SH, SA)	2.4	SA; HQW	2014	Fecal
18-87-10a5	Topsail Sound	Conditional area at Surf City Marina. Shellfish Growing Area-Shellfish Growing Area-Conditionally Approved	2.7	SA; HQW	2014	Fecal
18-87-10	Topsail Sound	Prohibited areas at Queens Grant and Hwy 210 Bridge	56.20	SA; HQW	2006	Fecal
18-87-10c	Topsail Sound	Entire Sound north of ICWW Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	1144.5	SA; HQW	2006	Fecal
18-87-10d	Topsail Sound	Conditional areas at mouth of Batts Mill Creek and at Hwy 210 Bridge Shellfish Conditionally Approved Open (Fecal, SH, SA)	12.7	SA; HQW	2006	Fecal
18-87-10d	Topsail Sound	Conditional areas at mouth of Batts Mill Creek and at Hwy 210 Bridge. Shellfish Growing Area-Shellfish Growing Area-Conditionally Approved	12.7	SA; HQW	2006	Fecal
18-87-1a	Turkey Creek	From source to 0.25 miles inland of Intracoastal Waterway to ICWW Shellfish Conditionally Approved Open (Fecal, SH, SA)	79.5	SA; ORW	2006	Fecal
18-87-1b	Turkey Creek	From 0.25 miles inland of ICWW to Intracoastal Waterway Shellfish Conditionally Approved Open (Fecal, SH, SA)	59.6	SA; ORW	2006	Fecal
18-87-2	Everett Bay	Entire Bay Excluding That Portion In King Creek Restricted Area	59.8	SA; ORW	2006	Fecal
18-87-3	Stump Sound	Entire Sound excluding that portion of King Creek Restricted Area. Shellfish Conditionally Approved Open (Fecal, SH, SA)	87.3	SA; ORW	2002	Fecal
18-87-5	Hardison Creek	From source to Intracoastal Waterway	11.60	SA; HQW	2008	Fecal
18-87-6	Batts Mill Creek (Barlow Creek)	From source to Intracoastal Waterway Shellfish Growing Area-Shellfish Growing Area-Conditionally Approved	40.8	SA; HQW	2006	Fecal
18-87-6-1	County Line Branch	From source to Batts Mill Creek	1.0	SA; HQW	2006	Fecal
18-87-6-2	Cypress Branch	From source to Batts Mill Creek	1.0	SA; HQW	2006	Fecal

18-87-7	Old Mill Creek	From source to Intracoastal Waterway Shellfish Growing Area-Conditionally Approved Open (Fecal, SH, SA)	0.1	SA; HQW	2006	Fecal
19-39-0.5	Intracoastal Waterway	From northeastern boundary of Cape Fear River Basin to Daybeacon #17 including all unnamed bays guts and channels	84.63	SA; HQW	2002	Fecal
19-39-2	Goose Bay	Entire Bay	38.64	SA; HQW	2013	Fecal
19-39-1a	Rogers Bay	At mouth	3.96	SA; HQW	2013	Fecal

Note: From 2014 Water Quality Assessment 303(d) List from North Carolina DEQ (2014).

Shellfish closures and swimming advisories are indicators of poor water quality. Stormwater runoff is the primary contributing factor to the degradation of water quality. Historic water quality records from the N.C. DWQ and Shellfish Sanitation show that increased pathogen indicators in the creeks corresponds to increased urbanization of the watershed (see Appendix A for non-point source reports in detail). No additional non-point source or point source pollutants have been identified as causing impairments other than bacteria, which is being transported by stormwater. Both point and non-point source areas of interest have been identified and listed in Appendix A; including possible animals, subdivision, wastewater management, and other potential sources of pathogens.

Land use change has reduced the area's ability to infiltrate runoff. Instead of rainfall being infiltrated into the ground and vegetation, stormwater runoff flows quickly over impervious surfaces and into waterbodies with limited opportunity to naturally absorb into the environment thus increasing the volume of water being transported and aggravating instances of localized flooding. As water travels across hard, impervious surfaces, bacteria and other pollutants are collected and transported through stormwater connected conveyance systems, such as curbs, pipes, and ditches directly to our waterways. The reduction of stormwater volume is the most beneficial and cost-effective way to minimize bacteria and other pollutants (such as total suspended solids, nutrient, and harmful constituents like oils, heavy metals, and chemicals) and can reduce localized flooding.

Restoration of pre-development, natural hydrology can result in less bacteria and other pollutants in coastal waterways. Bacteria is affected by the following factors: the natural mortality of fecal coliform and enterococcus bacteria, the prevention of bacteria and pollutants from entering waterbodies and the reduction in the velocity of waters traveling off the landscape resulting from lower flows. Infiltration of rainfall into the ground serves as an extremely effective filtration system of bacteria and pollutants. Additionally, once bacteria enter the landscape they are subject to higher rates of mortality from the sun's ultraviolet radiation. Reducing the flow velocity of stormwater reduces the discharge of bacteria and other pollutants into surface waters.

3 Volume Reduction Target

Rather than focusing on reducing sources of pollutants from stormwater runoff, *the proven management techniques used in this plan focus on reducing the overall volume of stormwater runoff in order to limit the conveyance from the land into coastal waters.* Low-impact development (LID) and stormwater reduction techniques can achieve this goal by replicating the natural hydrology and increasing infiltration of water into soils. LID practices are a form of land planning and engineering that primarily focuses on mimicking natural hydrology of the area to limit stormwater runoff. For already developed locations stormwater reduction techniques can reduce the amount of stormwater entering waterways. The result of implementing stormwater control practices is that less bacteria and pollutants are transported off the land and into water systems. The primary issue to be addressed through the stormwater runoff volume reduction methodology is the reduction of fecal coliform contamination caused by urban development within the watershed (Table 3-1). Stormwater runoff is the direct cause of increased fecal coliform contamination within Stump Sound watersheds.

Table 3-1.
Identifying and linking concerns, causes and indicators.

Issue	Source of Issue	Quantify Issue Indicators
Water quality is impaired and not meeting its Designated Use standard of Class SA	Non-point source bacteria transported by stormwater runoff	<ul style="list-style-type: none"> Fecal coliform cannot exceed GM of 14/100 ml
Instances of localized flooding	Volume of stormwater runoff due to impervious surfaces	<ul style="list-style-type: none"> Volume of water

3.1 STORMWATER VOLUME REDUCTION CALCULATION METHODOLOGY

The process of calculating stormwater runoff volume reduction goals has been standardized utilizing instructions developed by the North Carolina Coastal Federation, a non-profit organization dedicated to preserving and protecting North Carolina’s coast, and WithersRavenel, a civil and environmental engineering firm. Utilizing aerial imagery of the baseline year (or the earliest available aerial imagery of the watershed), land characterization was conducted by delineating parcel information, development (pervious, impervious), and soil characteristics (HSG) for each land use scenario (each aerial imagery year). The delineated land use parcels were then analyzed to estimate the average percent impervious coverage. Summations were calculated of overall percent coverage based on land use and soil. From this information, the runoff curve number is calculated then runoff depth is calculated for the 1-year, 24-hour depth of precipitation using formulas developed by the United States Department of Agriculture Natural Resource Conservation Service (USDA NRCS) in the *TR-55 Manual*. A runoff curve number (commonly referred to as CN) is a numeric parameter derived from combining the effects of soil, watershed characteristics, and land use. The following curve numbers were utilized:

Land Use Classification	HSG
-------------------------	-----

	A	B	C	D
Impervious	98 CN	98 CN	98 CN	98 CN
Open Space	39 CN	61 CN	74 CN	80 CN
Woods	30 CN	55 CN	70 CN	77 CN

The following designations were utilized to categorize land use in the Stump Sound Watershed:

Land Use Classification	Designation
Impervious	Areas with distinctive impervious coverage from paved parking lots, roofs, driveways, curbs, etc.
Open Space	Grassy areas where there is 75% or more grassy space such as from lawns, parks, golf courses, cemeteries, fields, pastures, etc.
Woods	Forested areas with thorough coverage, these areas are often protected from grazing, and forest litter and brush adequately cover the soil.

The resulting value is then multiplied by the area of the watershed, which will give the total estimated stormwater runoff volume anticipated in response to the prescribed depth of rainfall over a 24-hour period.

The volume difference between the baseline year and the analyzed year is calculated to determine the estimated volume of stormwater runoff that needs to be reduced to replicate pre-impairment conditions.

NOAA precipitation models state that a 1-year, 24-hour storm event for Stump Sound results in **3.72 inches of precipitation**. The 1-year, 24-hour storm event is used because it has been established as the maximum storm parameter possible to protect shellfishing waters (Class SA) in North Carolina by DEQ.

3.2 STORMWATER RUNOFF REDUCTION LOAD SUMMARY

The Table 3-2 is a summary of all 11 watersheds reduction load goals for each watershed during a 1-year, 24-hour storm event. Refer to Appendix C for detailed stormwater runoff calculations for each watershed. The follow volume reduction results represent base numbers of volumetric changes between the years based on land use changes. These volumetric reduction goals do not take into consideration more complex nuances, such as changes in stormwater regulation or minor or major stormwater reduction and retrofit projects. This subtly is address through the goals and objectives discussed in the following section, where an inventory of stormwater reduction measures throughout each watershed should be taken and volumetric credit should be accounted for towards meeting the volume goals. These general reduction volumetric goals represent an overarching and consistent pattern throughout the watersheds of land use changes resulting in an increase in stormwater runoff and an increase in the number of closures.

Table 3-2.

Summary of reduction loads for all watersheds during a 1-year, 24-hour storm event.

Watershed	Total Acres	Runoff 1998 (acre-feet)	Runoff 2015 (acre-feet)	Reduction Goals		
				Acre-Feet	Cubic Feet	Gallons
Waters Bay-Surf City	2,565.65	237.59	238.70	1.11	48,388.41	361,945.33
South Morris Landing	423.61	29.93	31.18	1.25	54,470.22	407,437.21
Old Mill Creek	699.77	51.66	52.97	1.31	57,007.53	426,416.31
Goose Bay and Sound	2,365.34	227.12	229.03	1.90	82,951.99	620,480.86
Morris Landing	534.15	46.21	48.59	2.38	103,814.80	776,534.73
Everett Bay and Sound	1,541.51	125.14	133.99	8.85	385,521.41	2,883,700.17
Turkey Creek	5,643.19	338.93	350.31	11.37	495,278.26	3,704,681.41
Mill Creek-Alligator Bay	3,896.18	349.20	362.04	12.83	558,982.28	4,181,187.43
King Creek-Spicer Bay	4,155.21	363.69	379.86	16.17	704,484.59	5,269,544.70
Batts Mill Creek	4,683.87	443.16	459.37	16.18	704,732.25	5,271,397.20
Permuda and Sound	833.08	80.01	110.53	30.52	1,329,260.27	9,942,886.81

4 Goals

All participating partners seek to utilize various voluntary stormwater reduction techniques to reduce stormwater runoff by a total of **33,846,212.16 gallons** in the Stump Sound Watershed during a 1-year, 24-hour storm. Volume reduction will be achieved by:

- (1) Tally the volume that's being collected by existing stormwater retrofit (current projects are not included in the reduction estimate);
- (2) Installing new targeted stormwater reduction techniques in the watersheds;
- (3) Engaging the community in plan implementation.

4.1 PRIMARY GOAL

The goal of this plan is to reduce water quality impairments within the Stump Sound Watershed. This goal will be accomplished over the coming **30 years** by achieving objectives and management actions identified below (Table 4-1). Over time, reductions in the volume of stormwater runoff will be achieved through implementation of this plan and will result in measurable water quality improvements, realized by gradual increases in opportunities to harvest shellfish in Stump Sound. All participating jurisdictions will work collaboratively and individually to achieve the goal and objectives of the plan.

Table 4-1. The primary goal of the watershed management plan and the objectives.

Proposed Primary Goal	
Restore impaired water quality in eleven Stump Sound watersheds.	
OBJECTIVES	
1	New development and redevelopment should not create additional water quality impairments.
2	Seek opportunities for reducing the volume of stormwater runoff from existing private land uses.
3	Seek opportunities to apply stormwater reduction techniques on public properties.
4	Conduct periodic monitoring and review to ensure the goal and objectives of the plan are being met.
5	Educate the community about stormwater pollution and volume reduction needs and engaged in accomplishing the plan objectives.

4.2 OBJECTIVES

Objective 1. New development and redevelopment should not create additional water quality impairments.

Action #	Specific Action
1-1	Participating jurisdictions will review existing codes and ordinances to determine impediments to low impact stormwater designs for new development and redevelopment. Participating jurisdictions will consider amending codes and ordinances that inhibit LID design.
1-2	Participating jurisdictions will consider implementing local stormwater reduction incentives for new development and redevelopment (see Appendix D for suggestions on various incentives).

Objective 2. Seek opportunities for reducing the volume of stormwater runoff from existing private land uses.

Action #	Specific Action
2-1	Identify potential retrofit projects with willing private partners in each watershed.
2-2	Seek funding opportunities for identified stormwater retrofit projects on private lands.
2-3	Participating jurisdictions will educate landowners to disconnect impervious surfaces or minimize stormwater runoff from their property, and will consider implementing incentives for landowners to reduce the amount of stormwater runoff from their property (see Appendix D for various strategies).

Objective 3. Seek opportunities to apply stormwater reduction techniques on public properties.

Action #	Specific Action
3-1	Participating jurisdictions will regularly review capital improvement plans to consider the incorporation of stormwater reduction techniques.
3-2	Identify potential stormwater reduction projects at existing streets, rights-of-way, buildings, parks, parking lots, drainage systems, and other public properties. Prioritize retrofits at public buildings and properties that can serve as demonstration sites of stormwater retrofits. Additionally, coordinate with N.C. Department of Transportation on TIP or any other department projects.
3-3	Secure funds for stormwater retrofits at public properties.

Objective 4. Conduct periodic monitoring and review to ensure the goal and objectives of the plan are being met.

Action #	Specific Action
4-1	Participating jurisdictions will maintain a simple inventory and monitor performance of stormwater reduction retrofits that have been installed within the watersheds.
4-2	Review and update the plan as necessary based upon findings from water quality data and the status of implementation.
4-3	Document the volume of stormwater reduced by each retrofit by utilizing the <i>Runoff Reduction Calculator Tool</i> or <i>Watershed EZ</i> , or similar volume reduction calculation tools.

Objective 5. Educate the community about stormwater pollution and volume reduction needs and engaged in accomplishing the plan objectives.

Action #	Specific Action
5-1	Coordinate education and outreach throughout Stump Sound by creating an education committee who will develop a uniform education and outreach plan for Stump Sound.
5-2	Participating jurisdictions will seek opportunities to offer technical training for planners, engineers, developers, landscapers and local government staff on stormwater volume reduction techniques.



5 Management Strategies

The nonregulatory management solutions, strategies, and techniques within this section are strictly intended to identify potential opportunities that the participating jurisdictions can consider based on the information compiled during the development of this restoration plan. The solutions listed are general in scope and do not reflect actual projects that are being implementation. Before implementing any project or management solution, further consideration and research is recommended on individual site feasibility, consultations with engineers and other relevant professional, consideration of the effects of the proposed project on the community and watershed, and true economic costs of implementing a project.

Table 5-1 presents a variety of project ideas that can be considered as funding becomes available. The Lifespan, represents the national average project longevity when regular maintenance occurs. The Estimated Cost does not incorporate staff time of partners involved or volunteer time and strictly considers cost of materials and professional labor to install a project. The Estimated Costs are based on national averages from the Center for Neighborhood Technology and do not reflect actual bids or local averages. Estimate Cost reflect total cost to install or execute all components of the Action and Indicator (it does not reflect each individual installation but the installation of all Indicators). The Maintenance Schedule column should be taken into consideration as part of the technical needs of the plan. Additional types of projects and their associated costs are presented in Table 5-2.

Table 5-1. Stormwater management strategy ideas and associated costs and needs^{1,2}.

Management Strategy Idea	Lifespan ¹ (approx. years)	Maintenance Schedule	Estimate Cost ²	Indicator
Install stormwater signs at public docks and parks	30	Annually assess of signage, incorporate with regular landscape maintenance schedule	\$5,000	# of 10 signs installed
Printing of <i>Smart Yard</i> and other educational material prints made available at Libraries, Town Halls, events, and other public locations	N/A	Annually provide additional prints to Public buildings	\$5,000	# of prints
Install downspout retrofit at Libraries, Fire Stations, Police Stations, Schools and Town Halls , and other public buildings	50	Annually, incorporate with regular building maintenance schedule	\$2,000	# of 10 retrofits
Install rain cisterns at Town Halls and Fire Departments	30	Annually, incorporate with regular building maintenance schedule	\$10,000	# of 10 cisterns
Install raingarden at Library, Town Halls and Schools	25	Annually, incorporate with regular landscape maintenance schedule	\$7,000	# of 5 rain garden and signs

¹ Lifespan average approximation derived from:
Green Values Stormwater Calculator [Program tool]. (2016). Center for Neighborhood Technology.
Retrieved from <http://greenvalues.cnt.org/>

Replace parking lot with permeable pavement at libraries, Town Halls and Police stations	25	Annually, incorporate with regular building maintenance schedule	\$50,000-\$100,000	# of 3 parking lots installed and signs
Remove curb in public parking lot and replant with native plant garden or rain garden	25	Annually, incorporate with regular landscape maintenance	\$2,000	# of 1 gardens
Shade tree planting along Highways	30	Monthly, incorporate with regular landscape maintenance	\$5,000	# of 50 trees planted
Install animal waste station receptacles at parks and docks	20	Monthly, incorporate bag replacement with regular trash schedule	\$5,000	# of 10 pet waste stations
Install native plants at Town welcoming signs	20	Monthly, incorporate with regular landscape maintenance	\$3,000	# of 6 native plant gardens
Installation of living shorelines projects at or near stormwater runoff outflows	30	Annually, replantings may occur, structure enhancement as necessary	\$125,000	# of 7 living shoreline projects

Note²: Estimations from Green Values National Stormwater Management Calculator based on national averages.

5.1 FUNDING COST AND TECHNICAL NEEDS

The total cost to implement a project varies greatly due to parameters such as site characteristics, size of project, design complexity, labor and materials, changes in the cost of goods and services market, and other parameters. As such, once a project is selected, the partners of the projects will need to determine project estimates. Project partners can explore various funding sources on a project by project basis. The information compiled within this plan will serve as a source when developing funding proposals.

Presently, technical needs for all projects include receiving true project estimates based on site conditions and potentially, input of professional construction or engineering knowledge as some projects will require this level of expertise. Additional technical needs include the development of project partnerships with state agencies, local organizations, or academia professionals who can provide expertise. The Maintenance Schedule column of Table 5-1 should be taken into consideration as part of the technical considerations of the plan as maintenances requires forethought to ensure funding and technical skills are available for the duration of the life cycle of the projects. Table 5-2 should be taken into consideration when determining maintenance costs of each project. Several projects rely on using the in-kind services of volunteers to complete projects. Projects such as downspout retrofit installation, rain garden installation, and living shoreline installation; can utilize in-kind volunteer services to build and conduct maintenance, which can potentially decrease project costs. Additionally, consideration should be given to the amount of staff time that will be dedicated by the town and its partners on each project. Other various project based needs include the potential need to conduct soil surveys and water table survey of a site to accurately determine the potential for water infiltration, this will aid in more accurately determining how well certain retrofits will perform at certain sites.

Table 5-2. Approximate cost per unit of various stormwater retrofit techniques.

Stormwater Retrofit Technique	Approximate Cost per Unit ²	Maintenance Cost
Amend Soil	\$15-\$60 per cubic yard	\$.02 per cubic yard
Curb Cuts	\$5-\$25 per ft ²	\$.30-\$.60 per ft ²
Bioswale (for parking lot or roadside)	\$6-\$24 per ft ²	\$.06-\$.21 per ft ²
Native Plants	\$.02-\$.15 per ft ²	\$.03-\$.08 per ft ²
Permeable pavement	\$5-\$12 per ft ²	\$.01-\$.22 per ft ²
Planter Boxes	\$.55-\$24 per ft ²	\$.04-\$.1 per ft ²
Rain garden	\$5-16 per ft ²	\$.30-\$.60 per ft ²
Rainwater harvesting	\$200/rain barrel \$1,000/1400-gal cistern \$10,000/10,000-gal cistern	\$0 \$0 \$0
Reroute downspout	\$9/downspout	\$0
Tree Box Filter	\$70-\$600 per ft ²	\$.3-\$14 per ft ²
Trees	\$100-400 each	\$.20 each
Vegetated Filter Strips	\$.03-\$.33	\$.07 per ft ²

Note: Estimations from Green Values National Stormwater Management Calculator based on national averages.

² Cost average approximation derived from:
Green Values Stormwater Calculator. (2016). Center for Neighborhood Technology. Retrieved from http://greenvalues.cnt.org/national/cost_detail.php

5.2 EDUCATION AND OUTREACH

The targeted audience of education and outreach for Stump Sound Watershed is the community, which include residents of the watershed, business owners and K-12 students. Partnerships with public schools are an effective means of engaging the community and implementing education and outreach objectives. According to statistics from the United States Census Bureau, 77% of adults are married and 56% of adults who reside within the watershed have children being between the ages of 6 to 17 years old. Education and outreach activities should keep this in mind and emphasis should be placed on family-friendly projects such as rain garden and living shoreline projects. Stump Sound Watershed has a mixture of renters and homeowners residing within its boundaries.

Education and outreach to the community can encourage the use of residential stormwater retrofits such as disconnecting downspouts, planting native plants, installing rain barrels, and other techniques. Residents, whether renting or homeowners, can be encouraged to understand how their homes and properties contribute to the water quantity and quality of the watersheds. This information can potentially be disseminated to residents through the following techniques, further research and collaboration with environmental educators should be considered before beginning an outreach project:

- Distribution of the *Smart Yards* informational booklet developed by the North Carolina Coastal Federation. The *Smart Yards* booklet can be mailed directly to all residents or can be made available at public buildings like the Town Hall.
- Presentations on residential solutions at public town meetings on a regular basis.
- Encourage residents to attend or participate in project demonstrations and installation at public buildings to learn how to install retrofits.
- Install educational signs about stormwater runoff at public areas such as: Town Hall, town parks, and other areas that are frequented by residents.
- Present an article about residential stormwater issues in the town paper, social media, or newsletter.
- Outreach to subdivision homeowner's associations to encourage stormwater and water quality education and disconnecting impervious surfaces.

5.2.1 Businesses, Developers, and Commercial Land Owners

There are many businesses and commercial land owners within Stump Sound Watershed. Commercial areas account for some of the largest continuous, non-disconnected areas of impervious surfaces. Businesses could be encouraged to participate in retrofits at public and commercial properties. Education and outreach to businesses, developers, real estate agents, landscapers, and commercial landowners can focus on the disconnection of impervious surfaces, capital improvements, and LID techniques for new development. The town could offer incentives to encourage businesses to install these techniques (see Appendix D). Various methods could be used to educate the business community, examples include:

- Encourage businesses to host *Smart Yards* or other stormwater information for distribution to the community.
- Meet with businesses to encourage participation and discuss potential retrofits that align with their capital improvement plans.

- Conduct meeting for businesses and commercial land owners to educate them on stormwater issues and to promote LID techniques.
- Encourage businesses, developers, and others to attend *Low Impact Development for Water Quality Protection Workshop*, hosted by NC Coastal Reserve, or similar workshops that educate attendees on stormwater management solutions.
- Invite businesses to participate or sponsor events, such as stormwater retrofit installations, to encourage community involvement and cooperation.
- Encourage those who are interested in retrofits that increase green space and permeable surfaces. Retrofits can vary from small-scale solutions like planting shade trees, installing box planters or installing rain gardens to large-scale solutions like converting retention ponds into constructed wetlands.
- Encourage businesses with large parking lots to remove curbed medians and replace them with rain gardens, swales, or permeable pavement.
- Encourage businesses to install signs of their retrofit accomplishments. Create a recognition award for those who install retrofits.
- Survey businesses, developers, and commercial land owners to determine the number of retrofits that have been installed. Determine if resident knowledge has expanded.

5.2.2 Stump Sound K-12 Students

Water quality education for students is not only beneficial for the long-term integrity of the watershed but for North Carolina. School campuses would be an ideal location for several structural projects and community outreach efforts. Local businesses can be encouraged to sponsor student service projects such as rain garden installation. Example projects such as permeable pavement and downspout retrofits with signs could also be installed. Education and outreach to students can focus on stormwater, water quality, and non-structural retrofit lessons that students can relay to their families or strategies they can implement at their homes. Students can be encouraged to understand their role within the watersheds. Collaboration with environmental educators should be considered before beginning an outreach plan:

- Development of age appropriate lessons associated with demonstration sites in the watershed.
- Encourage class participation in the installation of rain gardens, downspout disconnection, and other retrofit techniques as service projects or field trips.
- Present an article in the school's newsletter for parents to encourage family discussion.

5.3 MONITORING

Shellfish Sanitation and Recreational Water Quality section of the Division of Marine Fisheries (DMF) is responsible for monitoring the bacteria levels in coastal waters and has the authority to close waters to shellfishing and issue swimming advisories when bacterial levels are unacceptable. This is accomplished through monitoring water quality conditions at over a thousand stations for shellfishing and 204 stations for swimming. In addition, every three years N.C. Shellfish Sanitation staff ground truth the entire shoreline of shellfish growing areas to document current and potential pollution sources. The data collected by Shellfish Sanitation is publicly available and is a source of historical and present-day information regarding water quality of an area. By utilizing data that has already been collected,

communities can research and develop plans without implementing extensive and costly data collection and monitoring programs. Shellfish closure area information can be used by communities to determine what waterways are impaired and to what extent the waterway is being affected. These up-to-date surveys and monitoring station data will be the primary source of information.

Monitoring will be conducted by using the indicators listed in Table 5-3 that are both qualitative and quantitative measures of changes within the watershed.

Table 5-3. The primary indicators and how to measure the indicators.

Primary Indicators				
Reduce stormwater runoff volume to restore water quality				
	Indicator	Measured by	Collected by	Collection Cycle
1	Fecal Coliform	Comparing numerical historical data and modern measurements of fecal coliform for changes in impairment frequencies and quantity of bacteria per sample.	Shellfish Sanitation	Yearly; reports released every 3 years.
2	Stormwater Runoff Volume	Applying stormwater reduction techniques and determining how much stormwater is reduced by the techniques; these measures should attempt to reduce current stormwater runoff volume to the levels of the baseline year.	Partners	Upon completion of projects.

The following is a list of existing water monitoring stations identified through Storage and Retrieval for Water Quality Data (STORET) system and N.C. Shellfish Sanitation (Table 4-4). It is relevant to note that this is not an exhaustive list and that more water quality monitoring stations may exist through local non-profits, academia, or private companies who may be willing to share data. The region contains over the 35 monitoring stations within 0.5 miles of the boundary of the watersheds. The region has thorough coverage, as does each watershed. Opportunities to enhance coverage would be to install stations more upstream as conditions improve.

Table 5-4.

Water quality monitoring stations.

Waterbody	Station Name	Station No	Organization
Morris Landing	By Beacon #49, ICWW	14	Shellfish Sanitation
Stump Sound	Sea Haven Bay	15	Shellfish Sanitation
Everett Bay	Tar Landing	18	Shellfish Sanitation
Everett Bay	Everett Bay	19	Shellfish Sanitation
Turkey Creek	Mouth of Turkey Creek	20	Shellfish Sanitation
Turkey Creek	Turkey Creek, near ramp	20A	Shellfish Sanitation
Goose Bay	Mouth of Rogers Bay	21	Shellfish Sanitation
Goose Bay	Goose Bay	22	Shellfish Sanitation
Kings Creek	Spicer Bay, E of Closure	23	Shellfish Sanitation
Kings Creek	Kings Creek, W of Closure	24A	Shellfish Sanitation
Stump Sound	Marker #43, ICWW	27	Shellfish Sanitation
Stump sound	At west end of Permuda Island	28	Shellfish Sanitation
Stump Sound	Permuda Island, Adams Lease	29	Shellfish Sanitation

Old Mill Creek	Waters Bay, 1300 yds. SW of Station #4	3	Shellfish Sanitation
Topsail Sound	Old Settlers Beach, E of closure	34A	Shellfish Sanitation
South Morris Landing	Middle Cove west of Dixon Point	35	Shellfish Sanitation
Topsail Sound	750 yards south by east of Day Marker #159, in creek	36	Shellfish Sanitation
Old Mill Creek	Queens Hole, 1300 yds. NE of Station #3	4	Shellfish Sanitation
Batts Mill Creek	Mouth of Batts Mill Creek	5	Shellfish Sanitation
Topsail Sound	By Flashing Beacon #61, ICWW	6	Shellfish Sanitation
Headwaters King's Creek	KINGS CRK NR HOLLY RIDGE	B9850000	NCDEQ-DWQ
Goose Bay	INTRACOASTAL WTRWY AT GOOSE BAY NR HOLLY RIDGE	B9860000	NCDEQ-DWQ
Morris Landing	ICW AT MORRIS LANDING	B9865000	NCDEQ-DWQ
Everett Bay	ICW AT THOMAS LANDING	B9870500	NCDEQ-DWQ
Goose Bay	(Near Goose Bay)	NLA06608-0685	EPA National Aquatic Resources Survey
Mill Creek-Alligator Bay	MILL CRK AT SR 1518 NR GRANT	P6100000	NCDEQ-DWQ
Mill Creek-Alligator Bay	MILL CRK AT ALLIGATOR BAY NR GRANT	P6250000	NCDEQ-DWQ
Goose Bay	ICW AT NC 210 NR GOOSE BAY	P9860000	NCDEQ-DWQ
Morris Landing	Stump Sound just east of Dixon Point	S54A	NC Recreational Water Quality Program
King's Creek	"ICW, Stump Sound near the mouth of King's Creek"	S55	NC Recreational Water Quality Program
Turkey Creek	Stump Sound, Mouth of Turkey Creek	S55A	NC Recreational Water Quality Program
Alligator Bay	ICW, marker #25 at Alligator Bay	S56	NC Recreational Water Quality Program

5.4 MILESTONES

Milestones are measurable accomplishments utilized to track positive changes and success of the plan. If a milestone is not met, an assessment will be conducted at the time of the annual plan review to determine the cause and the appropriate steps that can be taken to address any shortcomings or unforeseen circumstances. The milestones of the Stump Sound Watersheds for restoring water quality through volume reduction of surface runoff are:

5.4.1 Short-Term (< 10 years)

- Reducing stormwater runoff by 25% (8,461,553 gallons) of 33,846,212 gallons that occurs during a one-year, 24-hour storm event through the implementation of stormwater reduction techniques, determining volume that current stormwater projects reduce, and the objectives of this plan.
- Develop an education and outreach concept for the target groups (residents, students, and business owners) including educational materials.
- Hold annual education and outreach event.
- Source funding for at least five stormwater reduction projects.

5.4.2 Mid-Term (< 20 years)

- Reducing stormwater runoff by 50% (16,923,106 gallons) of 33,846,212 gallons that occurs during a one-year, 24-hour storm event through the implementation of stormwater reduction

techniques, determining volume that current stormwater projects reduce, and the objectives of this plan.

- Hold annual education and outreach event.
- Source funding for at least five additional stormwater reduction projects.

5.4.3 Long-Term (< 30 years)

- Reducing stormwater runoff by 33,846,212 gallons that occurs during a one-year, 24-hour storm event through the implementation of stormwater reduction techniques, determining volume that current stormwater projects reduce, and the objectives of this plan.
- Hold annual education and outreach event.
- Source funding for at least five additional stormwater reduction projects.

5.5 EVALUATION

To ensure that the Stump Sound plan is meeting the needs of the watershed and community, the management plan should be evaluated on a regular basis to determine effectiveness (Table 5-5). The partners will track progress on plan implementation including tracking educational events, project development, lists of potential projects, staff and volunteer hours, running totals of project runoff reduction, and updating monitoring records

Table 5-5. Evaluation of the Stump Sound Watershed Management Plan.

Evaluation	Indicator
Calculate the approximate volume reduced by stormwater retrofits that are installed	Utilize <i>Watershed EZ</i> , <i>Runoff Reduction Calculator</i> , or similar tool to determine a volumetric total.
Mid-course evaluation	Conduct full assessment of plan with suggestions on ways to enhance or redirect the plan
Publicize successes	Update community on successes to increase commitment, motivation, and morale. Publish report on watershed health. Recognize past, current and future projects for the year.

5.6 IMPLEMENTATION SCHEDULE

The following discusses the proposed implementation schedule to achieve all project ideas of the plan (Table 5-6).

Table 5-6. Overview of potential project ideas schedule.

Potential Project Ideas	Start Time
Participating jurisdictions will review existing codes and ordinances to determine potential impediments to low impact stormwater designs for new development and redevelopment. Participating jurisdictions will consider amending codes and ordinances that inhibit LID design (Obj. 1-1).	Year 1
Participating jurisdictions will regularly review capital improvement plans to consider the incorporation of stormwater reduction techniques (Obj. 3-1). Identify potential stormwater reduction projects at existing streets, rights-of-way, buildings, parks, parking lots, drainage systems, and other public properties. Prioritize retrofits at public buildings and properties that can serve as demonstration sites of stormwater retrofits. Additionally, coordinate with NC Department of Transportation on TIP or any other department projects (Obj. 3-2). Secure funds for retrofits at public properties (Obj. 3-3).	Year 1
Identify potential retrofit projects with willing private partners in each watershed (Obj. 2-1). Seek funding opportunities for identified stormwater retrofit projects on private lands. (Obj. 2-2).	Year 1
Participating jurisdictions will consider implementing local stormwater reduction incentives for new development and redevelopment (see Appendix D for various incentives) (Obj. 1-2). Participating jurisdictions will educate landowners to disconnect impervious surfaces or minimize stormwater runoff from their property, and will consider implementing incentives for landowners to reduce the amount of stormwater runoff from their property (see Appendix D for various strategies) (Obj. 2-3).	Year 1
Participating jurisdictions will maintain a simple inventory and monitor performance of stormwater reduction retrofits that have been installed within the watersheds (Obj. 4-1). Document the volume of stormwater reduced by each retrofit by utilizing the Runoff Reduction Calculator Tool or Watershed EZ, or similar volume reduction calculation tools (Obj. 4-3).	Year 1
Coordinate education and outreach throughout Stump Sound by creating an education committee who will develop a uniform education and outreach plan for Stump Sound (Obj. 5-1).	Year 1
Publish quick report updating stakeholders on watershed on an annual or similar schedule based on recommendations of Education Committee.	Year 1
Participating jurisdictions will coordinate to offer technical training opportunities for planners, engineers, developers, landscapers and local government staff on techniques to reduce volume of stormwater (Obj. 5-2).	Year 2
Promote use of stormwater retrofits within private lands based on recommendations of Education Committee.	Year 2
Begin implementing stormwater retrofit projects on public sites by 5 years.	Year 5
Review and update the plan as necessary based upon findings from water quality data and the status of implementation (Obj. 4-2).	Year 5, 10, 15, 20
Education and Outreach program evaluation.	Year 10
Mid-course Evaluation. Update the Watershed Management Plan if necessary.	Year 15
Final Assessment. Review entire plan and update plan for next 30 years.	Year 30

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Historical Timeline

- 1989 Stump Sound designated Outstanding Resources Waters (ORW)
- 2004 Everetts Bay Oyster Habitat Restoration Project: Isolated patch reefs; 4.34 acres; shallow subtidal
- 2004 Morris Landing Clean Water Preserve N.C. Clean Water Management Trust Fund
- 2004 Morris Landing Living Shorelines
- 2005 Alligator Bay Oyster Habitat Restoration Project: Isolated patch reefs; 3.5 acres; shallow subtidal
- 2005 Morris Landing Living Shorelines: Shoreline sill; 15 feet, 150 shell bags
- 2007 New River Oyster Habitat Restoration Project: Isolated patch reefs; 4.2 acres; shallow subtidal
- 2008 Morris Landing Living Shorelines: Shoreline sill; 150 feet; 1,500 shell bags
- 2009 Stump Sound Oyster Habitat Restoration Project: Isolated patch reefs; 4.0 acres; shallow subtidal
- 2010 Stump Sound Oyster Habitat Restoration Project: Isolated patch reefs; 4.0 acres; shallow subtidal
- 2010 ARRA Jobs and Oyster Habitat Restoration Project: Isolated patch reefs; 5 acres; shallow subtidal and intertidal
- 2010 Stump Sound Oyster Habitat Restoration Project: Isolated patch reefs; 4.0 acres; shallow subtidal
- 2011 Morris Landing Living Shorelines: Shoreline sill; 150 feet; 1,500 shell bags

Acronyms and Definitions

303(d) List	A list of waterbodies in each state that are too polluted or degraded to meet water quality standards. States are required to update their lists every two years.
319 Grant	A grant program, named after Section 319 of the Clean Water Act, funded by EPA and administered by NC DEQ to study and find solutions to impaired water.
APPROVED AREA	An area determined suitable for the harvest of shellfish for direct market purposes.
BIORETENTION AREAS	Also, known as rain gardens, these provide onsite retention of stormwater using vegetated depressions engineered to collect, store, and infiltrate runoff.
BMP	Best Management Practice of stormwater management; also, commonly referred to as <i>Stormwater Control Measure (SCM)</i> or <i>Stormwater Infiltration Practice (SIP)</i> .
CAFO	Confined Animal Feeding Operation
CATCHMENT	A geographic unit within a subwatershed made up of a singular river, stream, or branch that contributes to a larger watershed.
CFU	Colony Forming Unit, used to measure fecal coliform bacteria concentrations.
CONDITIONALLY APPROVED CLOSED	This management strategy by North Carolina Shellfish Sanitation, refers to shellfish-growing waters that are closed to harvest because of high bacteria concentrations but can be opened temporarily, usually during periods of drought, when bacteria levels are low enough to make the shellfish safe to eat.
CONDITIONALLY APPROVED OPEN	This management strategy by North Carolina Shellfish Sanitation, refers to shellfish growing areas that are open to harvest but are temporarily closed after periods of moderate or heavy rain.
CWA	Clean Water Act
DCM	North Carolina Division of Coastal Management
DEGRADED WATERS	General description of surface waters that have elevated pollution levels, could include high bacteria levels, pathogens, sediment, low dissolved oxygen, and/or high nutrient levels. This is not a legal description of impairment (see impaired waters definition).
DEQ	North Carolina Department of Environmental Quality
DESIGNATED USE	A Clean Water Act term referring to the use, such as swimming, shellfish harvesting or aquatic life support, that a waterbody has been designated with by the state. The waterbody may not actually be able to support its designated use.
DOT	Department of Transportation
EPA	Environmental Protection Agency
EXISTING USE	A Clean Water Act term referring to all current uses and any use the waterbody has supported since November 28, 1975.
FDA	U.S. Food and Drug Administration
FECAL COLIFORM	These bacteria are found in the intestines of warm-blooded animals. They are not normally harmful to humans, but if found in a waterbody they could indicate the presence of harmful bacteria. Because they are easy to detect in the environment, these bacteria have been used for decades to determine the suitability of shellfish-growing waters.
FLOW	The volume of water, often measured in cubic feet per second (cfs), flowing in a stream or through a stormwater conveyance system.
GIS	Geographic Information Systems
GROWING WATERS	Waters that support or could support shellfish life.
HUC	Hydrologic Unit Code
HYDROGRAPH	A graph showing changes in the discharge of a surface water river, stream or creek over a period of time.
HYDROLOGIC CYCLE	The cycle by which water evaporates from oceans and other bodies of water, accumulates as water vapor in clouds, and returns to the oceans and other bodies of water as precipitation or groundwater. Also, known as the water cycle.

HYDROLOGY	The science dealing with the waters of the earth, their distribution on the surface and underground, and the cycle involving evaporation, precipitation, flow to the seas, etc.
IMPAIRED WATERS	This Clean Water Act term refers to waters that no longer meet their designated uses. That would include conditionally approved and conditionally closed waters and any water where swimming advisories are being issued. These waters have been listed as impaired on the state's 303(d) list for EPA.
IMPERVIOUS COVER	A hard surface area, such as a parking lot or rooftop, that prevents or retards water from entering the soil, thus causing water to run off the surface in greater quantities and at an increased rate of flow.
INTERTIDAL LAND USE	Area of land that is submerged during high tide and exposed at low tide. The management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods.
LID	Low Impact Development refers to management strategies that attempt to mimic conditions to reduce the flow of stormwater. To be successful, they should be integrated into all phases of urban planning and design from the individual residential lot level to the entire watershed.
LULC	Land use/land cover
MAXIMUM EXTENT PRACTICABLE	This term appears in many state and federal pollution regulations. It generally refers to pollution controls that are technologically available and capable of being done after taking into consideration cost and logistics.
MS4	Municipal separate storm sewer systems
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source, diffused sources of pollution, where there is no singular distinct outflow point.
NRCS	Natural Resources Conservation Service
NSSP	National Shellfish Sanitation Program
RETROFITTING	Structural stormwater management measures for preexisting development designed to help reduce the effect of impervious areas, minimize channel erosion, reduce pollutant loads, promote conditions for improve aquatic habitat, and correct past efforts that no longer represent the best science or technology.
ROW	Right of Way
RUNOFF CURVE	A runoff curve number is a numeric parameter derived from combining the effects of soil, watershed characteristics, and land use.
SA	This is a state salt water classification intended for shellfish harvesting. These are waters that should also support aquatic life, both primary and secondary recreation (activities with frequent or prolonged skin contact), and shellfishing for market purposes. It is one of the highest water classifications in the state.
SB	This is a state salt water classification intended for swimming.
SC	This is a state salt water classification intended for fish propagation and incidental swimming. The waters are safe for swimming but have a higher risk of pollution and human illness than SB waters.
SCM	Stormwater Control Measure, also more commonly known as a Best Management Practice (BMP) of stormwater management; also, commonly referred to as <i>Stormwater Infiltration Practice (SIP)</i>
Shellfish	"Shellfish" as referenced in this document means molluscan shellfish, oysters and clams.
SHELLFISH SANITATION	Shellfish Sanitation and Recreational Water Quality Section, N.C. Division of Marine Fisheries, N.C. DEQ.

SIP	Stormwater Infiltration Practice, also more commonly known as a Best Management Practice (BMP) of stormwater management; also, commonly referred to as <i>Stormwater Control Measure (SCM)</i> .
STORMWATER	Water from rain that flows over the land surface, picking up pollutants that are on the ground.
SUBWATERSHED	A geographic unit within a watershed made up of individual minor rivers, streams, or branches that contribute to a larger watershed.
TMDL	Total maximum daily load, the maximum amount of a pollutant that can be found in a waterbody and still meet federal Clean Water Act standards.
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WATERSHED	All areas that drain to a waterbody, whether that be a lake, mouth of a river, or ocean.
WQS	Water quality standards
WWTP	Wastewater Treatment Plant

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Appendix A Watershed Description

The Stump Sound Watershed is made up of 11 watersheds, spanning across multiple local governments (listed in Table A-1). Within the entire watershed, sources of stormwater runoff pollution have been attributed to urban development. The following are the major waterbodies for each watershed:

Table A-1.

Watersheds of Stump Sound

	Watershed Name	Major Waterbody
1	Batts Mill Creek	Batts Mill Creek
2	Old Mill Creek	Old Mill Creek
3	Waters Bay-Surf City	<i>Topsail Sound</i>
4	South Morris Landing	<i>Unnamed tidal channel</i>
5	Morris Landing	<i>Unnamed tidal channel</i>
6	King Creek-Spicer Bay	King Creek
7	Permuda and Sound	<i>Stump Sound</i>
8	Everett Bay-Topsail	<i>Everett Bay</i>
9	Turkey Creek	Turkey Creek
10	Mill Creek-Alligator Bay	Mill Creek
11	Goose Bay and Sound	<i>Goose Bay</i>

PHYSICAL AND NATURAL FEATURES

Stump Sound watersheds are predominately at or below Highway 17 and include parts of Topsail Island. All watersheds drain directly into or flow to the Outstanding Resource Waters of Stump Sound. The currents in Stump Sound are influenced by diurnal tides that rise and fall through Stump Sound, part of the Intracoastal Waterway. The area is characterized by low-lying elevation with the highest areas being approximately 50 feet above sea level (Figure A-3).

Stump Sound Watersheds Topography

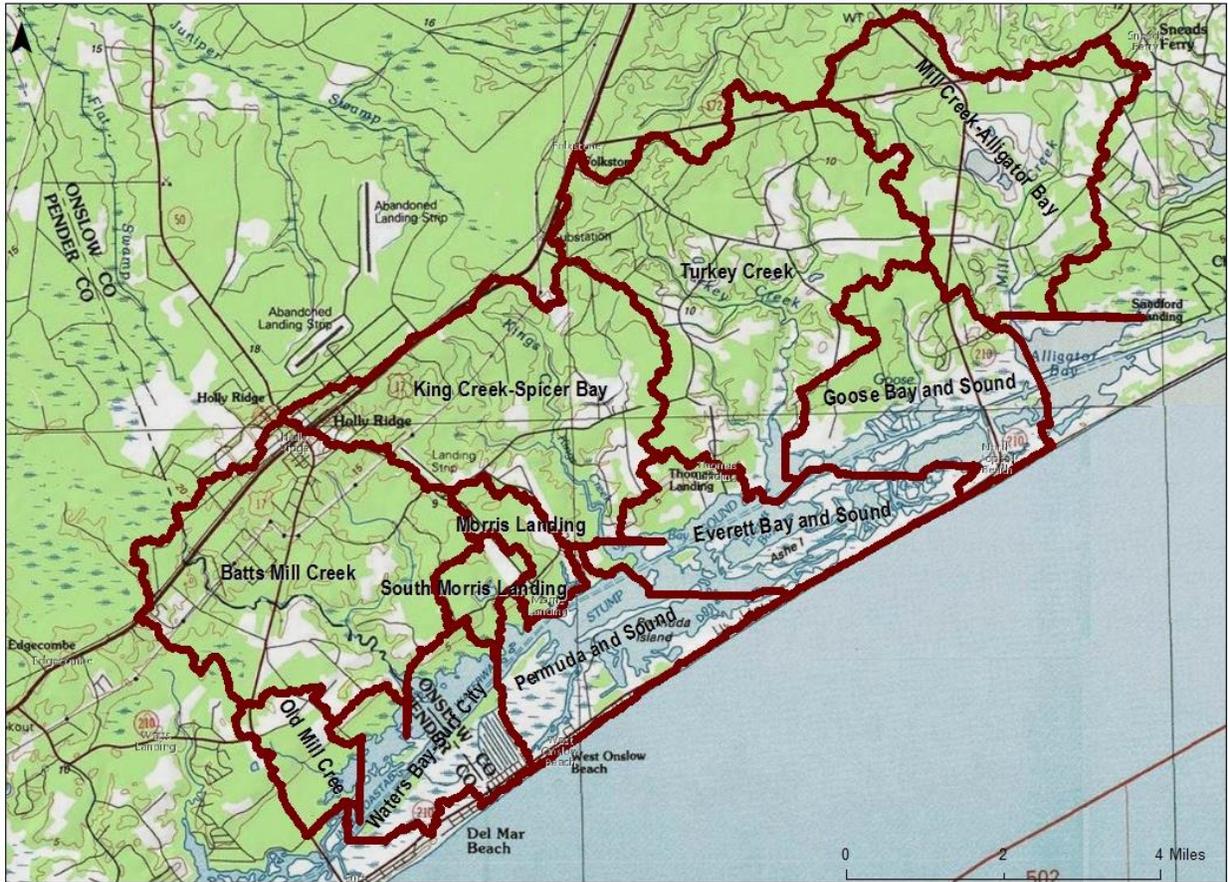


Figure A-3. Topographic map of Stump Sound.

SOILS

Stump Sound watersheds are predominated by Group A hydrologic soil according to the United States Department of Agriculture Natural Resource Conservation Service (NRCS) data collected from Web Soil Survey (Figure A-4). The only other hydrologic soils found within the region are Group B and D soils. Four hydrologic groups (A, B, C, D) exist with progressively increased runoff potential; soils classified under Group A have low runoff potential, while soils classified under Group D have high runoff potential. The most notable Group D soils are located along Interstate Highway 17 and increases in prevalence as the area moves inland. Group B soils appear to occur most prevalently near the banks of the major creeks of most of the watersheds.

Four hydrologic soil groups (HSG; A, B, C, D) exist with progressively decreased infiltration potential characteristics; soils classified under Group A have the highest infiltration potential and are often the quickest draining soils, while soils classified under Group D have the highest runoff potential. It is possible to have a soil type that has characteristics from two hydrologic groups; for example, a soil can be designated as Group A/D, which means it has characteristics of both Group A and Group D. This is because of the changing nature of that specific soil taxonomy when it is fully saturated. Once a hydraulic threshold is reached, the soil type converts to another hydrologic group because of the change of the available water capacity of the soil. Certain wet soils are placed in Group D based solely on the presence of a water table within 60 centimeters (24 inches) of the surface, even though the saturated hydraulic conductivity may be favorable for water transmission. If these soils can be adequately drained, they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. For the purpose of hydrologic soil group, adequately drained means that the seasonal high-water table is kept at least 60 centimeters (24 inches) below the surface in a soil where it would be higher in a natural state. NRCS soil surveys are ideal for watershed scale analysis and determining runoff volume rates. These data are used to calculate the runoff volume rates in this plan.

The following is the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) summary description for each soil group³:

-
- **Group A** soils are sands, loamy sands, or sandy loams. These soils have high infiltration rates even when thoroughly saturated. These soils consist of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
 - **Group B** soils are silt loams or loams. These soils have moderate infiltration rates when thoroughly saturated and consist of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
 - **Group C** soils are sandy clay loams. These soils have low infiltration rates when thoroughly saturated and consist of soils with a horizon that impedes downward movement of water and possess moderately fine to fine texture.
 - **Group D** soils are clay loams, silty clay loams, sandy clays, silty clays, or clay. These soils have the highest runoff potential. These soils have very low infiltration rates when thoroughly saturated and consist of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material.

Soil survey data can be used when trying to determine which areas have the most ideal combined characteristics for retrofit projects. Site soil characteristics, as with any characteristic, should always be field surveyed to

³ Natural Resources Conservation Service. (n.d.). Updated Hydrologic Soil Group. *United States Department of Agriculture Natural Resource Conservation Service.*

determine the extent of characteristics at a project site. Additionally, previous experiences from installation of retrofits along the coast have revealed that a simple handheld auger assessment of soils may not be sufficient and it may be necessary to take a deeper sample to surpass a confining layer of lower infiltrating soil types covering sandy Group A soils.

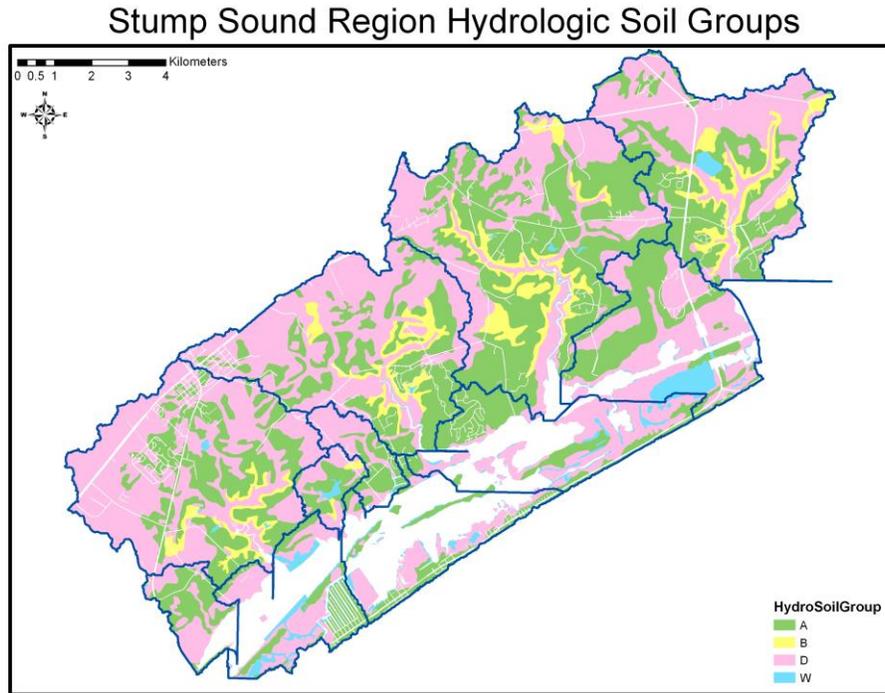


Figure A-4. Hydrologic soil group map of Stump Sound watersheds.

STRATEGIC HABITAT AREA REGION 3

The Stump Sound watersheds fall within the Strategic Habitat Area Region 3 by N.C. Division of Marine Fisheries 2014 designations (Figures A-5 and A-6). Strategic Habitat Areas were designated to identify exceptional habitat for coastal fisheries. These areas are particularly at risk and are considered high priority for restoration and protection by the state.

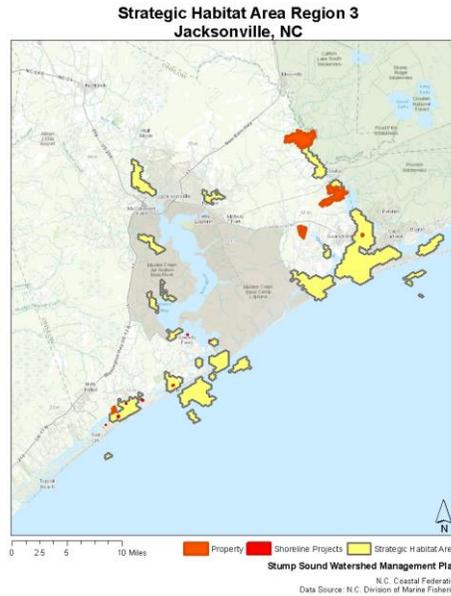


Figure A-5. Map of Strategic Habitat Area of Onslow County.

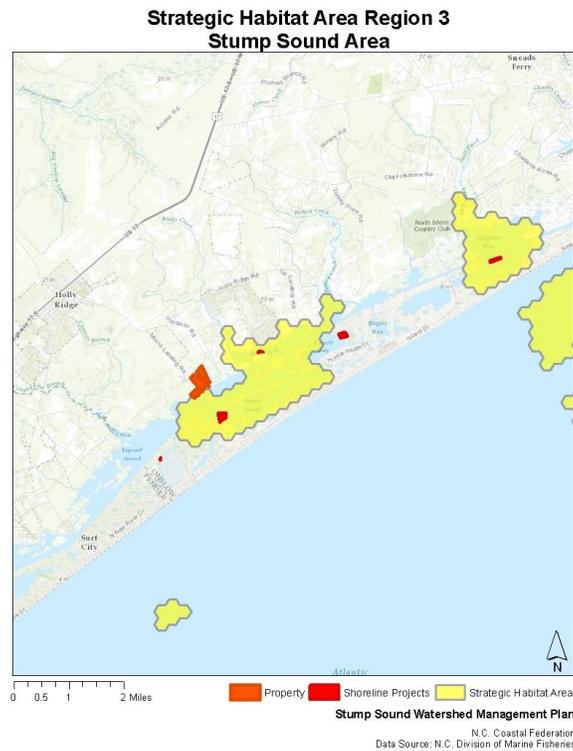


Figure A-6. Map of Stump Sound locations of Strategic Habitat Area.

BIODIVERSITY AND WILDLIFE HABITAT ASSESSMENT

Maps were created using July 2013 N.C. Department of Environment Quality (DEQ) N.C. Natural Heritage Program datasets from N.C. OneMap (OneMap, 2013). Conservation assessment values were rated on a scale of one (moderate conservation value) to ten (maximum conservation value) and includes some areas that are unrated.

N.C. Natural Heritage Program obtained the data used to develop this scale from various state and federal agencies including: N.C. Division of Coastal Management, U.S. Fish and Wildlife Services, N.C. Division of Water Quality, N.C. Division of Marine Fisheries, N.C. Wildlife Resources Commission, N.C. Chapter of the Audubon Society, and U.S. Environmental Protection Agency (North Carolina Department of Environmental Quality[DEQ], 2013).

Specifically, data included natural heritage areas, aquatic and terrestrial biodiversity, threatened and endangered species, Outstanding Resource Waters and High Quality Waters rankings, open and closed shellfish habitat, oyster sanctuaries, submerged aquatic vegetation, wetlands and National Wetland Inventory, and other datasets. The biodiversity and wildlife habitat assessment rankings were developed to provide support to state and local governments and agencies as well as conservation organizations as a means to incorporate data for conservation, land use, and planning purposes. From the maps, it is apparent that coastal and riverine habitat is of the highest conservation value; these areas are rated eight or higher.

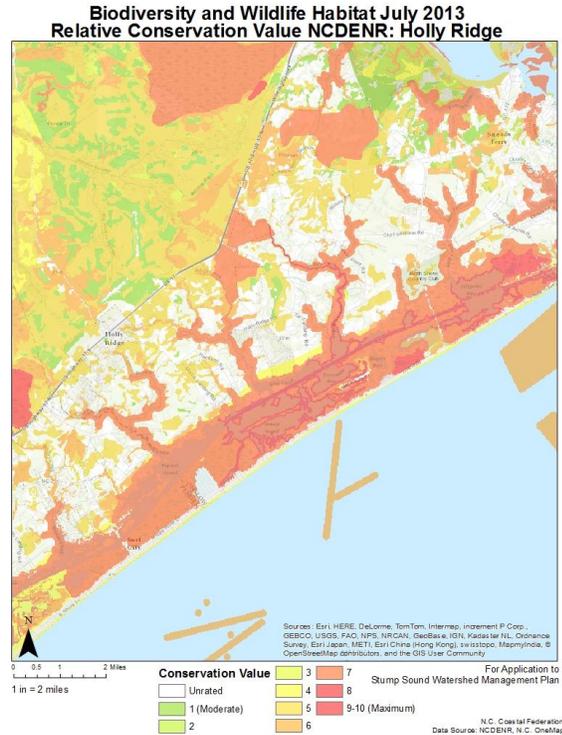


Figure A-6. Map of Natural Heritage Program's areas of high biodiversity.

LAND USE

The Stump Sound watersheds flow through multiple local governments including:

- Town of Holly Ridge
- Town of North Topsail Beach
- Town of Surf City
- Town of Topsail Beach
- Unincorporated Sneads Ferry

The watersheds fall within the southeastern portion of Onslow County and the northeastern edge of Pender County. Historically, the watershed has seen minimal development. Primary development has been near North Carolina Highway 17, 50 and 210, which intersect many of the watersheds. This development includes road expansion, commercial businesses and residential housing. Within the past two decades, rapid residential development has occurred of undeveloped land.

Commercially zoned parcels with preexisting businesses have experienced an expansion in imperviously surfaces, typically because of the installation of parking lots. There has also been moderate expansion of new commercial development within many of the watersheds.

The Stump Sound watersheds are currently used as roughly 2,235 acres are used for commercial purposes, while 26,454 acres are used for residential purposes. There are a variety of constructed features within the watershed. For example, the North Shore Golf Course in Sneads Ferry, which is surrounded by residential housing

development and established in 1988. There are no marinas within the watersheds. There are multiple residential docks, multi-boat docks and boat ramps. Some waterfront residences have bulkheads; overall, the shorelines of the watershed remain unhardened. Creek, canal and Intracoastal Waterway dredging does occur within the watersheds. Substantial mosquito ditching has occurred along the Intracoastal Waterway. At present, there are no known commercial silviculture or military activities within the watershed; although, these activities do occur in adjacent watersheds to the north of Kings Creek-Spicer Bay watershed and Mill Creek-Alligator Bay. There are numerous small scale farms, most being under 50 acres; one of the largest being approximately 90 acres.

Historically, concerns regarding significant, rapid development within Stump Sound began in the 1980s (see Timeline). In the 1980s when a large condominium project was proposed on Permuda Island, which is in Stump Sound waters. Permuda Island is approximately 50 acres with low-lying elevation not exceeding 6 feet above sea level. The proposed high-density development raised issues within the community regarding the implications of land use practices and the wide-reaching effects development would have within the area. The issues concerning Permuda Island was advocated by an organization called the Stump Sound Shell fishermen who were backed by environmental groups including the North Carolina Coastal Federation. The controversy over the development stemmed from concerns regarding stormwater runoff pollution. Pollution is problematic for the shellfish fishery, which requires high water quality to provide the regionally famous “Stump Sound Oysters”. The advocacy organizations and local citizens continuously kept the pressure on local officials who oversaw building permits. By April of 1985, the CAMA permit was declined for the high-density development due to the serious issues of stormwater runoff and an overwhelmed sewer system that the development would cause, which the state agreed was a significant issue. In 1987, the North Carolina Nature Conservancy bought Permuda Island and sold it to the state. Permuda Island was added to the Estuarine Sanctuary Program to preserve its ecosystem. In 1989, Stump Sound was designated an “Outstanding Resource Waters”.

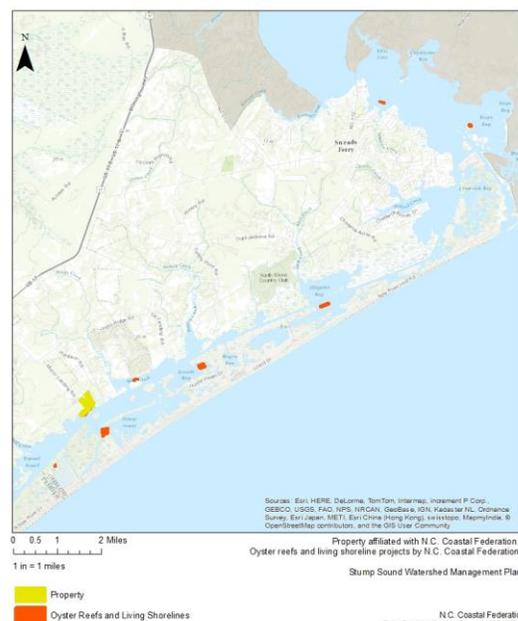
Stormwater runoff occurs when impervious surfaces aid in the transport of water during storm events. When water hits the surface of asphalt or rooftops or other impervious surfaces, it cannot follow natural hydrology or percolate into the ground. Instead during transport, it collects pollutants including bacteria. The Stump Sound Watershed has many waterways that are open for shellfishing. However, there are some that are closed, and to prevent more waterway closures, stormwater pollution needs to be reduced.

In coastal North Carolina, closure of shellfishing waters is a significant issue. Stump Sound is known to have prime shellfishing water. The amount of shellfishing waters continues to shrink on a yearly basis as closure areas expand. Shellfish are filter feeders and obtain food from the surroundings waters by filtering out the particles in the water and consuming them. Shellfishing waters can fall under one of four categories which are "approved", "conditionally approved-open", "conditionally approved-closed" and "prohibited".

N.C. COASTAL FEDERATION PROPERTIES AND PROJECT SITES

The following map depicts locations of N.C. Coastal Federation property and projects within the Stump Sound region. In total, there are eight oyster reefs and living shorelines projects and one property, Morris Landing Clean Water Preserve. The perimeters of projects are based on Global Positioning System (GPS) coordinates on file. The property perimeter is based on parcel property data from the Onslow County Geographical Information Services (GIS) office (Onslow County, 2013). Projects were completed at the following locations: Traps Bay of New River, Alligator Bay, Everetts Bay, Kings Creek, Settler's Beach Canals, Permuda Island Bay, and Morris landing.

N.C. Coastal Federation Properties and Projects



ONSLow SERVICE AREA

Within Onslow County, the primary sewer and water provider for the county is Onslow Water and Sewer Authority (ONWASA). There are many smaller entities that provide these services as well. Pluris provides water and sewer service to North Topsail Beach and Sneads Ferry but it is not necessarily mutually exclusive, some residents in Sneads Ferry have both Pluris and ONWASA services. Blue Creek Utilities provides some services in Richlands, while ONWASA is completing development for water and sewer service. Scientific Water and Sewage Corporation provides some services to certain developments in Jacksonville. The City of Jacksonville and the Marine Corps Bases maintain their own water and sewer system. The Town of Surf City is serviced by both ONWASA and the Town of Surf City's own utilities. Specifically, the portion of Surf City in Onslow County (between Broadway and 9th Street) receives water services from ONWASA and residents in the portion of Surf City in Pender County receive service from the town itself. However, sewer service is provided by the town itself for the entire town. From preliminary research, it appears that none of these minor companies maintain spray fields.

The Town of Surf City Waste Water Treatment Plant (WWTP) (State Non-Discharge Permit: WQ0000795, State Permit: WQCS00278) was completed in 2009 and has a capacity of 1.5 million gallons per day (Town of Surf City, 2013a). The Surf City WWTP has over 30 acres of storage ponds and 200 acres of solid set irrigation (Town of Surf City, 2013a). It services over 3,200 customers for sewer using 29 miles of gravity lines, 29 miles of force main, and 42 lift stations (Town of Surf City, 2013b).

Of the six treatment facilities and nine collection systems, the ONWASA Holly Ridge Facility (Non-Discharge Permit: WQ0019907, a Wastewater Irrigation permit) is the only treatment facility in relative proximity to the Stump Sound region. The Summerhouse Water Reclamation Facility (Non-Discharge Permit: WQ0029945, a High Rate Infiltration permit that allows 400,000 gallons per day) is also within the Stump Sound Region and is considered part of the Holly Ridge Wastewater Treatment Plant operation even though it is in a different area of Holly Ridge than the main reclamation facility. The facility treated 78,276,080 gallons in 2013 and it sprayed 58,790,120 gallons (ONWASA, 2014). The facility has a 13.3-million-gallon storage lagoon and ten spray fields of 93.42 wetted acres with 789 sprayheads (ONWASA, 2014). According to ONWASA, there are plans for Summerhouse to absorb the Holly Ridge plant to expand sewer service to accommodate new growth and incorporate new technology for wastewater processing in Holly Ridge (Personal Communication, January 7, 2015).

PENDER SERVICE AREAS

Overall in Pender County, water and sewer services are rendered by Pender County Utilities as a public works. The portion of the Town of Surf City in Pender County services its own water and it provides sewer services to the entire town in both counties. The areas outside of Surf City and Topsail and along the coastline just south of North Carolina Highway 210 (the portion west of US highway 17) is within the Rocky Point-Topsail Water and Sewer District of Pender County Utilities. Pender County Utilities does publish their projected future demands and estimates that Rocky Point-Topsail will have a demand of 3.19 million gallons per day by 2015, 4.59 million gallons per day by 2020, and 5.61 million gallons per day by 2025 (McKim and Creed Engineers, 2006). None of the Pender County Utility waste treatment facilities are in the Stump Sound region, there are many wastewater pump stations along the 17 corridors.

PROJECTED GROWTH

According to McKim and Creed Engineers report for Pender County, it is projected to reach a population of 75,000 to 81,000 by 2030 (2006). The report projected that growth could be greatly affected by improvements to Pender County's infrastructure (McKim and Creed Engineers, 2006). The report projects that the Topsail Township, Surf City, Topsail Beach, and the surrounding area of these towns will see steady growth. These numbers include areas beyond the scope of the Stump Sound Watersheds boundaries, which is why these numbers are larger than the demographic information. The following Table A-2 is summarizes from the projected growth table from their report:

Table A-2.

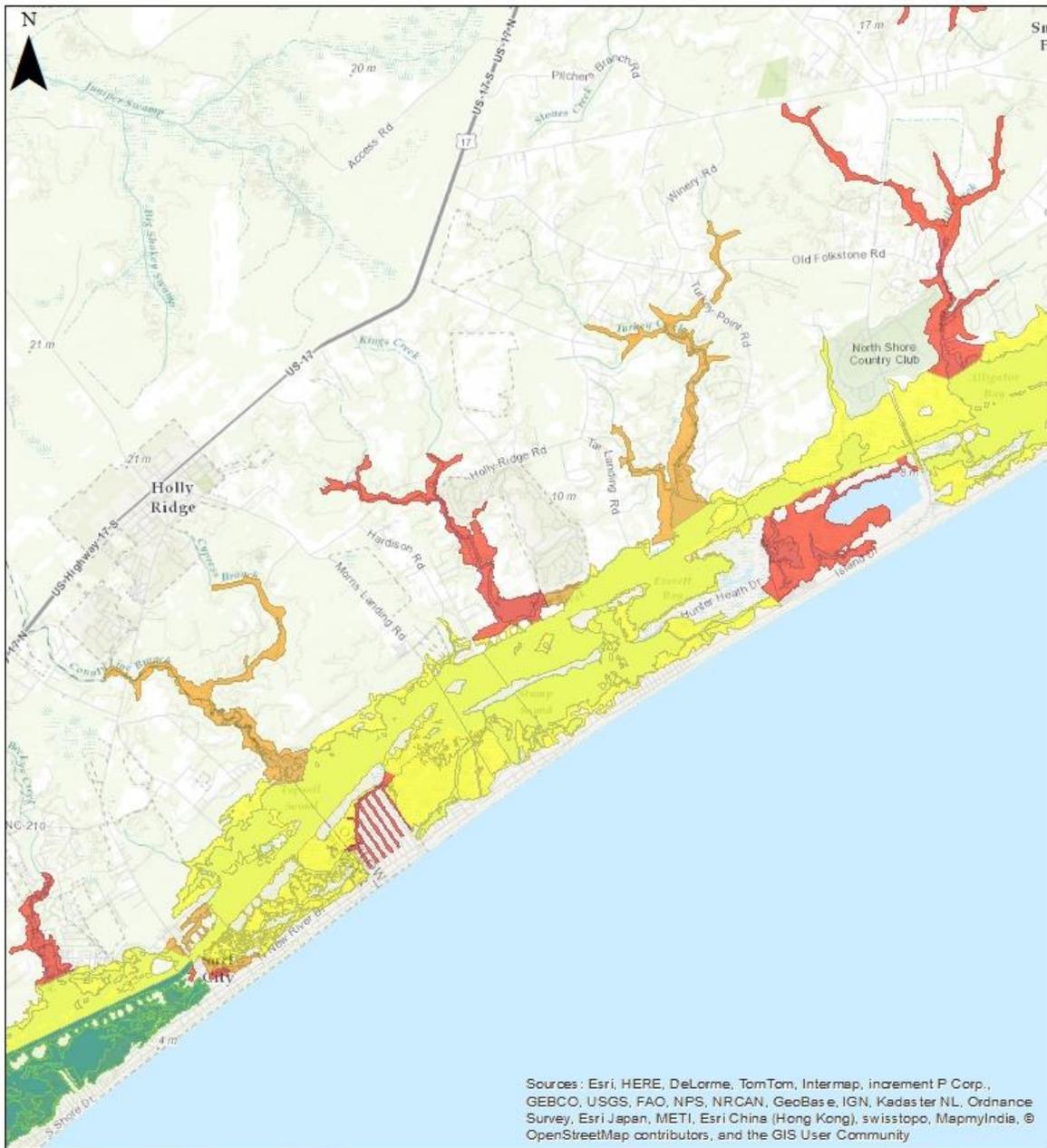
Projected Population Growth for the Topsail Region.

	2000	2005	2010	2015	2020	2025	2030
Topsail	13,806	16,188	18,857	25,126	31,615	34,484	37,379
Surf City	1,101	1,160	1,625	2,190	2,775	3,380	3,985
Topsail Beach	471	526	588	800	1,012	1,224	1,436
Remainder	12,234	14,503	17,046	19,589	22,132	24,675	27,218

Note: Adapted from *Pender County Water Master Plan* Table Number 3: Projected Population by Township by McKim and Creed Engineers (2006).

DRAFT

Shellfish Growing Area: March 2014 Stump Sound Region



Harvest Area ■ Approved ■ Conditionally Approved - Open ■ Conditionally Approved - Closed ■ Prohibited

0 0.75 1.5 3 Miles

1 in = 1 miles

Stump Sound Watershed Management Plan

North Carolina Coastal Federation
Data Source: NCDENR DMF Shellfish Sanitation

SOURCE ASSESSMENT

The primary source being addressed through this restoration plan will be stormwater runoff, which carries pollutants such as bacteria, the most predominate water quality impairment as identified by state reports and TMDL studies.

NONPOINT SOURCE POLLUTION

Due to rapid urban development and alteration of natural hydrology within the watershed, bacterial pollutants have been found to be the primary issue as reported in water quality assessments and Shellfish Sanitation reports. The difficulty in preventing violations of bacteria standards for coastal waters caused by stormwater runoff is compounded by the unique challenges related to coastal hydrology and bacteria pollution. These are:

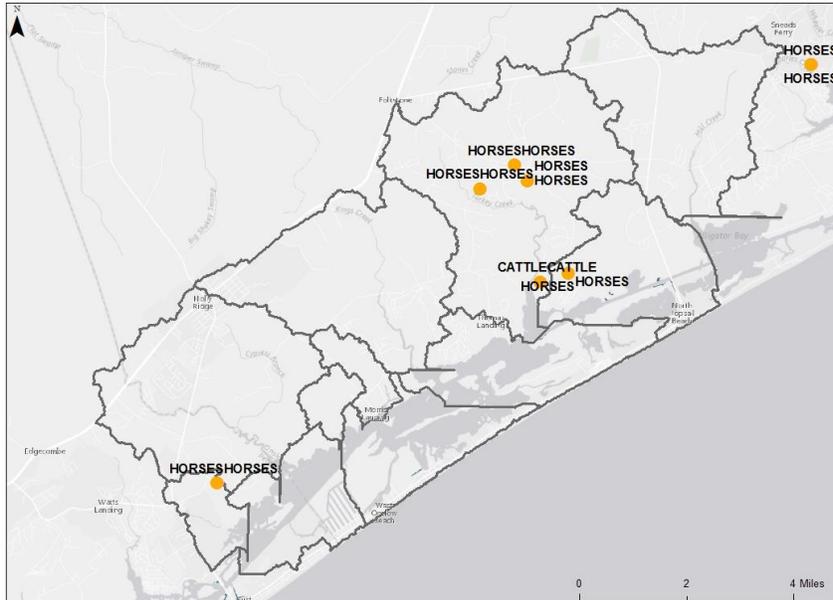
1. The two bacteria used as indicators of water quality, fecal coliform and enterococcus, naturally occur across the terrestrial landscape. These bacteria originate in the feces of warm-blooded animals, such as birds, deer, raccoons and domestic pets. Although prudent measures should be taken to reduce the sources of bacteria, these efforts alone will not result in satisfactory improvements in coastal water quality due to unnatural levels of stormwater being discharged.
2. Treating stormwater runoff to remove bacteria pollution before it flows into shellfishing and swimming waters is impractical. Although some technology exists for decreasing bacteria levels in runoff, it is not able to reduce levels to ensure pristine water quality necessary to allow shellfish harvest and swimming.
3. Treated runoff can easily be re-contaminated. Due to the ubiquitous nature of bacteria on the landscape, treated runoff, once discharged back on the landscape, will simply pick up more bacteria. The result is ineffective and costly treatment.

A more effective approach is to reduce the amount of stormwater entering waterways. Stormwater runoff can convey a variety of nonpoint source pollutants from a variety of sources. Potential nonpoint sources range from animal sources to connected conveyance systems. There are numerous monitoring stations utilized by N.C. Shellfish Sanitation to classify shellfish growing waters to determine which waterbodies are suitable for harvest and raw consumption. The Division of Water Resources uses this water quality data to ensure that designated uses are being met (Refer to section 6-3 for more information on monitoring). Every three years N.C. Shellfish Sanitation staff ground truth the entire shoreline of shellfish growing areas to document current and potential pollution sources. The data collected by Shellfish Sanitation is publicly available and is a source of historical and present-day information regarding water quality of an area. By utilizing historic data, communities can research long term changes in water quality. Shellfish closure area information can be used by communities to determine what waterways are impaired and the source of impairment. These up-to-date surveys and monitoring station data will be the primary source of historic and current information.

The following data was sourced from Shellfish Sanitation's combined year reports.

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Animal Nonpoint Sources

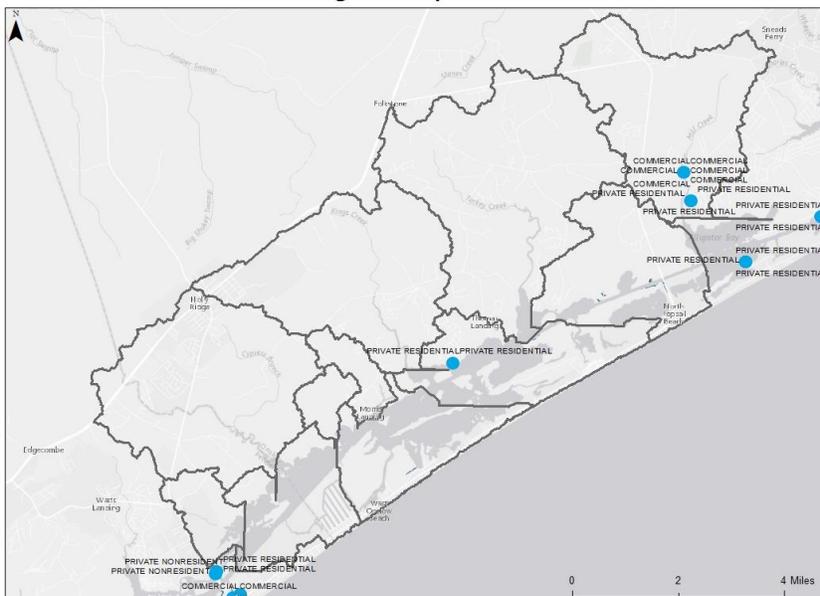


A variety of non-point sources exist within the watersheds that can attribute to degradation of water quality. Within the watersheds, there are six identified non-point sources of concern by Shellfish Sanitation surveys. Five are horse stables and one family farm with livestock. These animal sources can be a contributing factor to bacteria pollution; however, it is unlikely that these small-scale stables and farm are the primary sources of issues throughout all the watersheds. These locations should be monitored, like the rest of the watersheds, for growth or expansion that can impact a watershed. It may be worthwhile to build partnerships with owners

to utilize animal practices that reduce water quality impacts.



Dockage Nonpoint Source



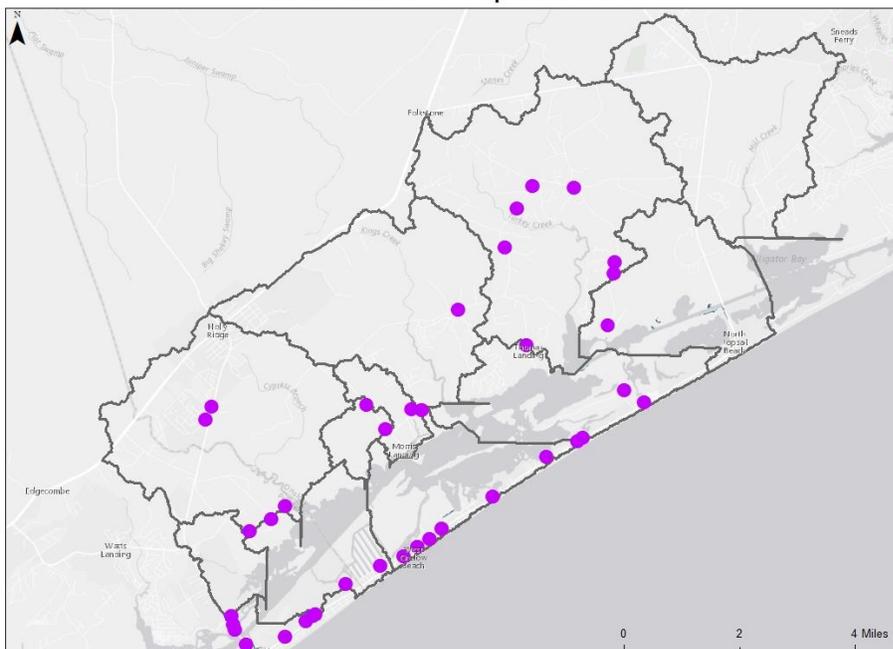
There are three docks within the watersheds that are potential sources of non-point source pollution. Issues concerning non-point source pollution from docks stem from boat cleaners, litter, and fuel discharge. As of 2016, chemical pollutants are not a major source of concern within the watersheds. These are being noted here if these do become an issue in the future.

Golf Courses Nonpoint Source



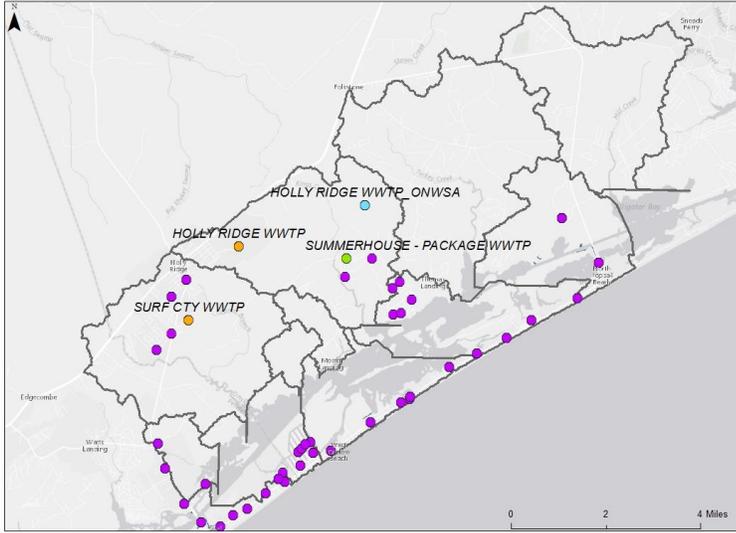
There is one golf course, North Shore Golf Course, which was opened in 1988 and includes a surrounding housing development.

Subdivision Nonpoint Source



There are many major subdivisions that are potential sources of non-point source pollution. Pollutants from subdivisions are often concentrated due to the number of residence in a small area and are typically nutrients, pesticides, yard debris, and bacteria from domestic pets. It is relevant to note the number of subdivision within the Permuda and Sound watershed.

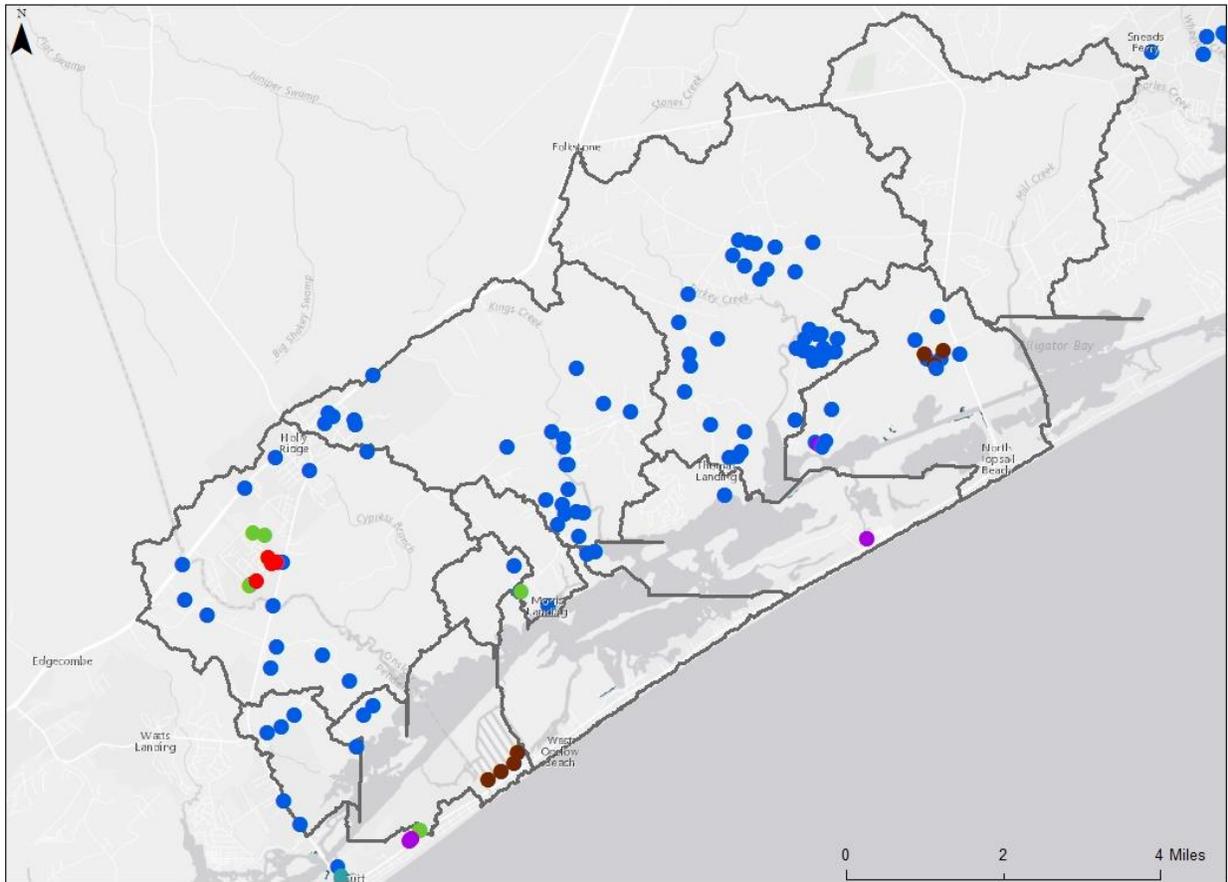
Wastewater Nonpoint Source



The following wastewater stations and facilities exist with the watersheds. It is relevant to be aware of the locations of wastewater stations and facilities. Many of these locations represent both point and nonpoint sources of pollution.



Stormwater Nonpoint Source



Point Sources

NPDES Permits

None of the NPDES wastewater individual permits are found within the Stump Sound region. The two closest NPDES permits are Dixon WTP held by ONWASA in Sneads Ferry and Belvedere Plantation Well 2 WTP held by Carolina Water Service. Figure A-9 is a screenshot showing the locations of the two facilities with permits.

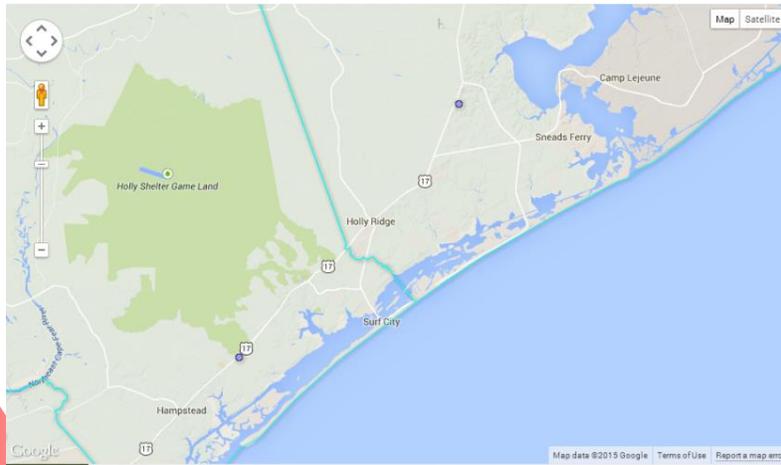


Figure A-9. Map of North Carolina Department of Environmental Quality(DEC) location of NPDES permit facilities using a Google embedded map (2015).

The following list is NPDES active general permits in Onslow and Pender Counties that fall within the watersheds:

Permit Number	Organization Name	Facility Name	Permit Type	Waterbody Name
NCG560017	Onslow County	Onslow County Mosquito Control	Pesticide General Permit COC	
NCG560002	Pender County	Pender County Mosquito Control	Pesticide General Permit COC	
NCG560013	Town of North Topsail Beach	North Topsail Beach Mosquito Control	Pesticide General Permit COC	
NCG560011	Town of Topsail Beach	Topsail Beach Mosquito Control	Pesticide General Permit COC	

Note: Adapted from *List of Active General Permits* by North Carolina Division of Water Resources, 2014.

The general permits that may impact the Stump Sound region directly are those that belong to Onslow County, the Town of North Topsail Beach, Pender County, and the Town of Topsail Beach. These permits are for general pesticide application for mosquito control.

NPDES Stormwater Permits

The following is a list of all stormwater discharge permits in Onslow County:

Permit Number	Owner Organization Name	Facility Name	Permit Type	Permit Status
NCG030586	Advanced Machine Group Inc	Advanced Machine Group - Holly Ridge	Metal Fabrication Stormwater Discharge COC	Active
NCG060315	J & J Snack Foods Handhelds Corporation	Holly Ridge Processing Facility	Food/Tobacco/Soaps/Cosmetics/Public Warehousing Stormwater Discharge COC	Active
NCG140022	S & W Ready Mix Concrete Company LLC	Onslow County - Holly Ridge Facility	Ready Mix Concrete Stormwater/Wastewater Discharge COC	Active
NCG140399	S T Wooten Corporation	Sneads Ferry Ready-Mix Concrete Plant #21	Ready Mix Concrete Stormwater/Wastewater Discharge COC	Active
NCG140428	S T Wooten Corporation	Burton Industrial Park Concrete Plant for S T Wooten Corporation	Ready Mix Concrete Stormwater/Wastewater Discharge COC	Active

Note: Adapted from *Active NPDES Stormwater Permit List* by North Carolina Division of Water Resources, 2014a.

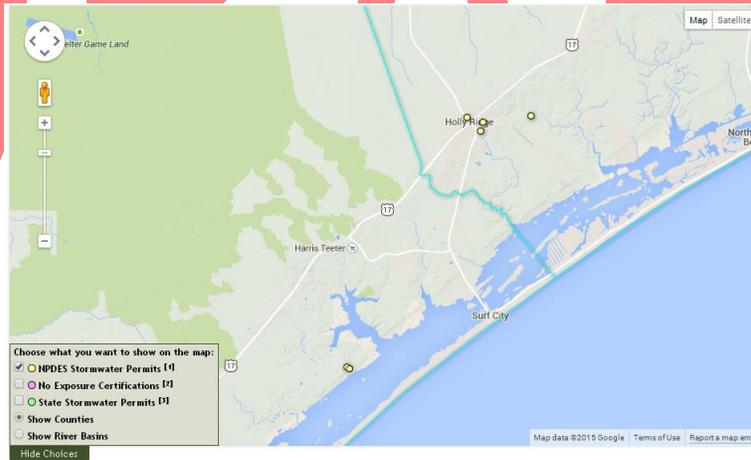


Figure A-10. Image of Google Maps show the locations of stormwater permit holders in the Stump Sound region (2015).

5.6.1.1 NPDES Phase II MS4 Permits

In 1990, Phase I of the NPDES permitting requirements was established to reduce pollutants from industrial activity stemming from ten categories, construction that disturbed five or more acres, and municipalities with 100,000 or more people that had Municipal Separate Storm Sewer Systems (MS4) (Figure A-10; Division of Energy, Mineral and Land, n.d.a). Phase II permitting requirements added construction that disturbed one or more acres and communities with less than 100,000 people that had MS4. In North Carolina, Phase II permitting requirements are strictly for public entities as defined by 15A NCAC 2H.0126 (Division of Water Quality, n.d.). Currently permitted NPDES Phase 1 and Phase II entities in the Stump Sound region as of 2010 are:

PERMITTEE	Universal Stormwater Management Plan?	DESCRIPTION
Camp LeJeune	No	NPDES Permit - Phase I MS4/Military
Jacksonville	No	NPDES Permitted Phase II MS4

Note: Adapted from *List of Permitted Phase II Entities* by Division of Energy, Mineral and Land Resources (2010).

It is relevant to note that Onslow County is a Phase II Tipped County, which occurs due to population size or stormwater characteristics. Pender County is not a Phase II county. Projects in Phase II Tipped counties require both Phase II permits with post-construction requirements and must follow Coastal Stormwater Rules (Division of Energy, Mineral and Land, n.d.b).

State Stormwater Permits

As of December 2014, North Carolina has issued 2,073 State Stormwater Permits in Onslow County and 691 in Pender County (Division of Water Resources, 2014b). The types of regulatory activities vary from Alternative Design, Exclusion, Exempted, General Permit, Detention Pond, Hybrid Infiltration, Hybrid Sand Filters, Infiltration, Low Density, and Redevelopment. A significant number of permits appears to be for low density regulatory activity. The permits are held by both private and government entities. There is a relatively high amount of State Stormwater Permit holders within the Stump Sound region as depicted by Figure A-11.

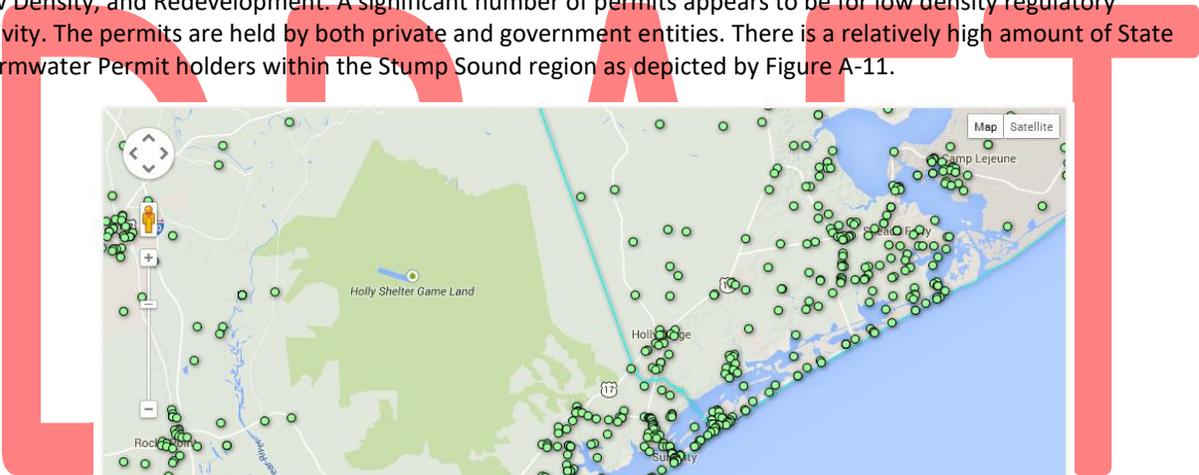


Figure A-11. Screenshot of a Google Map of State Stormwater Permits within the Stump Sound region (2015).

State Non-Discharge Permits

The Wastewater Branch of the Division of Water Resources, issues Non-Discharge Permits to entities that reclaim water and permitting residual and wastewater effluent facilities. The following list represents those that reclaim water in Onslow and Pender County located within one of the Stump Sound watersheds:

Permit Number	Permittee	Facility	Permit Type	Permitted Flow (GPD)
WQ0031647	Deuce Investments Inc	Morris Landing WWTF	High Rate Infiltration	60000

WQ0033896	Fussell, Elizabeth	Fussell SFR	Single-Family Residence Wastewater Irrigation	480
WQ0019907	Onslow Water and Sewer Authority	Holly Ridge WWTF	Wastewater Irrigation	260626
WQ0029945	Onslow Water and Sewer Authority	Summerhouse Water Reclamation Facility	High Rate Infiltration	400000
WQ0034075	Onslow Water and Sewer Authority	Stump Sound Phase 1 Reclaimed Water Dist.	Reclaimed Water Distribution	
WQ0000795	Town of Surf City	Surf City WWTF	Wastewater Irrigation	1200000
WQ0034806	Wooten, Wesley	Coastal Residuals	Land Application of Residual Solids (503)	

Note: Adapted from *Non-Discharge Active and Expired Permits Report* by the Division of Water Resources (2015).

Of interest should be Deuce Investment's property, which is less than 1 mile inland from Morris Landing Clean Water Preserve and the ONWASA Summerhouse Water Reclamation Facility, which sits less than 1.5 miles inland of Spicer Bay and 0.25 miles from Kings Creek. Figure A-12 is a screenshot of the locations of these facilities relative to Stump Sound.

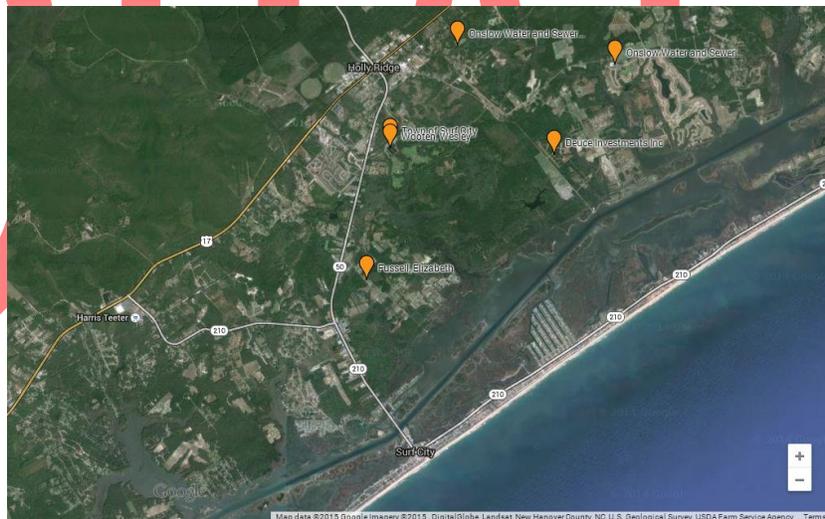


Figure A-12. Screenshot of Google Maps depicting Non-Discharge Permit holders from *Non-Discharge Active and Expired Permits Report* by the Division of Water Resources (2015).

Additional Potential Sources

There are no known Brown Fields, CERCLA Sites, mining operations, DSCA sites, Hazardous Waste Sites, landfills or issues initially found within the watershed. within the watersheds. There are many additional sources of concern that are worthwhile noting but may not pose a current issue within the watershed. There are also many sites that are permanently closed with expired permits that no longer an active source of discharge that are not listed.

Facility	Location	Report No.	Summary
Area 51 Powder Coating	301 US HWY 17 Holly Ridge, NC	RCRA Handler ID: NCS000001303	Hazardous Waste Generator: Conditionally Exempt Small Quantity Generator

Gulfstream Steel	301 US HWY 17 Holly Ridge, NC	EPA Facility ID: 110043284834	Air discharge
CVS PHARMACY #2548	13461 NC HWY 50 SURF CITY, NC	NCR000154120	Hazardous waste permit
CVS PHARMACY #7750	1309 HWY 210 SNEADS FERRY, NC	NCR000153080	Hazardous waste permit
Holly Ridge Refuse Disposal	E. HWY 50	FID 594 EPAID NONCD0000478	Pre-regulatory landfill (closed prior to January 1, 1983 permitting regulations).

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Appendix B Regulatory

When implementing projects consideration should be given to Coastal Area Management Act (CAMA). Some projects may require CAMA permits, consideration of the should be given when developing a timeline for project completion.

Congress enacted the federal Clean Water Act (CWA) (33 U.S.C. §1251 et seq. (1972)) to establish regulations on water quality standards for waters with a purpose of protecting surface waters for drinking, fishing and recreation. The EPA set water quality standards for many contaminants in surface waters as well as established pollution control programs. The CWA establishes use designations that mandate that waters maintain their designated usage. In North Carolina, the Department of Environmental Quality Division of Water Resources is responsible for delegating water quality designations. When waters do not meet this, they are listed on the 303(d) lists.

North Carolina first adopted formal coastal stormwater management rules in 1988. These rules proved inadequate to stop the continued spread of bacteria pollution in coastal waterways. The failure of these rules was recognized in 2008 by the N.C. Environmental Management Commission when more robust rules were adopted. The new rules increased the amount of stormwater that must be controlled in all 20 coastal counties, especially within one-half mile of Class SA waters (North Carolina's Surface Water Classification designation for commercial shellfishing waters and one of the highest designations given). By using Class SA waters as a standard, a management plan can focus on achieving the highest water quality that is regularly monitored.

Combined EPA and N.C. DEQ Guidelines

In North Carolina, the NPS Planning section in the DEQ DWR manages 319 grants. For proposals to qualify to be reviewed, watershed restoration plans in North Carolina must include the EPA watershed restoration plan nine minimum elements.

Below is a compiled list of criteria that is required by the EPA and N.C. DEQ. All the criteria listed are addressed within this watershed management plan.

1. Identification of impairment, pollutant, causes and sources of pollution that need to be controlled. Pollution sources that need control measures should include estimates of their presence in the watershed
 - a. Include a map of the watershed
 - b. Identifies the major causes and sources of impairment
 - c. Identify Point vs. Nonpoint sources
 - d. Identify the indicators to be measured
2. Identify and detail reduction load and the measures necessary to meet water quality standards
 - a. Indicate the quantitative reduction load
 - b. Prioritize proposed activities and identify critical areas that need management
 - c. Describe future and current management measures within the watershed
 - d. Document relevant authorities that may have a role in management plan
 - e. Management activities should address the indicators
3. Detailed management activities and the expected outcome
 - a. Describe the various management activities that will address the pollutant
 - b. Establish what the expected potential pollutant load reductions
4. Identification of technical and financial assistance needed to implement as well as long-term operation and maintenance measures
 - a. Estimate amount of technical assistance needed
 - b. Estimate amount of financial assistance needed, ideal utilizing a detailed cost list
 - c. Identify federal, state, local, and private funds or resources that could potentially assist
5. Education and information plan for the watershed
 - a. Clearly identify stakeholders

- b. Programs should have multifaceted involvement from local, state and federal programs and agencies
- 6. Plan implementation schedule
 - a. Identify timeline of actions implementation with specifics on what entity will accomplish the actions
 - b. Schedule should address short and long term actions and milestones
- 7. Implementation and tracking of measurable milestones to ensure benchmarks of success are being addressed
 - a. Milestones should be measurable and have a clear timeframe on when the milestone should be measured
- 8. Indicator to measure progress toward meeting watershed goals
 - a. Direct measurements (such as bacterial counts) or indirect measurements (such as number of beach closings) that can indicate whether substantial progress is being made
 - b. Should address how to proceed/modify strategies if interim goals are not being met
- 9. Monitoring component to evaluate effectiveness of plan
 - a. Monitoring should be of the load reduction goals to measure progress towards water quality improvement

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WATER QUALITY STANDARDS

Further information regarding 303(d) List and its reporting categories⁴:

“The term “303(d) list” or “list” is short for a state’s list of impaired and threatened waters (e.g. stream/river segments, lakes). States are required to submit their list for EPA approval every two years. For each water on the list, the state identifies the pollutant causing the impairment, when known. In addition, the state assigns a priority for development of Total Maximum Daily Loads (TMDL) based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40 C.F.R. §130.7(b)(4)).

In general, once a water body has been added to a state’s list of impaired waters it stays there until the state develops a TMDL and EPA approves it. EPA reporting guidance provides a way to keep track of a state’s water bodies, from listing as impaired to meeting water quality standards. This tracking system contains a running account of all the state’s water bodies and categorizes each based on the attainment status. For example, once a TMDL is developed, a water body is no longer on the 303(d) list, but it is still tracked until the water is fully restored.”

Table 1. EPA 303(d) List Integrated Report Categories

Category/Subcategory	Description
Category 1	Meets tested standards for clean waters. All designated uses are supported, no use is threatened.
Category 2	Waters of concern. Available data and/or information indicate that some, but not all, designated uses are supported.
Category 3	Insufficient data. There is insufficient available data and/or information to make a use support determination.
Category 4	Polluted waters that do not require a TMDL. Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.
Category 4a	Has a TMDL. A State developed TMDL has been approved by EPA or a TMDL has been established by EPA for any segment-pollutant combination.
Category 4b	Has a pollution control program. Other required control measures are expected to result in the attainment of an applicable water quality standard in a reasonable period of time.
Category 4c	Is impaired by a non-pollutant. The non-attainment of any applicable water quality standard for the segment is the result of pollution and is not caused by a pollutant.
Category 5	Polluted waters that require a TMDL or other WQI project. Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

DWR PRIMARY SURFACE WATER CLASSIFICATIONS

All surface waters in North Carolina are assigned a primary classification by the N.C. Division of Water Resources (DWR). All waters must at least meet the standards for Class C (fishable / swimmable) waters. The other primary classifications provide additional levels of protection for primary water contact recreation (Class B) and drinking water (Water Supply Classes I through V). To find the classification of a water body you can either use the BIMS database or contact Adriene Weaver of the Classifications & Standards/Rules Review Branch. To view the regulatory differences between the currently implemented classifications for freshwaters, click here for the

⁴ Environmental Protection Agency. Retrieved from <https://www.epa.gov/tmdl/program-overview-303d-listing>

freshwater classifications table. To view the regulatory differences between the currently implemented classifications for tidal saltwaters, click here for the tidal saltwaters classifications table.

Table 2. North Carolina surface water classifications. Full descriptions available on [DEQ Website](#).

Primary Use Classifications	
SA	Commercial Shellfishing
SB	Primary Recreation in tidal salt water
SC	Aquatic Life, Secondary Recreation, and Fishing in tidal salt water
SWL	Coastal wetlands
Supplemental Use Classifications	
HQW	High Quality Waters
ORW	Outstanding Resource Waters
NSW	Nutrient Sensitive Waters
CA	Critical Area
UWL	Unique Wetland
+, @, #, *	Special Designations (variable based on river basin)

Class C

Waters protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner.

Class B

Waters protected for all Class C uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

Water Supply I (WS-I)

Waters protected for all Class C uses plus waters used as sources of water supply for drinking, culinary, or food processing purposes for those users desiring maximum protection for their water supplies. WS-I waters are those within natural and undeveloped watersheds in public ownership. All WS-I waters are HQW by supplemental classification. More information: [Water Supply Watershed Protection Program Homepage](#)

Water Supply II (WS-II)

Waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I classification is not feasible. These waters are also protected for Class C uses. WS-II waters are generally in predominantly undeveloped watersheds. All WS-II waters are HQW by supplemental classification. More information: [Water Supply Watershed Protection Program Homepage](#)

Water Supply III (WS-III)

Waters used as sources of water supply for drinking, culinary, or food processing purposes where a more protective WS-I or II classification is not feasible. These waters are also protected for Class C uses. WS-III waters are generally in low to moderately developed watersheds. More information: [Water Supply Watershed Protection Program Homepage](#)

Water Supply IV (WS-IV)

Waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I, II or III classification is not feasible. These waters are also protected for Class C uses. WS-IV waters are generally in moderately to highly developed watersheds or Protected Areas. More information: [Water Supply Watershed Protection Program Homepage](#)

Water Supply V (WS-V)

Waters protected as water supplies which are generally upstream and draining to Class WS-IV waters or waters used by industry to supply their employees with drinking water or as waters formerly used as water supply. These waters are also protected for Class C uses. More information: [Water Supply Watershed Protection Program Homepage](#)

Class WL

Freshwater Wetlands are a subset of all wetlands, which in turn are waters that support vegetation that is adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. These waters are protected for storm and flood water storage, aquatic life, wildlife, hydrologic functions, filtration and shoreline protection.

Class SC

All tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife.

Class SB

Tidal salt waters protected for all SC uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

Class SA

Tidal salt waters that are used for commercial shellfishing or marketing purposes and are also protected for all Class SC and Class SB uses. All SA waters are also HQW by supplemental classification.

Class SWL

These are saltwaters that meet the definition of coastal wetlands as defined by the Division of Coastal Management and which are located landward of the mean high water line or wetlands contiguous to estuarine waters as defined by the Division of Coastal Management.

DWR SUPPLEMENTAL CLASSIFICATIONS

Supplemental classifications are sometimes added by DWR to the primary classifications to provide additional protection to waters with special uses or values.

Future Water Supply (FWS)

Supplemental classification for waters intended as a future source of drinking, culinary, or food processing purposes. FWS would be applied to one of the primary water supply classifications (WS-I, WS-II, WS-III, or WS-IV). Currently no water bodies in the state carry this designation.

High Quality Waters (HQW)

Supplemental classification intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission.

The following waters are HQW by definition:

- WS-I,
- WS-II,
- SA (commercial shellfishing),
- ORW,

Primary nursery areas (PNA) or other functional nursery areas designated by the Marine Fisheries Commission, or Waters for which DWR has received a petition for reclassification to either WS-I or WS-II.

Outstanding Resource Waters (ORW)

All outstanding resource waters are a subset of High Quality Waters. This supplemental classification is intended to protect unique and special waters having excellent water quality and being of exceptional state or national

ecological or recreational significance. To qualify, waters must be rated Excellent by DWR and have one of the following outstanding resource values:

- Outstanding fish habitat and fisheries,
- Unusually high level of water based recreation or potential for such kind of recreation,
- Some special designation such as North Carolina Natural and Scenic River or National Wildlife Refuge,
- Important component of state or national park or forest, or
- Special ecological or scientific significance (rare or endangered species habitat, research or educational areas).

For more details, refer to the [Biological Assessment Branch homepage](#).

Nutrient Sensitive Waters (NSW)

Supplemental classification intended for waters needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation.

Swamp Waters (Sw)

Supplemental classification intended to recognize those waters which have low velocities and other natural characteristics which are different from adjacent streams.

Trout Waters (Tr)

Supplemental classification intended to protect freshwaters which have conditions which shall sustain and allow for trout propagation and survival of stocked trout on a year-round basis. This classification is not the same as the NC Wildlife Resources Commission's Designated Public Mountain Trout Waters designation.

Unique Wetland (UWL)

Supplemental classification for wetlands of exceptional state or national ecological significance. These wetlands may include wetlands that have been documented to the satisfaction of the Environmental Management Commission as habitat essential for the conservation of state or federally listed threatened or endangered species.

Table 3. North Carolina water quality classification and standards.

Classification	Description
Class SA	<p>Tidal salt waters that are used for commercial shellfishing or marketing purposes and are also protected for all Class SC and Class SB uses. All SA waters are also HQW by supplemental classification.</p> <p>The following water quality standards apply to surface waters that are used for shellfishing for market purposes and are classified SA. Water quality standards applicable to Class SC waters as described in Rule .0220 of this Section also apply to Class SA waters.</p> <ol style="list-style-type: none"> (1) Best Usage of Waters. Shellfishing for market purposes and any other usage specified by the "SB" or "SC" classification; (2) Conditions Related to Best Usage. Waters shall meet the current sanitary and bacteriological standards as adopted by the Commission for Health Services and shall be suitable for shellfish culture; any source of water pollution which precludes any of these uses, including their functioning as PNAs, on either a short-term or a long-term basis shall be considered to be violating a water quality standard; (3) Quality Standards applicable to Class SA Waters: <ol style="list-style-type: none"> a. Floating solids; settleable solids; sludge deposits: none attributable to sewage, industrial wastes or other wastes; b. Sewage: none; c. Industrial wastes, or other wastes: none which are not effectively treated to the satisfaction of the Commission in accordance with the requirements of the Division of Health Services;

	<p>d. 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.</p>
<p>Class SB</p>	<p>Tidal salt waters protected for all SC uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.</p> <p>The following water quality standards apply to surface waters that are used for primary recreation, including frequent or organized swimming, and are classified SB. Water quality standards applicable to Class SC waters are described in Rule .0220 of this Section also apply to SB waters.</p> <ol style="list-style-type: none"> 1. Best Usage of Waters. Primary recreation and any other usage specified by the "SC" classification; 2. Conditions Related to Best Usage. The waters shall meet accepted sanitary standards of water quality for outdoor bathing places as specified in Item of this Rule and will be of sufficient size and depth for primary recreation purposes; any source of water pollution which precludes any of these uses, including their functioning as PNAs, on either a short-term or a long-term basis shall be considered to be violating a water quality standard; 3. Quality Standards applicable to Class SB waters: <ol style="list-style-type: none"> a. Floating solids; settleable solids; sludge deposits: none attributable to sewage, industrial wastes or other wastes; b. Sewage; industrial wastes; or other wastes: none which are not effectively treated to the satisfaction of the Commission; in determining the degree of treatment required for such waters discharged into waters which are to be used for bathing, the Commission shall take into consideration quantity and quality of the sewage and other wastes involved and the proximity of such discharges to the waters in this class; discharges in the immediate vicinity of bathing areas may not be allowed if the Director determines that the waste cannot be treated to ensure the protection of primary recreation; c. Organisms of coliform group: fecal coliforms not to exceed a geometric mean of 200/100 ml (MF count) based on at least five consecutive samples examined during any 30-day period and not to exceed 400/100 ml in more than 20 percent of the samples examined during such period.
<p>Class SC</p>	<p>All tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife. The water quality standards for all tidal salt waters are the basic standards applicable to Class SC waters. Additional and more stringent standards applicable to other specific tidal salt water classifications are specified in Rules .0221 and .0222 of this Section.</p> <ol style="list-style-type: none"> 1. Best Usage of Waters. Aquatic life propagation and maintenance of biological integrity (including fishing, fish and functioning PNAs), wildlife, secondary recreation, and any other usage except primary recreation or shellfishing for market purposes. 2. Conditions Related to Best Usage. The waters shall be suitable for aquatic life propagation and maintenance of biological integrity, wildlife, and secondary recreation; Any source of water pollution which precludes any of these uses, including their functioning as PNAs, on either a short-term or a long-term basis shall be considered to be violating a water quality standard. 3. Quality standards applicable to all tidal salt waters: <ol style="list-style-type: none"> a. Chlorophyll a (corrected): not greater than 40 ug/l in sounds, estuaries, and other waters subject to growths of macroscopic or microscopic vegetation; the Commission or its designee may prohibit or limit any discharge of waste into surface waters if, in the opinion

- of the Director, the surface waters experience or the discharge would result in growths of microscopic or macroscopic vegetation such that the standards established pursuant to this Rule would be violated or the intended best usage of the waters would be impaired;
- b. Dissolved oxygen: not less than 5.0 mg/l, except that swamp waters, poorly flushed tidally influenced streams or embayments, or estuarine bottom waters may have lower values if caused by natural conditions;
 - c. Floating solids; settleable solids; sludge deposits: only such amounts attributable to sewage, industrial wastes or other wastes, as shall not make the waters unsafe or unsuitable for aquatic life and wildlife, or impair the waters for any designated uses;
 - d. Gases, total dissolved: not greater than 110 percent of saturation;
 - e. **Organisms of coliform group: fecal coliforms not to exceed geometric mean of 200/100 ml (MF count) based upon at least five consecutive samples examined during any 30 day period; not to exceed 400/100 ml in more than 20 percent of the samples examined during such period;** violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable nonpoint source pollution; all coliform concentrations are to be analyzed using the MF technique unless high turbidity or other adverse conditions necessitate the tube dilution method; in case of controversy over results the MPN 5-tube dilution method shall be used as the reference method;
 - f. Oils; deleterious substances; colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation or to aquatic life and wildlife or adversely affect the palatability of fish, aesthetic quality or impair the waters for any designated uses; for the purpose of implementing this Rule, oils, deleterious substances, colored or other wastes shall include but not be limited to substances that cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines pursuant to 40 CFR 110.4(a)-(b);
 - g. pH: shall be normal for the waters in the area, which generally shall range between 6.8 and 8.5 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions;
 - h. Phenolic compounds: only such levels as shall not result in fish-flesh tainting or impairment of other best usage;
 - i. Radioactive substances: (i) Combined radium-226 and radium-228: The maximum average annual activity level (based on at least four samples, collected quarterly) for combined radium-226, and radium-228 shall not exceed five picoCuries per liter; (ii) Alpha Emitters. The average annual gross alpha particle activity (including radium-226, but excluding radon and uranium) shall not exceed 15 picoCuries per liter; (iii) Beta Emitters. The maximum average annual activity level (based on at least four samples, collected quarterly) for strontium-90 shall not exceed eight picoCuries per liter; nor shall the average annual gross beta particle activity (excluding potassium-40 and other naturally occurring radio-nuclides) exceed 50 picoCuries per liter; nor shall the maximum average annual activity level for tritium exceed 20,000 picoCuries per liter;
 - j. Salinity: changes in salinity due to hydrological modifications shall not result in removal of the functions of a PNA; projects that are determined by the Director to result in modifications of salinity such that functions of a PNA are impaired will be required to employ water management practices to mitigate salinity impacts;
 - k. Temperature: shall not be increased above the natural water temperature by more than 0.8 degrees C (1.44 degrees F) during the months of June, July, and August nor more than 2.2 degrees C (3.96 degrees F) during other months and in no cases to exceed 32 degrees C (89.6 degrees F) due to the discharge of heated liquids;
 - l. Turbidity: the turbidity in the receiving water shall not exceed 25 NTU; if turbidity exceeds this level due to natural background conditions, the existing turbidity level shall not be increased. Compliance with this turbidity standard can be met when land management activities employ Best Management Practices (BMPs) [as defined by Rule .0202(6) of this

Section] recommended by the Designated Nonpoint Source Agency (as defined by Rule .0202 of this Section). BMPs must be in full compliance with all specifications governing the proper design, installation, operation and maintenance of such BMPs;

- m. Toxic substances: numerical water quality standards (maximum permissible levels) to protect aquatic life applicable to all tidal saltwaters: (i) Arsenic, total recoverable: 50 ug/l; (ii) Cadmium: 5.0 ug/l; attainment of these water quality standards in surface waters shall be based on measurement of total recoverable metals concentrations unless appropriate studies have been conducted to translate total recoverable metals to a toxic form. Studies used to determine the toxic form or translators must be designed according to the "Water Quality Standards Handbook Second Edition" published by the Environmental Protection Agency (EPA 823-B-94-005a) or "The Metals Translator: Guidance For Calculating a Total Recoverable Permit Limit From a Dissolved Criterion" published by the Environmental Protection Agency (EPA 823-B-96-007) which are hereby incorporated by reference including any subsequent amendments. The Director shall consider conformance to EPA guidance as well as the presence of environmental conditions that limit the applicability of translators in approving the use of metal translators. (iii) Chromium, total: 20 ug/l; (iv) Cyanide: 1.0 ug/l; (v) Mercury: 0.025 ug/l; (vi) Lead, total recoverable: 25 ug/l; collection of data on sources, transport and fate of lead shall be required as part of the toxicity reduction evaluation for dischargers that are out of compliance with whole effluent toxicity testing requirements and the concentration of lead in the effluent is concomitantly determined to exceed an instream level of 3.1 ug/l from the discharge; (vii) Nickel: 8.3 ug/l; attainment of these water quality standards in surface waters shall be based on measurement of total recoverable metals concentrations unless appropriate studies have been conducted to translate total recoverable metals to a toxic form. Studies used to determine the toxic form or translators must be designed according to the "Water Quality Standards Handbook Second Edition" published by the Environmental Protection Agency (EPA 823-B-94-005a) or "The Metals Translator: Guidance For Calculating a Total Recoverable Permit Limit From a Dissolved Criterion" published by the Environmental Protection Agency (EPA 823-B-96-007) which are hereby incorporated by reference including any subsequent amendments. The Director shall consider conformance to EPA guidance as well as the presence of environmental conditions that limit the applicability of translators in approving the use of metal translators. (viii) Pesticides: (A) Aldrin: 0.003 ug/l; (B) Chlordane: 0.004 ug/l; (C) DDT: 0.001 ug/l; (D) Demeton: 0.1 ug/l; (E) Dieldrin: 0.002 ug/l; (F) Endosulfan: 0.009 ug/l; (G) Endrin: 0.002 ug/l; (H) Guthion: 0.01 ug/l; (I) Heptachlor: 0.004 ug/l; (J) Lindane: 0.004 ug/l; (K) Methoxychlor: 0.03 ug/l; (L) Mirex: 0.001 ug/l; (M) Parathion: 0.178 ug/l; (N) Toxaphene: 0.0002 ug/l. (ix) Polychlorinated biphenyls: 0.001 ug/l; (x) Selenium: 71 ug/l; (xi) Trialkyltin compounds: 0.002 ug/l expressed as tributyltin.

4. Action Levels for Toxic Substances: if the Action Levels for any of the substances listed in this Subparagraph (which are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics or associated waste characteristics) are determined by the waste load allocation to be exceeded in a receiving water by a discharge under the specified low flow criterion for toxic substances (Rule .0206 in this Section), the discharger shall be required to monitor the chemical or biological effects of the discharge; efforts shall be made by all dischargers to reduce or eliminate these substances from their effluents. Those substances for which Action Levels are listed in this Subparagraph may be limited as appropriate in the NPDES permit if sufficient information (to be determined for metals by measurements of that portion of the dissolved instream concentration of the Action Level parameter attributable to a specific NPDES permitted discharge) exists to indicate that any of those substances may be a causative factor resulting in toxicity of the effluent. NPDES permit limits may be based on translation of the toxic form to total recoverable metals. Studies used to determine the toxic form or translators must be designed according to: "Water Quality Standards Handbook Second Edition" published by the Environmental Protection Agency (EPA

823-B-94-005a) or "The Metals Translator: Guidance For Calculating a Total Recoverable Permit Limit From a Dissolved Criterion" published by the Environmental Protection Agency (EPA 823-B-96-007) which are hereby incorporated by reference including any subsequent amendments. The Director shall consider conformance to EPA guidance as well as the presence of environmental conditions that limit the applicability of translators in approving the use of metal translators. (a) Copper: 3 ug/l; (b) Silver: 0.1 ug/l; (c) Zinc: 86 ug/l.

Shellfish Sanitation Classifications

Table 4. Classifications used by Shellfish Sanitation for shellfish harvesting waters.

North Carolina Shellfish Sanitation Growing Area Classifications	
Approved	These areas are always open to shellfish harvesting and close only after rare heavy rainfall events such as hurricanes. The median fecal coliform Most Probable Number (MPN) or geometric mean MPN of water shall not exceed 14 per 100 milliliters, and the estimated 90th percentile shall not exceed an MPN of 43 per 100 mL for a five-tube decimal dilution test.
Conditionally Approved-Open Shellfish Areas	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed with a plan. These areas are open to harvest much of the year, but are immediately closed after certain sized rainfall events.
Conditionally Approved-Closed Shellfish Areas	Sanitary Survey indicates an area can meet approved area criteria during dry periods of time, and the pollutant event is known and predictable and can be managed with a plan. This growing area classification allows harvest when fecal coliform bacteria levels are lower than the state standard in areas that otherwise might be closed to harvesting. These areas are regularly monitored to determine if temporary openings are possible.
Prohibited Shellfish Harvest Areas	Sanitary Survey is not routinely conducted because previous sampling data did not meet criteria for Approval or Conditional Approved. Area may also be closed as a matter of regulation due to the presence of point source discharges or high concentrations of boats with heads.

Recreational Water Quality Standards

Tier	Description
Tier I	<p>"Tier I swimming area" means a swimming area used daily during the swimming season, including any public access swimming area and any other swimming area where people use the water for primary contact, including all oceanfront beaches.</p> <ol style="list-style-type: none"> 1. The enterococcus level in a Tier I swimming area shall not exceed either: <ol style="list-style-type: none"> a. A geometric mean of 35 enterococci per 100 milliliter of water, that includes a minimum of at least five samples collected within 30 days; or b. A single sample of 104 enterococci per 100 milliliters of water. <p>Tier I Swimming areas:</p> <ol style="list-style-type: none"> (1) A swimming advisory shall be issued by the Division when samples of water from a swimming area exceeds a geometric mean of 35 enterococci per 100 milliliters during the swimming season. (2) A swimming alert shall be issued by the Division when a single sample of water from a swimming area exceeds 104 enterococci per 100 milliliters and does not exceed 500 enterococci per 100 milliliters during the swimming season.

	<p>(3) A swimming advisory shall be issued by the Division when a sample of water from a swimming area exceeds a single sample of 500 enterococci per 100 milliliters during the swimming season.</p> <p>(4) A swimming advisory shall be issued by the Division when at least two of three concurrent water samples collected at a swimming area exceeds 104 enterococci per 100 milliliters during the swimming season.</p> <p>A Tier I swimming area advisory shall be rescinded when two consecutive weekly water samples and the geometric mean meet the bacteriological limits in Rule 18A .3402(a) of this Section. A swimming alert shall be rescinded within 24 hours of compliance with Rule 18A .3402(a)(2) of this Section.</p>
Tier II	<p>"Tier II swimming area" means a swimming area used an average of three days a week during the swimming season.</p> <p>The enterococcus level in a Tier II swimming area shall not exceed a single sample of 276 enterococci per 100 milliliters of water.</p> <p>Tier II swimming areas:</p> <p>(1) A swimming alert shall be issued by the Division when a single sample of water from a swimming area exceeds 276 enterococci per 100 milliliters and does not exceed 500 enterococci per 100 milliliters during the swimming season.</p> <p>(2) A swimming advisory shall be issued by the Division when a single sample of water from a swimming area exceeds 500 enterococci per 100 milliliters during the swimming season.</p> <p>A Tier II or Tier III swimming area advisory or alert shall be rescinded after water samples meet the bacteriological standard in Rule 18A .3402(b) or (c) of this Section.</p>
Tier III	<p>"Tier III swimming area" means a swimming area used an average of four days a month during the swimming season.</p> <p>Tier III swimming area with a water sample result of 500 enterococci per 100 milliliters or higher on the first sample shall be resampled the following day. If the laboratory results of the second sample exceed 500 enterococci per 100 milliliters a swimming advisory shall be issued by the Division.</p> <p>A Tier II or Tier III swimming area advisory or alert shall be rescinded after water samples meet the bacteriological standard in Rule 18A .3402(b) or (c) of this Section.</p>
Swimming Season	<p>April 1 through October 31 of each year.</p> <p>The enterococcus level in a Tier III swimming area shall not exceed two consecutive samples of 500 enterococci per 100 milliliters of water.</p>
Winter Season	<p>November 1 through March 31 of each year.</p>

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Appendix C Runoff Volume Reduction

The following section describes in detail the individual volume reduction goal findings for each of the 11 Stump Sound Watersheds.

BATTS MILL CREEK WATERSHED

Batts Mill Creek watershed is located on the southern end of the Stump Sound watersheds. Over the last two decades, undeveloped areas have decreased while the amount of commercial and residential impervious surface has increased, particularly between 1998 and 2015. Batts Mill Creek consists of 4,685.87 total acres. Batts Mill Creek, the primary waterbody within the watershed, was placed on the EPA's 303(d) list in 2006 due to excessive levels of fecal coliform bacteria. In 2004, shellfishing was closed in the Batts Mill Creek watershed and currently remains closed. There is currently no active monitoring station within Batts Mill Creek. The closest monitoring stations are located at Morris Landing (Station: 54A, Shellfish Sanitation; Station: B9865000, DEQ Division of Water Quality).

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 18.63 acres, making up a total of 150.5 acres by 2015 (not including ROW). Most of the impervious surface increases in Batts Mill Creek has been due to residential development. Right of ways increases from 167 acres to 225 acres by 2015. The total watershed is 4,683.87 acres.

Table C-1. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	1386.74	A	R Open	1326.84
A	R Impervious	27.98	A	R Impervious	30.09
A	C Open	72.81	A	C Open	71.13
A	C Impervious	13.98	A	C Impervious	15.66
B	R Open	235.35	B	R Open	235.53
B	R Impervious	1.33	B	R Impervious	1.14
B	C Open	-	B	C Open	-
B	C Impervious	-	B	C Impervious	-
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	2478.51	D	R Open	2460.59
D	R Impervious	27.65	D	R Impervious	41.48
D	C Open	193.41	D	C Open	196.31
D	C Impervious	60.96	D	C Impervious	62.16

Table C-2. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-foot)	Reduction Goals		
		Acre-foot	Cubic Feet	Gallons
2015	459.34			
1998	443.16	16.18	704,732.25	5,271,397.20

EVERETT BAY AND SOUND WATERSHED

The Everett Bay and Sound Watershed is made up of 1,541.51 total acres of land. In 1998, the amount of runoff for the watershed was 125.14 acre-feet. Comparatively, the value for the amount of runoff in 2015 was calculated at 133.99. Between 1998 and 2015, there was a noticeable decrease in the amount of residential and commercial open space between as well as an increase in the amount of impervious surface coverage. The Everett Bay and Sound Watershed appeared on the EPA's 303(d) list in 2006 due to high levels of fecal coliform bacteria. The Everett Bay Watershed has water bodies that are open for shellfishing and some that are closed. Turkey Creek and areas of Kings Creek, which are listed as "conditionally approved-closed", and areas of Everett Bay and parts of Kings Creek, which are listed as "prohibited", are all closed for shellfishing as of March 2014.

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 13.4 acres, making up a total of 17.8 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Everett Bay-Topsail Bay Watershed has been due to both residential and commercial development. Right of ways increases from 29.57 acres to 57.36 acres by 2015. The total watershed is 1541.51 acres.

Table C-4. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	593.43	A	R Open	563.26
A	R Impervious	5.21	A	R Impervious	10.39
A	C Open	56.51	A	C Open	52.01
A	C Impervious	1.47	A	C Impervious	5.96
B	R Open	-	B	R Open	-
B	R Impervious	-	B	R Impervious	-
B	C Open	-	B	C Open	-
B	C Impervious	-	B	C Impervious	-
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	677.46	D	R Open	675.48

D	R Impervious	1.81	D	R Impervious	3.80
D	C Open	55.70	D	C Open	53.96
D	C Impervious	0.41	D	C Impervious	2.15

Table C-5. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	133.99			
1998	125.14	8.85	385,521.41	2,883,700.17

GOOSE BAY AND SOUND WATERSHED

The Goose Bay and Sound Watershed is made up of 2,365.34 total acres of land. In 1998, the amount of runoff experienced was calculated at 227.12. In comparison, the amount of runoff calculated in 2015 was 229.03. During this time, there was a slight increase in the amount of impervious surface coverage. The Goose Bay and Sound Watershed appeared on the EPA's 303(d) list in 2006 due to high levels of fecal coliform bacteria. Currently, this area is classified as "conditionally approved-open".

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 10.7 acres, making up a total of 42.07 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Everett Bay and Sound has been due to both residential and commercial development. Right of ways increases from 91.58 acres to 99.58 acres by 2015. The total watershed is 2365.34 acres.

Table C-6. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	722.73	A	R Open	720.57
A	R Impervious	14.91	A	R Impervious	17.07
A	C Open	118.81	A	C Open	116.82
A	C Impervious	0.94	A	C Impervious	2.93
B	R Open	-	B	R Open	-
B	R Impervious	-	B	R Impervious	-
B	C Open	-	B	C Open	-

B	C Impervious	-	B	C Impervious	-
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	786.15	D	R Open	775.70
D	R Impervious	2.14	D	R Impervious	4.59
D	C Open	407.40	D	C Open	403.30
D	C Impervious	13.38	D	C Impervious	17.48

Table C-7. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	229.03			
1998	227.13	1.90	82,951.99	620,480.86



KING CREEK—SPICER BAY WATERSHED

The King Creek-Spicer Bay Watershed is made up of 4,155.21 total acres of land. In 1998, the total runoff calculated for this watershed was 363.69 acre-feet. In 2015, the amount of runoff totaled 379.86. This increase could be linked to the decrease in commercial and residential open space as well as the increase in impervious surfaces. The King Creek-Spicer Bay Watershed appeared on the EPA's 303(d) list in 2002 as a result in high levels of fecal coliform bacteria. In 1965, shellfishing was prohibited in both King Creek and Spicer Bay. In 1984, Spicer Bay reopened but then closed again in 1996. Currently this area is closed to shellfishing and listed as "conditionally approved-closed".

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 39.63 acres, making up a total of 109.97 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in King Creek—Spicer Bay Watershed has been due to both residential and commercial development. Right of ways increases from 144.57 acres to 156.99 acres by 2015. The total watershed is 4155.21 acres.

Table C-8. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	1228.32	A	R Open	1173.25
A	R Impervious	7.52	A	R Impervious	20.17
A	C Open	146.34	A	C Open	138.74
A	C Impervious	9.56	A	C Impervious	17.16
B	R Open	324.30	B	R Open	320.51
B	R Impervious	0.63	B	R Impervious	4.43
B	C Open	9.56	B	C Open	9.56
B	C Impervious	0.00	B	C Impervious	0.00
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	1847.21	D	R Open	1841.48
D	R Impervious	14.63	D	R Impervious	20.36
D	C Open	401.71	D	C Open	392.12
D	C Impervious	38.27	D	C Impervious	47.85

Table C-9. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	379.86			
1998	363.70	16.17	704,484.59	5,269,544.70

D	C Open	534.66	D	C Open	482.53
D	C Impervious	32.87	D	C Impervious	85.01

Table C-11. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	362.04			
1998	349.21	12.83	558,982.28	4,181,187.43

MORRIS LANDING WATERSHED



The Morris Landing Watershed is made up of 534.15 total acres of land. A small portion of Stump Sound is the only waterbody within the watershed. Since 1998, there has been a slight decrease in the amount of residential open space along with an increase in residential impervious surface. Little change was seen in commercial land use. This area appeared in the EPA's 303(d) list in 2006 and 2014, first for fecal coliform bacteria levels and then for enterococcus. The waters in this watershed remain open for shellfishing, but listed as "conditionally approved-open". Currently there are four monitoring sites within the Morris Landing watershed. Two of the stations are monitored by the North Carolina Department of Environment and Natural Resources Division of Environmental Health Shellfishing Sanitation and Recreational Water Quality. Those

stations are numbered as 35 and 14 and are located at Middle Cove, west of Dixon point and by Beacon #49 in the Intracoastal Water Way, respectively. The third station is located in the Intracoastal Water Way at Morris Landing and is monitored by the North Carolina Department of Environment and Natural Resources (Station ID: B9865000, Organization ID: 21NC01WQ).

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 10.17 acres, making up a total of 14.59 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Morris Landing Watershed has been due to both residential and commercial development. Right of ways increases from 14.75 acres to 27.65 acres by 2015. The total watershed is 534.15 acres.

Table C-12. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	198.98	A	R Open	198.77
A	R Impervious	2.03	A	R Impervious	11.24
A	C Open	0.00	A	C Open	0.00
A	C Impervious	0.00	A	C Impervious	0.00
B	R Open	0.39	B	R Open	0.39
B	R Impervious	0.00	B	R Impervious	0.00
B	C Open	0.00	B	C Open	0.00
B	C Impervious	0.00	B	C Impervious	0.00
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	308.83	D	R Open	294.98
D	R Impervious	2.39	D	R Impervious	3.35
D	C Open	0.00	D	C Open	0.00
D	C Impervious	0.00	D	C Impervious	0.00

Table C-13. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	48.59			
1998	46.21	2.38	103,814.80	776,534.73

OLD MILL CREEK WATERSHED

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 7.63 acres, making up a total of 14.59 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Old Mill Creek Watershed has been due to both residential developments. Right of ways remained at 16.65 acres by 2015. The total watershed is 699.77 acres.

Table C-14. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	296.73	A	R Open	291.88
A	R Impervious	2.61	A	R Impervious	7.46
A	C Open	9.04	A	C Open	7.61
A	C Impervious	4.17	A	C Impervious	5.60
B	R Open	2.74	B	R Open	2.37
B	R Impervious	0.00	B	R Impervious	0.36
B	C Open	0.00	B	C Open	0.00
B	C Impervious	0.00	B	C Impervious	0.00
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	355.00	D	R Open	354.02
D	R Impervious	0.18	D	R Impervious	1.17
D	C Open	11.51	D	C Open	11.51
D	C Impervious	0.00	D	C Impervious	0.00

Table C-15. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	52.97			
1998	51.66	1.31	57,007.53	426,416.31

SOUTH MORRIS LANDING WATERSHED



The South Morris Landing Watershed is made up of 423.61 total acres of land. A small portion of the Topsisail Sound is the only waterbody within the watershed. Since 1998, there has been a decrease in the amount of residential open space and an increase in residential impervious surface coverage. This area appeared on the EPA's 303(d) list in 2006 due to fecal coliform levels, but shellfishing remains open. Waters in this watershed are listed as "conditionally approved-open". Currently, there are no active monitoring sites within the South Morris Landing watershed.

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 9.01 acres, making up a total of 9.99 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Old Mill

Creek-Topsisail Bay Watershed has been due to residential developments. Right of ways increased from 3.72 to 4.87 acres by 2015. The total watershed is 423.61 acres.

Table C-16. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	179.69	A	R Open	174.22
A	R Impervious	0.00	A	R Impervious	4.42
A	C Open	0.00	A	C Open	0.00
A	C Impervious	0.00	A	C Impervious	0.00
B	R Open	25.25	B	R Open	25.21
B	R Impervious	0.98	B	R Impervious	1.03
B	C Open	0.00	B	C Open	0.00
B	C Impervious	0.00	B	C Impervious	0.00
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	213.86	D	R Open	209.32
D	R Impervious	0.00	D	R Impervious	4.54
D	C Open	0.00	D	C Open	0.00
D	C Impervious	0.00	D	C Impervious	0.00

Table C-17. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	31.18			
1998	29.93	1.25	54,470.22	407,437.21

PERMUDA AND SOUND WATERSHED

The Permuda and Sound Watershed is made up of 833.08 total acres of land. In 1998, the total runoff for this watershed was 80.01 acre-feet. In 2015, this value rose to 110.53. Between 1998 and 2015, the amount of residential and commercial open space decreased while the amount of residential and commercial impervious surface coverage increased. This area appeared on the EPA's 303(d) list in 2006 as a result of fecal coliform bacteria.

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 156.65 acres, making up a total of 179.90 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Permuda and Sound Watershed has been due to residential developments. Right of ways remains at 67.88 acres by 2015. The total watershed is 833.08 acres.

Table C-18. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	216.77	A	R Open	185.32
A	R Impervious	12.00	A	R Impervious	44.15
A	C Open	91.35	A	C Open	39.31
A	C Impervious	7.61	A	C Impervious	58.96
B	R Open	-	B	R Open	-
B	R Impervious	-	B	R Impervious	-
B	C Open	-	B	C Open	-
B	C Impervious	-	B	C Impervious	-
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	351.50	D	R Open	283.37
D	R Impervious	3.51	D	R Impervious	69.75
D	C Open	12.06	D	C Open	4.70
D	C Impervious	0.13	D	C Impervious	7.04

Table C-19. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	110.53			
1998	80.01	30.52	1,329,260.27	9,942,866.81

WATERS BAY-SURF CITY WATERSHED

Waters Bay-Surf City Watershed is made up of 2,565.65 total acres of land. The watershed houses both Topsail Sound and a portion of Batts Mill Creek. Since 1998, there has been a slight decrease in the amount of residential and commercial open space. In addition, there has been a slight increase in the amount of impervious surface coverage. This area was listed on the EPA's 303(d) list in 2006 as a result of fecal coliform bacteria levels. Shellfishing in this area remains open, but is listed as "conditionally approved-open". Currently there are five monitoring stations located within the Waters Bay-Surf City watershed, all of which are part of the Shellfish Sanitation Department. Stations four, five, and six are situated in Pender County. Station four is located near Queens Hole, station five is located by the mouth of Batts Mill Creek and station six is located by flashing beacon #61 in the Intracoastal Water Way. Stations 36 and 34A are situated in Onslow County. Station 36 is located 750 yards south by east of Day Marker #159 in a creek, while station 34A is located at Old Settlers Beach. All of these stations are monitored through the North Carolina Department of Environment and Natural Resources Division of Environmental Health Shellfishing Sanitation and Recreational Water Quality.

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 6.49 acres, making up a total of 24.22 impervious acres by 2015 (not including ROW). Most of the impervious surface increases in Waters Bay-Surf City Watershed has been due to residential developments. Right of ways remains at 48.04 acres by 2015. The total watershed is 2565.65 acres.

Table C-21. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	882.99	A	R Open	880.06
A	R Impervious	15.67	A	R Impervious	18.61
A	C Open	42.88	A	C Open	41.35
A	C Impervious	0.71	A	C Impervious	2.23
B	R Open	-	B	R Open	-
B	R Impervious	-	B	R Impervious	-

B	C Open	-	B	C Open	-
B	C Impervious	-	B	C Impervious	-
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	1334.14	D	R Open	1333.22
D	R Impervious	0.86	D	R Impervious	2.75
D	C Open	42.94	D	C Open	41.82
D	C Impervious	0.49	D	C Impervious	0.63

Table C-22. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	238.70			
1998	237.59	1.11	48,388.41	361,945.33



TURKEY CREEK WATERSHED

The Turkey Creek Watershed is made up of 5,643.19 total acres of land. In 1998 the amount of runoff was calculated as 338.93 acre-feet. Comparatively, the amount of runoff totaled 350.31 acre-feet. During this time, there was a decrease in the amount of residential and commercial open space as well as an increase in the amount of impervious surface coverage. The Turkey Creek Watershed appeared on the EPA's 303(d) list in 2002 due to high levels of fecal coliform bacteria. This could be a result of the presence of animal farms in the area. With fecal coliform bacteria being a leading pollutant in stormwater, animal farms can be large contributor to runoff pollution. There are three known spots in the Turkey Creek Watershed where there are horses and one location near the bottom of this area that houses cattle. In 1992, shellfishing was prohibited in all waters within the watershed. Currently the area is closed and classified as "conditionally approved-closed".

Between 1998 to 2015 (17-year time span), impervious surfaces have increased by approximately 73.41 acres, making up a total of 228.31 impervious acres by 2015 (not including ROW). Most of the

impervious surface increases in Turkey Creek Watershed has been due to residential developments. Right of ways increased from 133.26 to 162.01 acres by 2015. The total watershed is 5643.19 acres.

Table C-23. Summary of the total area of each soil type based on land use for the baseline year of 1998 and 2015 based on geospatial analysis.

1998			2015		
Soil Type	Land Use	Total Area	Soil Type	Land Use	Total Area
A	R Open	2642.40	A	R Open	2585.31
A	R Impervious	81.06	A	R Impervious	123.68
A	C Open	88.52	A	C Open	95.31
A	C Impervious	31.98	A	C Impervious	25.20
B	R Open	556.57	B	R Open	552.82
B	R Impervious	7.55	B	R Impervious	11.29
B	C Open	4.85	B	C Open	4.85
B	C Impervious	0.00	B	C Impervious	0.00
C	R Open	-	C	R Open	-
C	R Impervious	-	C	R Impervious	-
C	C Open	-	C	C Open	-
C	C Impervious	-	C	C Impervious	-
D	R Open	1925.45	D	R Open	1895.03
D	R Impervious	34.31	D	R Impervious	50.44
D	C Open	112.60	D	C Open	94.90
D	C Impervious	0.00	D	C Impervious	17.70

Table C-24. Summary of the total runoff volume reduction goals.

Year	Runoff (acre-feet)	Reduction Goals		
		Acre-feet	Cubic Feet	Gallons
2015	350.31			
1998	338.94	11.37	495,278.26	3,704,681.41

Appendix D Potential Stormwater Incentive Strategies

The following is an outline of potential stormwater incentive strategies that municipalities could consider to encourage early LID implementation.

Begin by reviewing the town's codes and ordinances utilizing the following worksheet:

<https://www.scdhec.gov/HomeandEnvironment/docs/ModelOrdinances/CodesandOrdinancesWorksheet.pdf>

Incentive Categories

The EPA has identified five basic incentive categories that can be utilized to encourage the reduction of stormwater⁵:

Incentive Type	Description
Stormwater Fee Discount	Require a stormwater fee that is based on impervious surface area. If property owners reduce need for service by reducing impervious area and the volume of runoff discharged from the property, the municipality reduces the fee.
Development Incentives	Offered to developers during the process of applying for development permits. Examples include: zoning upgrades, expedited permitting, reduced stormwater requirements and increases in floor area ratios
Grants	Provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices.
Rebates & Installation Financing	Provide funding, tax credits or reimbursements to property owners who install specific practices. Often focused on practices needed in certain areas or neighborhoods
Awards & Recognition Incentive	Provide marketing opportunities and public outreach for exemplary projects. May include monetary awards. Emphasize LID projects on website, at Council meetings and in utility mailers.

⁵ *Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanism*. 2009. US Environmental Protection Agency, EPA-833-F-09-001. Retrieved from https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_incentives_0.pdf

Basic Strategies

The following is a compiled list of basic strategies and descriptions (summarized or quoted directly from Slo County⁶ and EPA⁷; see Reference):

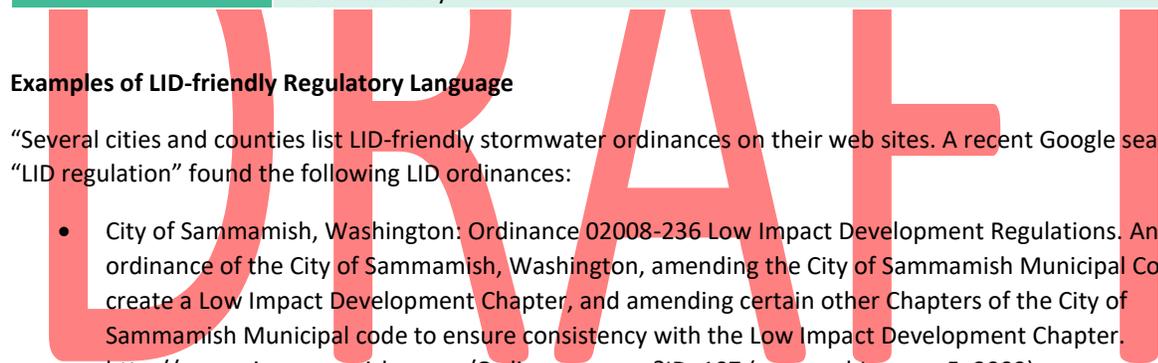
Strategy	Description
Adjustments to the Required Parking	Reducing parking is both an LID technique for reducing impervious surfaces as well to encourage more projects.
Dedicated Review Team	Create an LID review team that is familiar with and dedicated to LID projects.
Density bonuses	Allow greater residential densities with the implementation of LID techniques.
Disconnect of rooftop runoff credit	A credit is given when rooftop runoff is disconnected and then direction to a vegetated area where it can either infiltrate into the soil or filter over it. The credit is typically obtained by grading the site to promote overland filtering or by providing bioretention areas on single family residential lots.
Disconnection of Non-Rooftop Runoff Credit (aka Impervious Area Disconnection Credit)	This credit may be granted when impervious areas are disconnected from the stormwater control system via overland flow filtration/ infiltration (i.e., pervious) zones. These pervious areas are incorporated into the site design to receive runoff small impervious areas (e.g., driveways, small parking lots, etc.). This can be achieved by grading the site to promote overland vegetative filtering or by providing infiltration or “rain garden” areas.
Environmentally Sensitive Large Lot Neighborhood Credit (aka Environmentally Sensitive Development Credit)	This credit is targeted toward large lot residential developments that implement several Better Site Design practices to reduce stormwater discharges from the development. This credit may be granted when a group of environmental site design techniques are applied to low and very low density residential development (e.g., 1 dwelling unit per 2 acres [du/ac] or lower). The credit can eliminate the need for structural stormwater controls to treat water quality volume requirements. The project must have a total impervious cover (including streets) of less than 15% of the total area. utilize grass channels to convey runoff versus curb and gutter, etc.
Exemptions from local stormwater permitting	Allow redevelopment projects from being exempt from local stormwater permitting requirements if they can: <ul style="list-style-type: none"> • reduce the total impervious cover by 40% from existing conditions • Where site conditions prevent reduction in stormwater practices, implement controls for at least 40% of the site’s impervious area, or Where a combination of impervious area reduction and implementation of stormwater practices is used

⁶ Slo County. n.d. *List of Potential Municipal LID Incentive Programs*. Retrieved from <http://www.slocounty.ca.gov/Assets/PW/stormwater/Potential+LID+Incentives.pdf>

⁷ *Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanism*. 2009. US Environmental Protection Agency, EPA-833-F-09-001. Retrieved from https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_incentives_0.pdf

	for redevelopment projects, the combination of impervious area reduction and area controlled by stormwater management practices is equal to or exceeds 40%.
Fast track of review process	Provide priority status to LID projects with decreased time between receipt and review.
Green Roof Bonus	Add one square foot of additional floor area for each square foot of green roof, if green roof covers at least 50% of roof area and at least 30% of the garden contains plants.
LID Point system	Require a certain number of LID points and provide points when using approved LID IMP practices.
Managed Conservation Area Credit	A credit may be granted when areas of managed open space, typically reserved for passive recreation or agricultural practices, are conserved on a site. Under this credit, a designer would be able to subtract conservation areas from total site area when computing water quality volume requirements.
Modify building and inspection codes to include LID	Municipal entities that enforce building and inspection standards can also modify these standards in ways that acknowledge LID. In this subsection, we list sources of information on modifying building and inspection codes to make them more LID friendly. The list includes sources specific to Oregon and the Pacific Northwest, as well as from outside the region. http://www.econw.com/media/ap_files/ECONorthwest_Publication_LID-Clackamas-County-Case-Study_2009.pdf
Natural Area Conservation Credit	Credit may be granted when undisturbed, natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics. Under this credit, a designer would be able to subtract conservation areas from total site area when computing water quality volume requirements.
Property tax reduction	Reduce or waive property taxes on an LID project for a given number of years.
Reduction of municipal submittal fees	Projects that infiltrate 100 percent of stormwater receive up to 50% reduction in the stormwater utility fee
Stream and Vegetated Buffer Credit (aka Stream Buffer Credit or Sheet flow to Buffer Credit)	This credit may be granted when stormwater runoff is effectively treated by a stream buffer or other vegetated buffer. Effective treatment constitutes treating runoff as overland sheet flow through an appropriately vegetated and forested buffer. Under the proposed credit, a designer would be able to subtract areas draining via overland flow to the buffer from total site area when computing water quality volume requirements.
Tree canopy credit	Reduce stormwater treatment volume requirements as a ratio of the number of acceptably sized trees planted on the project
Vegetated Channel Credit (aka Grass Channel Credit (in	This credit may be granted when vegetated (grass) channels are used for water quality treatment. Site designers will be able to subtract the areas draining to a grass channel and

lieu of Curb and Gutter)	the channel area itself from total site area when computing water quality volume requirements.
Education Strategy	<ul style="list-style-type: none"> • Municipal sponsored public workshops on how to build rain gardens and emphasizing the increase in property value and curb appeal of LID landscaping • Municipal sponsored public workshops on how to make your own rain barrels • Municipal public education and outreach on how to conserve water and save money using rain barrels, rainwater harvesting water tanks, cisterns, and rain chains • Municipal sponsored contests with giveaways using rain barrels, rain harvesting water tanks, cisterns, and rain chains • Municipal sponsored gardening workshops promoting the value of rainwater harvesting, rain gardens, etc.
Business Outreach	Communication about grant opportunities, partnerships, awards, competitions, and regulations via email, newsletter, website, etc. directed directly at business owners and commercial land owners to encourage participation and encourage a vested interest in the community



Examples of LID-friendly Regulatory Language

“Several cities and counties list LID-friendly stormwater ordinances on their web sites. A recent Google search of “LID regulation” found the following LID ordinances:

- City of Sammamish, Washington: Ordinance 02008-236 Low Impact Development Regulations. An ordinance of the City of Sammamish, Washington, amending the City of Sammamish Municipal Code to create a Low Impact Development Chapter, and amending certain other Chapters of the City of Sammamish Municipal code to ensure consistency with the Low Impact Development Chapter. <http://www.ci.sammamish.wa.us/Ordinances.aspx?ID=107> (accessed January 5, 2009).
- Fauquier County, Virginia: A zoning ordinance text amendment to Sections 5-006.5, 12-610 and 15-300 related to utilization of Low Impact Development techniques with site development. http://www.fauquiercounty.gov/government/departments/BOS/past_agendas/02-14-08/lid_ord.htm (accessed January 5, 2009).
- Township of Lower Makefield, Pennsylvania: Ordinance No. 364. An ordinance of the Township of Lower Makefield, Bucks County, Pennsylvania, amending the Lower Makefield Township Codified Zoning Ordinance of 1996, as amended, to provide for Low Impact Development Standards. http://www.lmt.org/LID%20-%20ZONING%20v%206%20_4_.pdf (accessed January 5, 2009).”⁸
- Vermont utilizes a suite of stormwater regulations http://acrpc.org/files/2012/04/LID_For_VT_Towns.pdf

Discussion of challenges faced by developers and how municipalities can maximize the effectiveness of stormwater programs:

http://www.econw.com/media/ap_files/ECONorthwest_Publication_LID-Clackamas-County-Case-Study_2009.pdf

List of Cost savings from installed LID stormwater controls:

⁸ ECONorthwest. 2009. Low Impact Development at the local level: Developer’s experiences and city and county support. Retrieved from http://www.econw.com/media/ap_files/ECONorthwest_Publication_LID-Clackamas-County-Case-Study_2009.pdf

http://www.econw.com/media/ap_files/ECONorthwest_Publication_LID-Clackamas-County-Case-Study_2009.pdf

<http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/guidance/factsheets/Documents/Incorporating%20ESD%20into%20Municipal%20SW%20Programs.pdf>

<https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/IncorporatingLID.pdf>

Examples of Specific Stormwater Incentive Strategies

The following is a compiled list of specific incentive strategies and descriptions that are summarized or directly quoted from the EPA²:

Incentive Type Color Code				
Stormwater Fee Discount Incentive	Development Incentive	Grant Incentive	Rebates & Installation Financing Incentive	Awards and Recognition Incentive
Stormwater Fee Discount Programs				
Program Name	Description			
<u>Stormwater fee equitability</u> ⁹	Fees are based on actual impervious area at each site as determined by aerial photography, so the less impervious surface, the lower the fee charged. All properties.			
<u>Stormwater Management Utility Exemption</u> ²	Gainesville’s Stormwater Management Utility reduces monthly fees for nonresidential properties with privately maintained, onsite stormwater management retention systems. The utility’s base fee is established per the property’s impervious area and one-half its pervious parking areas. Credits of up to 100% are available based on the volume of onsite retention provided. Detention volume is not considered because that stormwater is discharged. Most credits range from 15% to 35%. Non-residential.			
<u>Stormwater Utility Discount</u> ²	Orlando’s stormwater utility provides a lower rate for commercial and multifamily residential properties with onsite stormwater management facilities. Properties with approved onsite retention or detention get a 42% credit on the rate charged per equivalent residential unit. Beneficiary: Commercial and multi-family residential Flow Chart for Rate Determination: http://www.cityoforlando.net/public_works/Stormwater/Utility%20Fee/FLOWCHART%20FOR%202008%20BILLING%20YEAR.pdf FAQs: http://www.cityoforlando.net/public_works/Stormwater/faq.htm#04.3			
<u>Stormwater Credits Program</u> ²	The County provides stormwater credit to landowners who install four types of practices: watershed stewardship, water quality, peak flow and channel protection. The total maximum credit for any property is 40%. Watershed stewardship practices include: public participation, low impact parcels, farmland deep tillage, stream			

⁹ *Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanism*. 2009. US Environmental Protection Agency, EPA-833-F-09-001. Retrieved from https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_incentives_0.pdf

	<p>restoration / streambank stabilization, watershed improvement project participation, conservation easements, conservation use valuation, assessment (CUVA) properties, county approved training programs, stream buffers that exceed 75' standards, fencing livestock out of streams, rain barrels, automatic sprinkler sensors, direct discharges, septic tank maintenance, and connection to sanitary sewers. Water quality credits of up to 10% are earned by property owners who install facilities that capture pollutants, thereby providing treatment of stormwater before it enters streams. There are several practices to accomplish this available to all property owners. Porous pavement, roof gardens and green roofs are acceptable practices to receive this credit. Residential property owners can install rain gardens to earn this credit. Channel protection credit (maximum 10%) is earned by property owners who provide protection of stream channels from bank and stream bed erosion by detaining and reducing the volume of stormwater from their properties. Peak flow credit (maximum 10%) is earned by property owners who install basins that delay the system, thereby protecting downstream of the highest flows from reaching the drainage properties.</p> <p>Beneficiary: Property owner in Gwinnett County.</p>
<u>Utility Fee Credit²</u>	<p>Credits are available for eligible properties that install, alter, or conduct activities that reduce the costs of services provided by the County. A 10% reduction of the stormwater fee is allowed for property owners; a 1% reduction is allowed for each percent of stormwater directed to rain garden. If all stormwater is treated on site, no fee is charged. Beneficiary: All properties</p>
<u>Stormwater Fee Discount²</u>	<p>Wichita's stormwater utility offers two types of credits only for properties with 50 or more equivalent residential units. Up to a 40% credit is available for detention that equals or exceeds the city's new development standards, which are based on a 100-year storm. An 80% credit is available for retention of all runoff 8 from the site. Wichita has not issued any credits, because the standards are difficult to achieve. Beneficiary: Residential</p>
<u>Drainage Charge Credit²</u>	<p>The Louisville and Jefferson County Metropolitan Sewer District (MSD) provides credits primarily for commercial properties with onsite detention for controlling peak flows. The credit amount depends on how the detention basin functions. Basins must be sized for 2-, 10-, or 100-year storms, and limit discharges to predevelopment runoff rates. Credits are available for each type of storm, with an 82% maximum credit if all criteria are met. Currently, MSD is evaluating ways to incorporate stormwater quality measures into its credit approach. Stormwater Fee Discount Beneficiary: Commercial</p>
<u>Storm Water Surcharge Credit²</u>	<p>Any non-residential property owner who has either installed an approved on-site post-construction storm water control facility, implemented an approved best management practice (BMP), or developed and implemented an approved education program, may apply for a reduction of the Surcharge applied to that specific parcel. The District will evaluate each case individually in determining the appropriate level of credit. A total maximum of an 80% credit against the Surcharge may be granted:</p> <ul style="list-style-type: none"> • The credit is applied by reducing the number of billable equivalent residential units. • The property parcel can qualify for both water quantity and water quality credits. • The maximum allowable water quantity credit percentage = 35%. • The maximum allowable water quality credit percentage = 50% <p>Beneficiary: Commercial</p>
<u>Stormwater Enterprise Fund Fee Abatement²</u>	<p>The City allows single and two-family residential properties to abate up to 50% of the total fee if they install and maintain infiltration systems or other means to reduce runoff. Commercial/industrial/multi-family properties are allowed this abatement if they install and maintain "state-of-the-art" stormwater treatment and infiltration systems. Typical devices that qualify are drywells, infiltration chambers, detention</p>

	ponds. Drinking water filtration systems and rain barrels do not qualify. The stormwater abatement continues if the impervious surface does not change. Beneficiary: Property owner in Reading, Massachusetts.
<u>Stormwater Quality Credit</u> ²	Residential storm water fee credit determined by the percent of a property's impervious area that drains to a stormwater management tool/practice (BMP). The maximum credit allowed is equal to 50% of the total percentage of impervious area draining to a BMP. Beneficiary: Residential
<u>NC CHARLOTTE Storm Water Services Credit</u> ²	A credit toward reducing a ratepayer's storm water user fee. The storm water fee is proportional to the amount of impervious area on a given property. The credit is also developed to be proportional to the effective reduction in impervious area. The credit is allowed for all properties except single-family residential properties, except in extraordinary situations. Credit will only be allowed for properties that maintain their structural controls in fully functional condition and per maintenance criteria and BMP standards. Credit will be allowed for previously constructed controls. A maximum of 100 percent of the user fee can be granted in credit with a maximum of 40% for peak reduction and 60% for volume reduction. Beneficiary: Commercial and Some Residential
<u>NC CHARLOTTE Stormwater Credit Fee</u> ²	Charlotte provides one or more credits to commercial, industrial, institutional, and multifamily residential properties and homeowner associations that provide stormwater management measures. Eligibility for credits is proportional to the extent that the measures address the impacts of peak discharge, total runoff 12 volume, and annual pollutant loading from the site. <ul style="list-style-type: none"> • Up to 100% credit is available as follows: • Up to 50% credit for reducing peak discharge from a 10-year, 6-hour storm; • Up to 25% credit for reducing total runoff volume from a 2-year, 6-hour storm; • Up to 25% credit for reducing annual pollutant loading. Each credit is conditional on continued compliance with the Charlotte/Mecklenburg Land Development Standards Manual and may be rescinded for noncompliance with those standards. Beneficiary: Commercial, industrial, institutional, multifamily residential
<u>NC DURHAM Stormwater credit</u> ²	Durham provides up to a 25% pollution credit for selected structural stormwater controls on nonresidential properties. The city first offered credits for onsite retention basins based on the pool volume for retention. Later, the city offered credits for onsite extended detention and extended detention-retention basins based on drawdown time. Currently, the maximum pollution credit goes to standard basin designs that achieve maximum pollutant removal efficiency under North Carolina's performance standards. For other structural controls listed in the state's standards, the city's pollution credit is linearly variable, with a maximum 25% credit for a removal efficiency of 85% of total suspended solids. The city recently approved the use of sand filters in addition to approved onsite basin designs, but no pollution credits have been established yet for their use. Durham receives few applications for credits. Beneficiary: Nonresidential properties
<u>NC Raleigh Stormwater Facility Credit</u> ²	A maximum 50% credit against stormwater fees for installing Stormwater Facilities exceeding City requirements specified in the Stormwater Ordinance. To qualify, customers must demonstrate that their existing Stormwater or New Stormwater Facility manages stormwater generated from their immediate property and/or upstream tributary areas.

<p>Clean River Rewards Incentive and Discount Program²</p>	<p>Portland, OR. Provides financial incentives to property owners who manage stormwater on their site through a discount on their monthly stormwater utility charge. The Portland City Council instituted a two-part rate—35% of the charge for providing drainage services to the property and 65% of the charge to provide drainage services to the public right of way that served the property. Not only did the charge breakdown reinforce that street drainage is an issue the City must deal with, it also allowed a portion of the rate to be discounted for properties providing onsite stormwater management. So, with 35% of the stormwater rate up for a potential discount, some properties could be encouraged to make retrofit changes. The CRID has a simplified discount program for residential properties based on volume control, and a more complex commercial property program that requires water quality and flow control for the full discount. Beneficiary: Residential and Commercial</p>
<p>Sixty-Five-Ten Discount²</p>	<p>Discount on fee assessment if your property is at least 65% forested, has no more than 10% effective impervious area and BMP for dispersing and infiltrating runoff are being met. Other conditions may apply and at least one site visit will be required for approval, but qualification for this discount would lower your assessment by one-rate category. Residential parcels meeting this condition will receive a discount equal to half the residential fee, or \$51.00. Both residential and commercial properties are eligible. This discount may not be combined with other runoff mitigation discounts Beneficiary: Residential / Commercial</p>
<p>Surface Water Utility Reductions²</p>	<p>The surface water utility rate can be reduced by a minimum of 10 percent for any new or remodeled commercial building that uses a permissive rainwater harvesting system properly sized to use the available roof surface of the building. Rate reductions more than 10 percent will be considered dependent upon the amount of rainwater harvested divided by the mean annual runoff volume generated by the total impervious surface area at the parcel. Additionally, properties using low impact development techniques as recommended in the Marysville Municipal Code may be eligible for a reduction in their surface water utility rate. Commercial properties</p>



Development Incentive	
Incentive Name	Description
<p>Green Building and Green Development Program²</p>	<p>Green buildings or green developments shall qualify for expedited permitting and priority inspections. Green buildings and developments shall be defined and certified as appropriate by the U.S. Green Building Council (i.e. Leadership in Energy and Environmental Design (LEED) certification) or the Florida Green Building Coalition. The County discontinued the permit fee rebate previously offered to these projects as well on December 28, 2007. Beneficiary: Qualified developer in Sarasota County.</p>
<p>Green Permit Program²</p>	<p>Chicago's Department of Construction and Permits (DCAP) has created an incentive that encourages inclusion of environmentally conscious design elements by promising developer's savings of both time and money. Architects, developers and building owners can be part of an expedited permit process by adding elements of green building strategies and technologies from a menu of items created by DCAP. Projects admitted into the Green Permit Program can receive permits in less than 30 business days as opposed to the 60 to 90 that are normally allotted for permit issuance. Participants that display a particularly high level of green strategy can possibly have consultant code review fees waived as well. A team of green building design experts compiled by the city help applicants navigate the permit process to ensure timely implementation of these technologies. Beneficiary: Architects, developers, and building owners</p>

<u>Floor Area Ratio Bonus²</u>	Projects that install ecoroofs in the Central City Plan District are eligible for a floor area ratio bonus, which increases the building’s allowable area, and can use ecoroofs to conform to the Central City Design Guidelines. Buildings can receive bonus FAR based on three ranges of ecoroof coverage in relation to the building’s footprint: 10-30%, 30-60% and 60% or greater earns one, two and three square feet of additional floor area per square foot of ecoroof respectively. Beneficiary: Commercial buildings in the Central City area of Portland. http://www.portlandonline.com/shared/cfm/image.cfm?id=53363 , see 510-28
<u>Stream and Vegetated Buffers Credit²</u>	Credit may be granted when stormwater runoff is effectively treated by a stream buffer or other vegetated buffer. Effective treatment constitutes treating runoff as overland sheet flow through an appropriately vegetated and forested buffer. Beneficiary: Developer
<u>Use of Vegetated Channels²</u>	This credit may be granted when vegetated (grass) channels are used for water quality treatment. Site designers will be able to subtract the areas draining to a grass channel and the channel area itself from the total site area when computing water quality volume requirements. Beneficiary: Developer
<u>Impervious Area Disconnection²</u>	This credit may be granted when impervious areas are disconnected from the stormwater control system via overland flow filtration/infiltration (i.e., pervious) zones. These pervious areas are incorporated into the site design to receive runoff from rooftops or other small impervious areas. If impervious areas are adequately disconnected in accordance with the criteria listed below, they can be deducted from the total site area when computing the water quality volume requirements. Beneficiary: Developer
<u>Water Quality Volume Credits²</u>	Allows for a reduction in the water quality treatment volume (WQv). The credit system directly translates into cost savings to the developer by reducing the size of structural stormwater control and conveyance facilities. If a developer incorporates one or more of the credited practices in the design of the site, the requirement for capture and treatment of the WQv will be reduced. Site designers are encouraged to utilize as many credits as they can on a site. Greater reductions in stormwater storage volumes can be achieved when many credits are combined (e.g., disconnecting rooftops and protecting natural conservation areas). Beneficiary: Developer

Grant Incentive	
Incentive Name	Description
<u>Sustainable Landscape Grant Program²</u>	Grants are awarded for up to 50% of the cost of the project, not to exceed \$5,000, including a maximum of \$3,500 for qualified irrigation equipment and a maximum of \$1,500 for climate-appropriate plants defined as very low, low, and medium water use plants. No turf or high water using plants or invasive plants will be funded. In addition to the \$5,000, applicants may also apply for rebates for specific irrigation equipment including weather-based irrigation controllers, rotary nozzles for sprinklers and synthetic turf. The grant is a reimbursement grant, paid upon completion of the approved project. Invoices to substantiate costs will be required for all reimbursements. This grant is a first come, first served program available until funds run out. Projects in the parkway will receive priority funding. Projects must be completed within 180 days of grant award to receive funding. Partial funding for incomplete projects will not be permitted. Beneficiary: Individuals, property owners, businesses, non-governmental organizations and public agencies who are water customers in Santa Monica; new construction and major remodel projects are not eligible.
<u>Green Roof Improvement Fund²</u>	A one year pilot redevelopment program to provide financial assistance for the installation of Green Roofs on certain eligible commercial facilities. Eligible Applicants can receive a grant for up to 50% of Eligible Costs, with a maximum assistance of

	\$100,000 per project and per applicant. All grants shall be in the form of reimbursement funding to be awarded only after the Green Roof is installed and all other requirements for funding are met. Beneficiary: Commercial
<u>Community Watershed Stewardship Grant²</u>	Watershed stewardship grants provide up to \$10,000 to schools, churches, businesses and other community organizations for projects that protect and enhance watershed health at the local level. Groups can use grant money for supplies, materials, equipment, room rentals, feasibility studies or technical assistance. Past projects include education and monitoring, ecoroofs, stormwater features, restoration, and naturescaping. Community organizations
<u>Impervious Surface Cost Share and Credit Program²</u>	As an incentive to reduce impervious surface, the county is making funds available for sharing the costs of converting impervious surface to (1) native vegetated landscape, (2) compost-amended lawn or (3) grassed, modular-grid pavement. To qualify, a plot plan, technical information and description must be submitted to county engineers who will work with the customer to develop the plan. 50% of costs up to \$20K will be reimbursed after the job is complete and inspected. Reducing impervious surface could potentially place the property into a lower rate category, reducing the surface water fee. Beneficiary: Commercial
<u>Aquatic Habitat Matching Grant²</u>	Seattle Public Utilities provides matching grants for individuals or groups to help improve Seattle's aquatic habitat along creeks and shorelines. Award amounts begin at \$2,000 per project, with \$300,000 in total awards available. Projects require a one-to-one match. Projects considered are those that improve, preserve, and/or restore aquatic habitat and/or ecological diversity and enhancement; address water flow and/or quality; or improve/prevent impacts from the City's drainage system. Beneficiary: Individuals or groups

Rebate/Installation Incentive	
Incentive Name	Description
<u>Rain Gutter Downspout Redirect Rebate, Rain Barrel Rebate, Cistern Rebate²</u>	<ol style="list-style-type: none"> 1. Rain Gutter Downspout Redirect Rebate (rainwater percolation): Up to \$40 per qualified rain gutter downspout (up to and including all downspouts on one's property), includes labor and materials. Rebates are available for the cost of redirecting rain gutter downspouts to permeable surfaces, such as landscaped areas. 2. Rain Barrel Rebate (rainwater storage): Rebates up to \$100 per barrel (limited to 125-gallon maximum capacity), includes design, labor and materials. 3. Cistern Rebate (rainwater storage): Up to \$500 per cistern (limited to cisterns over 500 gallons each), includes design, labor and materials. Beneficiary: Any property owner (resident, institution or business) in the City of Santa Monica and any tenant of said property with the permission of the owner.
<u>City of Palo Alto Innovative Stormwater Measures Rebate Program²</u>	<ol style="list-style-type: none"> 1. Rain Barrel Rebate: \$50 rebate for purchase and installation of a rain barrel to collect and harvest rainwater runoff from rooftops. 2. Permeable Pavement Rebate: Rebate of \$1.50 per square foot for installation of permeable pavement (porous asphalt concrete, pervious Portland cement concrete, or permeable interlocking concrete pavers) to reduce storm water runoff from driveways, walkways, patios, and parking lots. 3. Cistern Rebate: Rebate of 15 cents per gallon for purchase and installation of a cistern to collect and harvest rainwater runoff from rooftops and site runoff 4. Green Roof Rebate: Rebate of \$1.50 per square foot for the installation of a green (vegetated) roof to minimize storm runoff from rooftops. Rebates are limited to a maximum of \$1,000 per single-family residential property and \$10,000 for commercial/industrial and multi-family residential properties. Beneficiary: Residential, commercial, or governmental property owner in the City of Palo Alto, California.
<u>River Smart Homes²</u>	This program offers incentives to homeowners interested in reducing stormwater pollution from their properties. Homeowners receive up to \$1,200 to adopt one or

	more landscape enhancements, including shade trees, above-ground cisterns/rain barrels, permeable/porous pavers, rain gardens, and Bay Scaping. Beneficiary: Residential properties
<u>City of Maitland Incentive Programs</u> ²	The City has three stormwater/water quality incentive programs. Through the Shoreline Revegetation Program, the City will reimburse qualified residents up to 50% of the cost to purchase and install aquatic plants along their property shoreline. A maximum one-time reimbursement of \$200 is being offered. The Wetland Tree Planting Program provides lakefront homeowners up to three, 8- 10-foot-tall, bald cypress trees at a cost of only \$25 per tree. A City representative works with the homeowner to establish the ideal location for the trees to ensure that the trees will benefit the lake and the shoreline. Finally, the City has an Environmental Swale Program which pays for 20% of the cost to grade and sod a swale, or \$500 per property whichever is less. A City representative helps establish the best location for the swale to ensure that the lakes/canals have maximum water quality benefit. Beneficiary: Property owner in Maitland, Florida
<u>Roll Out the Barrel Events</u> ²	Events held where rain barrels sold at discounted prices (\$15 - \$20) to residents. Barrels were built by the City's ex-offender job training program by retrofitting recycled 55-gallon plastic barrels. City provided information on installing and maintaining rain barrels, as well as information on stormwater management and water conservation. Pilot program cost ~\$40K excluding city labor. Beneficiary: Residential
<u>Rain Gardens for Rock Island</u> ²	City reimburses residents \$4/square foot of rain garden space and if a rain is incorporated into the design the City will supply one for free. The City must approve the design prior to installation and inspect the rain garden upon completion prior to paying the incentive payment. Beneficiary: Residential property owner in Rock Island, Illinois.
<u>RainScapes Rewards</u> ¹	Up to \$1,200 is offered per single-family lot or up to \$5,000 per multi-family or commercial lot for installation of rain gardens, cisterns green roofs, native plants, shade trees and permeable pavement. Beneficiary: Residential and commercial properties
<u>Rain Garden Retrofit Project</u> ²	\$150K project to target homeowners in a specific neighborhood near Crystal Lake to compel residents to build rain gardens in their yards to reduce stormwater runoff. An architect met w/ residents free of charge to design the gardens and residents helped to build them. The city installed 6-ft. curb cuts w/ 2- ft. tapering sections on either side to direct stormwater off the streets and into the gardens. The project reduced runoff by 90% compared to neighboring control area. Homeowners maintain gardens w/ city assistance if needed. Beneficiary: Residential
<u>Street Redesign and Reconstruction</u> ²	As part of large-scale redesign of existing streets and utilities, the City offered to construct standard-size rain gardens in the public boulevard right-of-way on the front edge of residential properties. These gardens handle drainage from yards, rooftops, driveways and some runoff from the street. Residents volunteer to have the garden built by the City and are responsible for planting the provided plants and maintaining the gardens with free technical assistance from the City. Beneficiary: Residential RESOLVE. 2007. Public Funding Incentives for Private Residential and Commercial Watershed Protection Projects: Report on Key Case Studies and Community Workshop. http://www.resolve.org/rainscapesworkshop/Report.pdf .
<u>Rain Barrel Discount Program</u> ²	2,000 rain barrels made available to Minneapolis households at a reduced cost (\$45). Barrels made available thanks to a \$100,000 grant from the EPA's Region 5 Great Cities Program and in partnership w/ Minnesota/Metro Blooms and the Green Institute. Beneficiary: Residential
<u>Reverse Bidding Auction</u> ²	Reverse auction to encourage the installation of rain barrels and rain gardens. Bids were received from qualified residents which outlined what rain catcher projects they

	agreed to have installed and the incentive payment they requested to do so. The bids were selected based upon the project(s) they agreed to install, their scoring within an Environment Benefit Index and the amount of the incentive payment requested. The selected project(s) were installed for free and the residents were paid the bid amount as a one-time incentive payment. The first round of the reverse auction in 2007 resulted in 50 rain gardens and 100 rain barrels installed at 67 of the approximately 350 residential properties in the watershed. In 2008, the auction was repeated and an additional 35 rain gardens and 74 rain barrels were installed. Beneficiary: Residential property owner in the Shepherd Creek watershed.
<u>Downspout Disconnection Program</u> ²	Targets property owners to disconnect roof downspouts onto lawns and flowerbeds, or use onsite stormwater mgmt. facilities such as drywells and soakage trenches. The City's Plumbing division works directly with homeowners to disconnect downspouts without the homeowner having to get a plumbing permit. A target area of CSO basins is selected and Disconnection Program staff go to work, door-to-door canvassing to get voluntary agreement from property owners to complete the disconnection. Owners then complete the disconnection themselves and receive a \$53 per downspout incentive, or have the City complete the disconnection for them free of charge. The program is funded primarily by a mixture of capital and operating funds due to this ability to remove enough stormwater from the CSO system, that collection pipes may be able to be downsized providing significant pipe construction cost savings. Beneficiary: Residential



Grant Incentive	
Incentive Name	Description
<u>Mayor Daley's GreenWorks Awards</u> ²	Mayor Daley's GreenWorks Awards promote a green city by recognizing businesses, non-profits, schools and government agencies whose buildings, practices, and products or services are environmentally responsible. The GreenWorks Awards are presented annually. Beneficiary: Projects/buildings must be in the city of Chicago. The award program is open to businesses, non-profits, schools, and government agencies.
<u>Businesses for an Environmentally Sustainable Tomorrow (BEST)</u> ²	Since 1993, the BEST Awards have been presented annually to Portland area companies demonstrating excellence in business practices that promote economic growth and environmental benefits. The BEST Awards recognize businesses with significant and unique achievements in the following categories: (1) BEST Practices for Sustainability for Small, Medium and Large companies, (2) Sustainable Products or Services, (3) Innovations in Resource Conservation, (4) Green Building, and (4) Sustainable Food Systems. Beneficiary: Local businesses
<u>Eco-logical Business Program</u> ²	A certification and recognition program to highlight environmentally friendly businesses. After a certification visit, participating shops receive a shop display package, press coverage, listing on the program web site, and promotion on the radio and at public events. Beneficiary: Commercial
<u>Stormwater BMP Recognition Program</u> ²	The BMP Recognition Program recognizes innovative stormwater Best Management Practices (BMPs) in the southeastern region of Pennsylvania. The program is looking for projects such as rain gardens, green roofs, infiltration swales, and treatment wetlands. Those who are recognized will receive a certificate and/or award from top officials of the Department of Environmental Protection (DEP) and the City of Philadelphia; recognition at an awards ceremony; and region-wide media exposure, such as in partner newsletters and the PWD newsletter, which reaches over half a million households and businesses in the region, in addition to acknowledgment on

the PWD website. Beneficiary: Landscape architects, engineers, developers, university students, neighborhood residents and others

Reference

- Slo County. n.d. *List of Potential Municipal LID Incentive Programs*. Retrieved from <http://www.slocounty.ca.gov/Assets/PW/stormwater/Potential+LID+Incentives.pdf>
- Managing Wet Weather with Green Infrastructure Municipal Handbook: Incentive Mechanism*. 2009. US Environmental Protection Agency, EPA-833-F-09-001. Retrieved from https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_incentives_0.pdf
- Doll, A., and G. Lindsey. 1999. Credits Bring Economic Incentives for Onsite Stormwater Management. Watershed and Wet Weather Technical Bulletin, January 1999, Water Environment Federation. <http://stormwaterfinance.urbancenter.iupui.edu/PDFs/LindseyDoll.pdf>
- ECONorthwest. 2009. Low Impact Development at the local level: Developer's experiences and city and county support. Retrieved from http://www.econw.com/media/ap_files/ECONorthwest_Publication_LID-Clackamas-County-Case-Study_2009.pdf

DRAFT

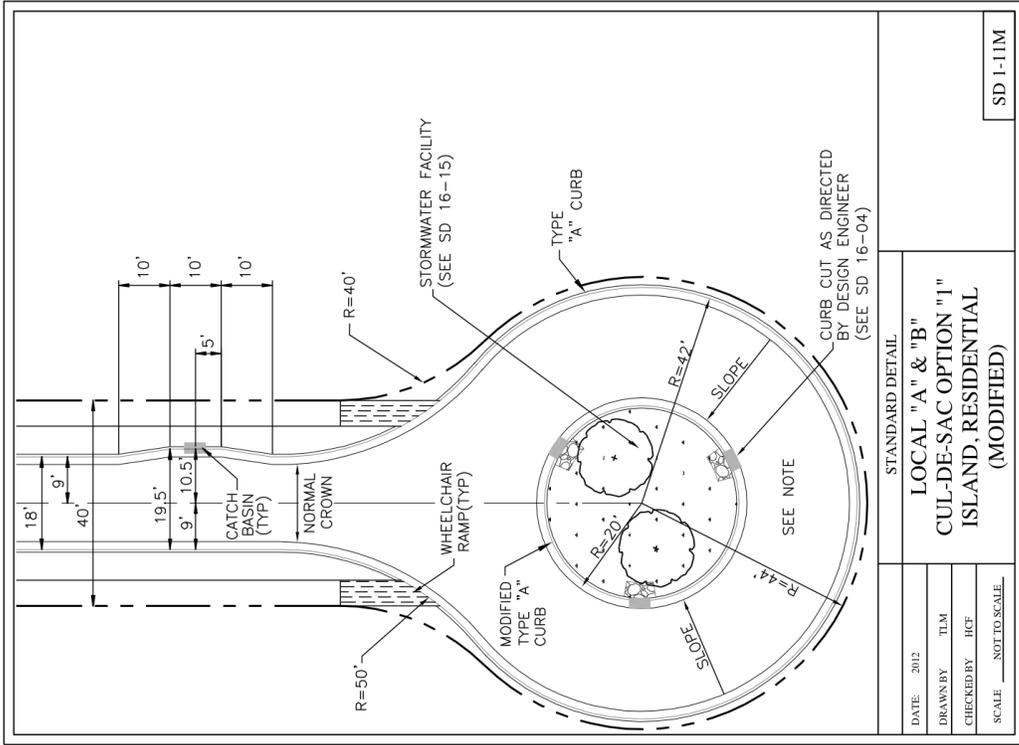
Appendix E *Green Street* Stormwater Management Devices

***Green Street* Stormwater Management Devices**

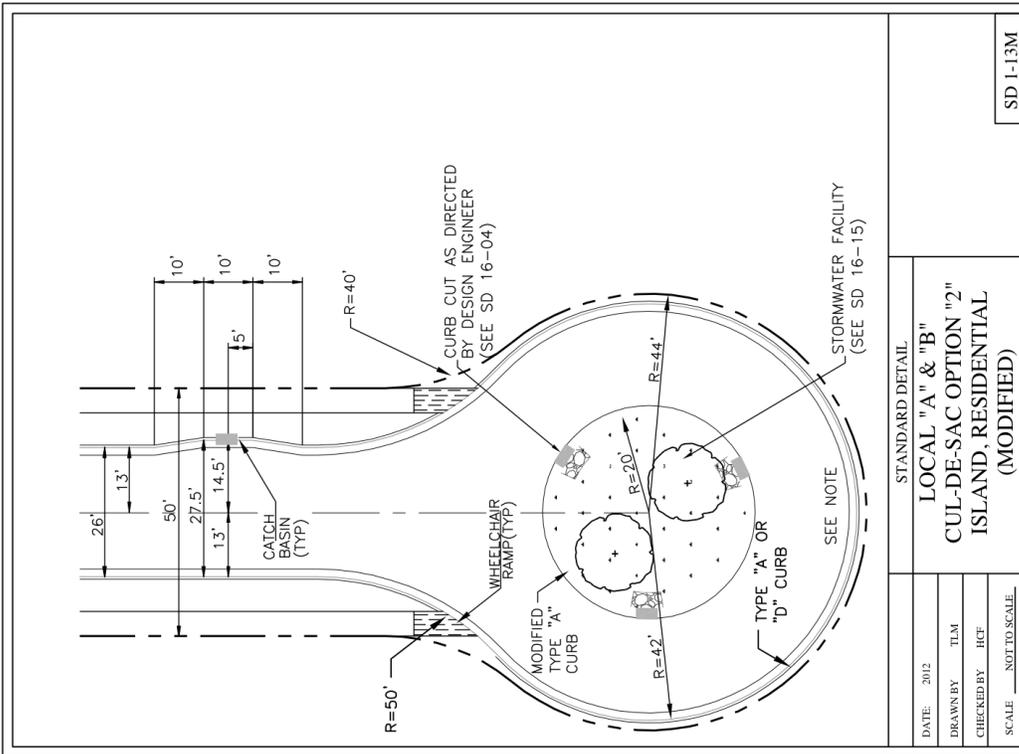
The purpose of this appendix is to provide example designs of typical stormwater runoff reduction practices that can be used within the public right of way. The measures shown are examples of the techniques and processes encouraged with the watershed management plan.

These details are intended to serve as the starting point for stormwater retrofits alongside active roadways. These details outline the major design elements of curbside stormwater management facilities. Roadside safety, pedestrian safety, maintenance, gutter spread and other factors must still be evaluated prior to implementation. Additionally, existing utilities or environmental conditions may make it necessary to modify or revise the standard designs to fit each individual BMP location. Curbside stormwater management may not be feasible in all locations.

DRAFT

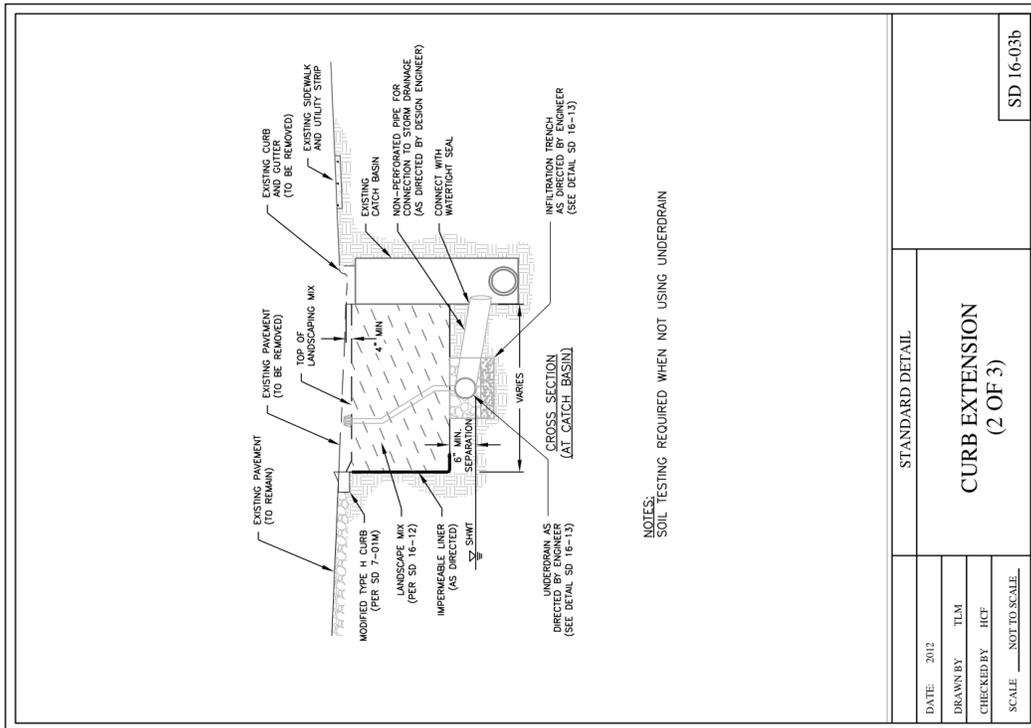
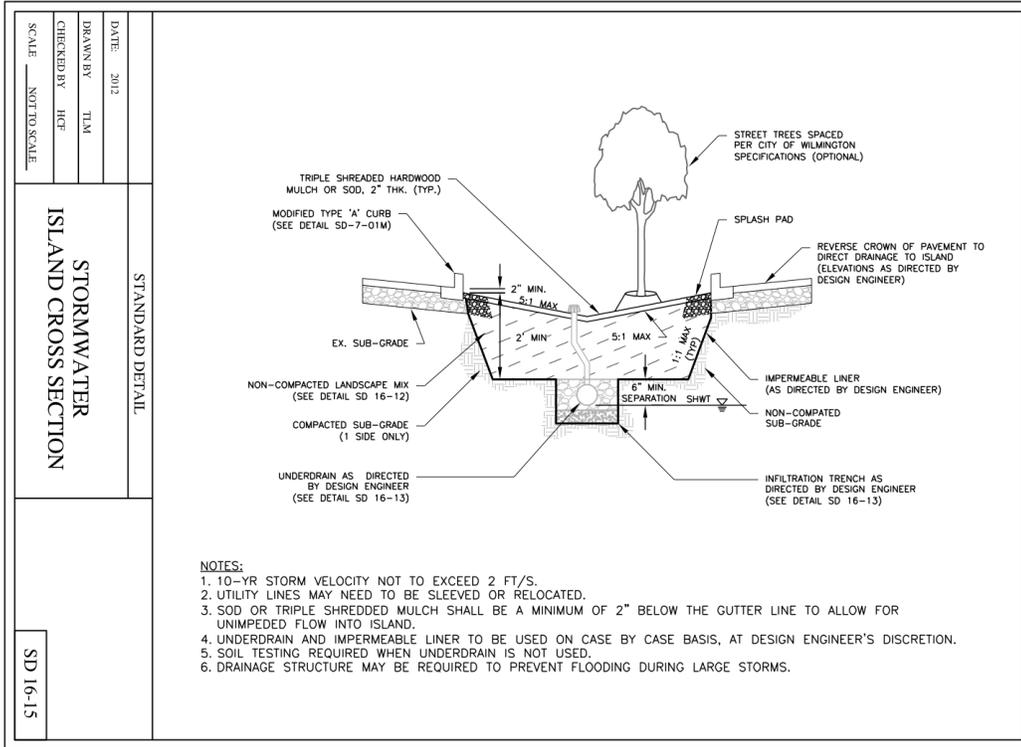


STANDARD DETAIL	
LOCAL "A" & "B"	
CUL-DE-SAC OPTION "1"	
ISLAND, RESIDENTIAL	
(MODIFIED)	
DATE: 2012	
DRAWN BY: TLM	
CHECKED BY: HCF	
SCALE: NOT TO SCALE	
SD 1-11M	

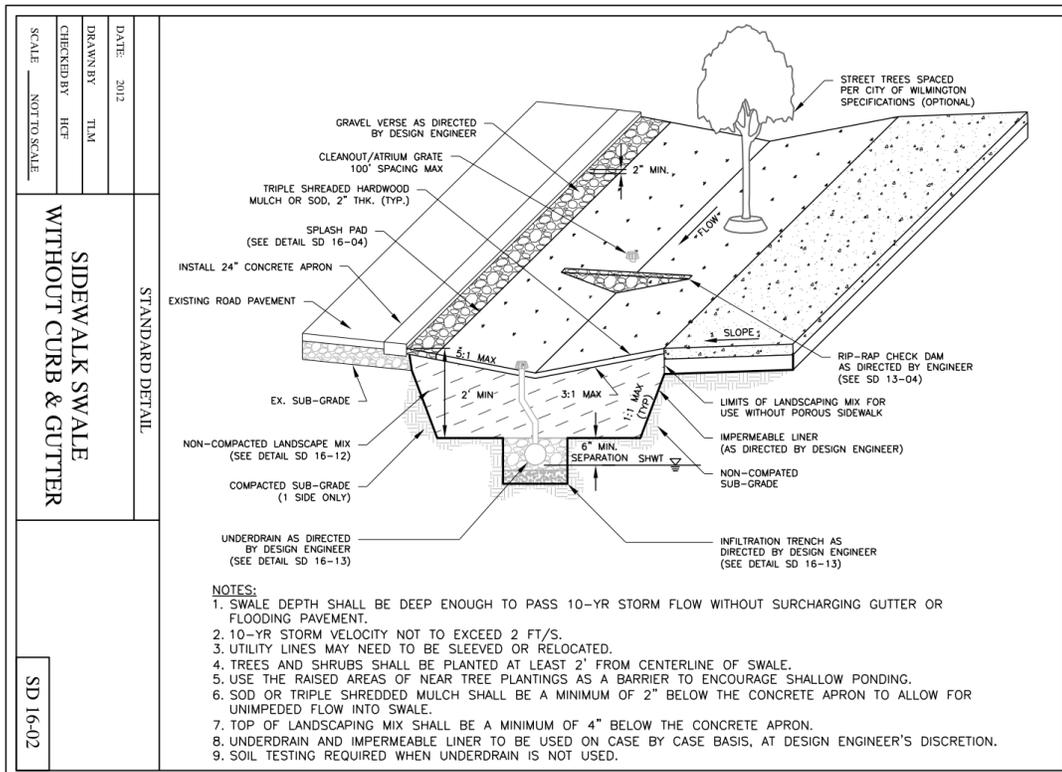
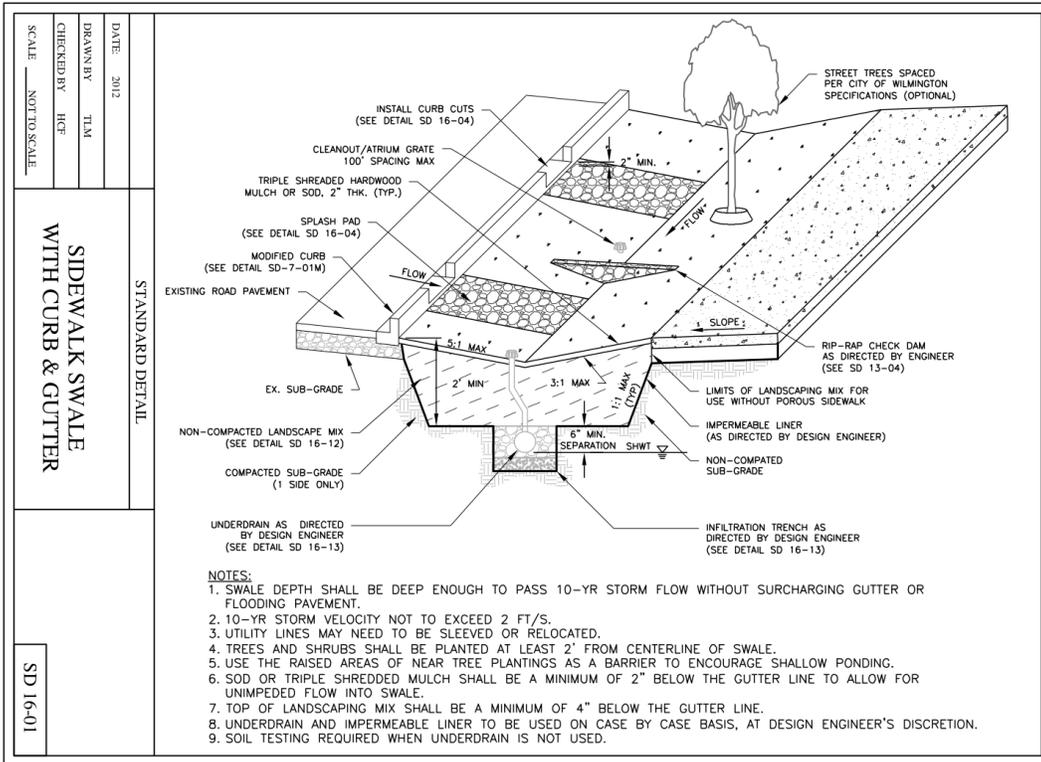


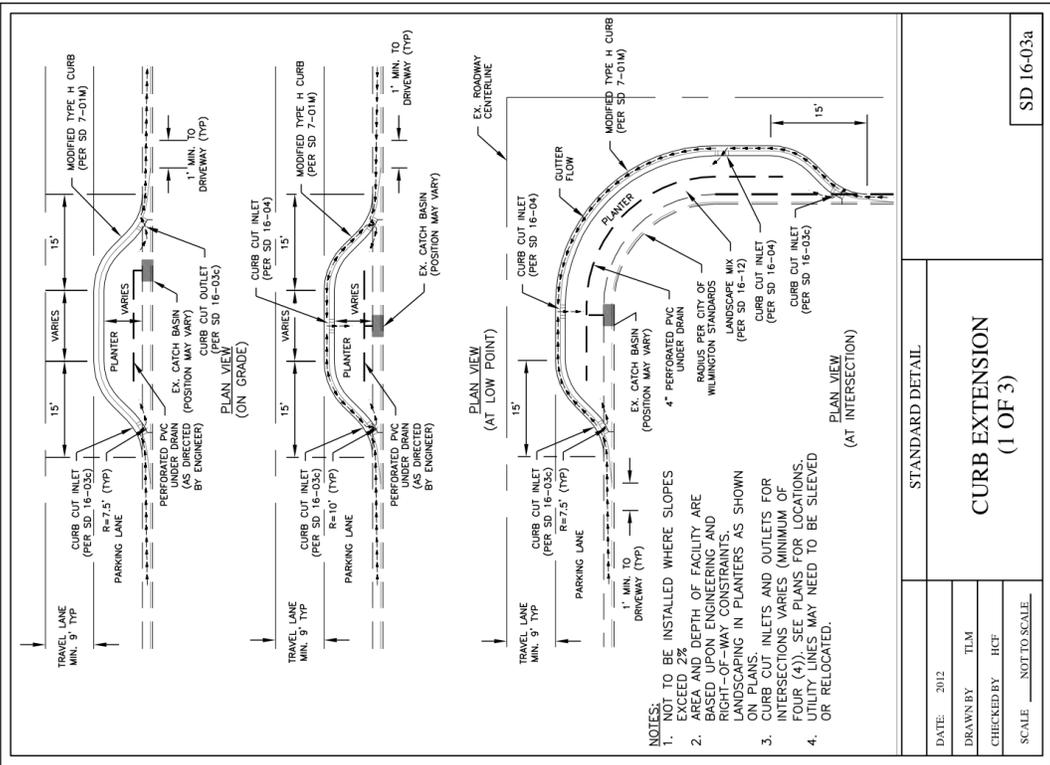
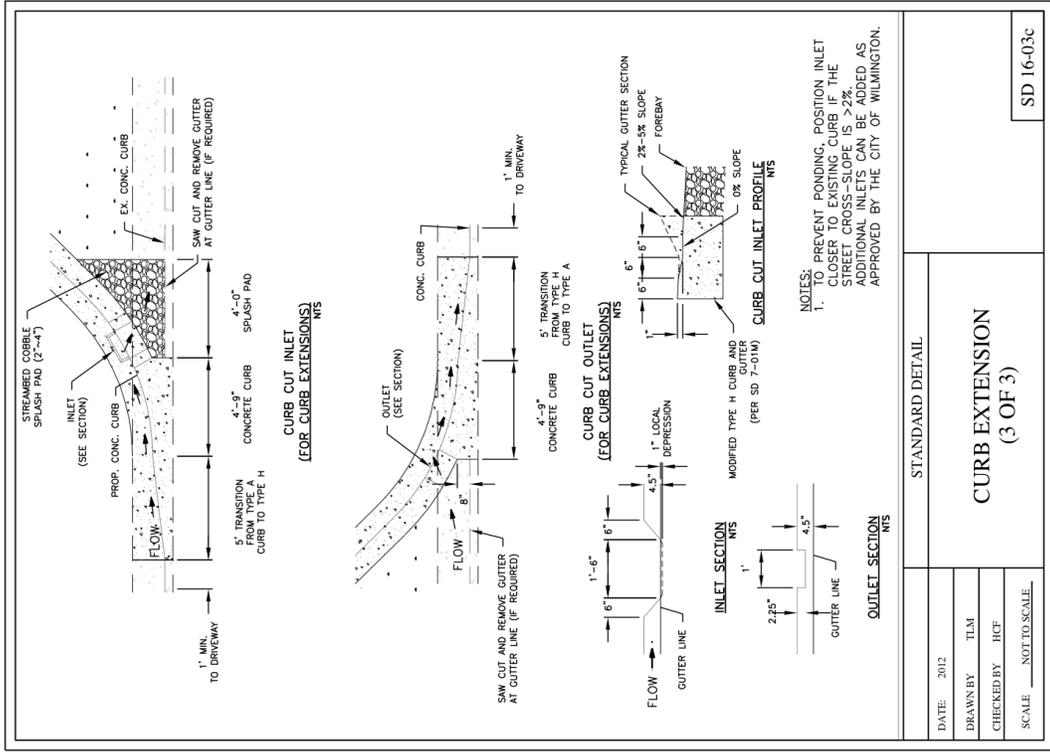
STANDARD DETAIL	
LOCAL "A" & "B"	
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ISLAND, RESIDENTIAL	
(MODIFIED)	
DATE: 2012	
DRAWN BY: TLM	
CHECKED BY: HCF	
SCALE: NOT TO SCALE	
SD 1-13M	





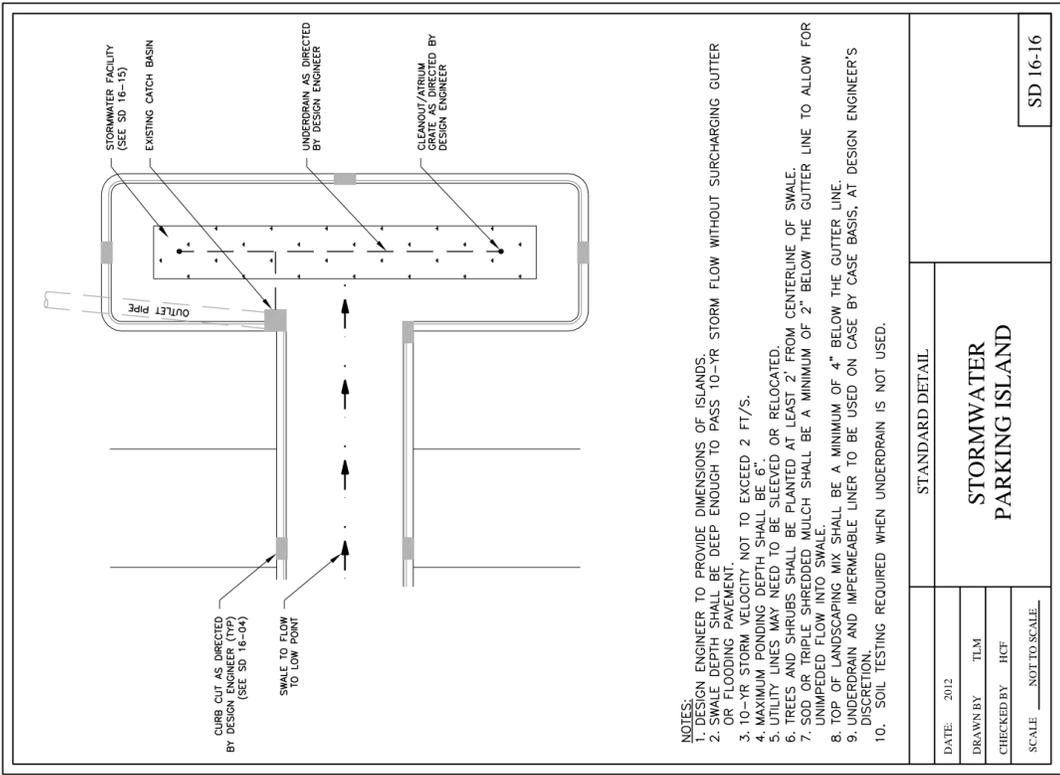
DATE: 2012 DRAWN BY: TLM CHECKED BY: HCF SCALE: NOT TO SCALE	STANDARD DETAIL CURB EXTENSION (2 OF 3)
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STANDARD DETAIL	
CURB EXTENSION (3 OF 3)	
DATE:	2012
DRAWN BY:	TLM
CHECKED BY:	HCF
SCALE:	NOT TO SCALE
SD 16-03c	

STANDARD DETAIL	
CURB EXTENSION (1 OF 3)	
DATE:	2012
DRAWN BY:	TLM
CHECKED BY:	HCF
SCALE:	NOT TO SCALE
SD 16-03a	



STANDARD DETAIL	
STORMWATER PARKING ISLAND	
DATE: 2012	
DRAWN BY: TLM	
CHECKED BY: HCF	
SCALE: NOT TO SCALE	

SD 16-16

RECOMMENDED PLANTS LIST FOR ALL STORMWATER DETAILS:	
SCIENTIFIC NAME	COMMON NAME
CERCIS CANADENSIS	RED BUD
CORNUS FLORIDA	DOGWOOD
ILEX ATTENUATA	FOSTER'S HOLLY
ILEX VOMITORIA	YAUPON HOLLY
LAGERSTROEMIA INDICA	CRAPE MYRTLE
MAGNOLIA SOULANGIANA	SAUCER MAGNOLIA
MAGNOLIA STELLATA	STAR MAGNOLIA
NYSSA SYLVATICA	BLACK GUM
TAXODIUM DISTICHUM	BALD CYPRESS

NOTE:
OTHER PLANTS, INCLUDING TREES, SHRUBS, AND GROUND COVERS, MAY BE PERMITTED ON A CASE BY CASE BASIS AS APPROVED BY CITY STAFF.

STANDARD DETAIL	
RECOMMENDED STORMWATER PLANTING LIST	
DATE: 2012	
DRAWN BY: TLM	
CHECKED BY: HCF	
SCALE: NOT TO SCALE	

SD 16-14

NATURAL SOIL INFILTRATION
 IN-SITU INFILTRATION MEDIA SHALL MEET THE REQUIREMENTS FOR INFILTRATION SYSTEMS AS DEFINED BY NCDWM IN THE CURRENT VERSION OF THE BMP MANUAL. SOIL TESTS SHALL BE COMPLETED AND SUBMITTED WITH THE DESIGNS TO CONFIRM COMPLIANCE WITH THE SPECIFICATIONS.

IN SITU SOIL SHALL MEET THE FOLLOWING SPECIFICATIONS

1. INFILTRATION RATE SHALL EXCEED 0.52 IN/HR, >3 IN/HR PREFERRED
2. P INDEX SHALL BE BETWEEN 10 AND 30
3. PARTICLE SIZE DISTRIBUTION
 - a. COARSE / VERY COARSE SAND 70% TO 80%
 - b. GRAVEL 10% TO 20%
 - c. SAND / SILT / CLAY OF CONTAMINATION FROM HEAVY METALS
 - d. SOIL SHALL BE FREE OF CONTAMINATION FROM HEAVY METALS
4. SEASONAL HIGH WATER ELEVATION SHALL BE AT LEAST 2' BELOW FINISHED SURFACE
5. AREAS USED FOR EROSION CONTROL SHALL BE CLEANED OF ALL ACCUMULATED SILTS, FINES, SEDIMENTS, AND DEBRIS PRIOR TO CONVERSION

LOW FLOW MEDIA MIXES
 FOR INSTALLATIONS REQUIRING ENGINEERED MEDIA WITH INFILTRATION RATES BETWEEN 0.52 IN/HR AND 10 IN/HR, THE GENERAL STANDARDS OF "BIORETENTION MIX" AS DEFINED IN THE CURRENT VERSION OF THE NCDWM BMP MANUAL SHALL APPLY.

THE ENGINEER SHALL PROVIDE SOILS SAMPLES, AND RESULTS OF LABORATORY SOIL TESTS DOCUMENTING COMPLIANCE WITH THE SOIL SPECIFICATIONS PRIOR TO FINAL PROJECT APPROVAL.

HIGH FLOW MEDIA MIXES
 FOR URBAN INSTALLATIONS OR OTHER INSTALLATIONS WHERE HIGHER INFILTRATION RATES ARE NECESSARY, ENGINEERED HIGH FLOW MEDIA MIXES MAY BE REQUIRED. HIGH FLOW MEDIA MIXES SHALL BE DESIGNED TO CAPTURE THE PARTICLES AND REMOVED FROM URBAN INFILTRATION THROUGH THE USE OF HIGHER PERFORMANCE PEAT / SAND FILTER MEDIA. THE MEDIA SUPPORTS MICROBIOLOGICAL ACTIVITY THAT CAPTURES NUTRIENTS FROM STORMWATER RUNOFF TO SUPPORT PLANT LIFE WHILE ALLOWING RUNOFF TO FLOW THROUGH THE MEDIA LAYERS AT A HIGH RATE.

ENGINEERED HIGH FLOW MEDIA SHALL MEET THE FOLLOWING SPECIFICATIONS

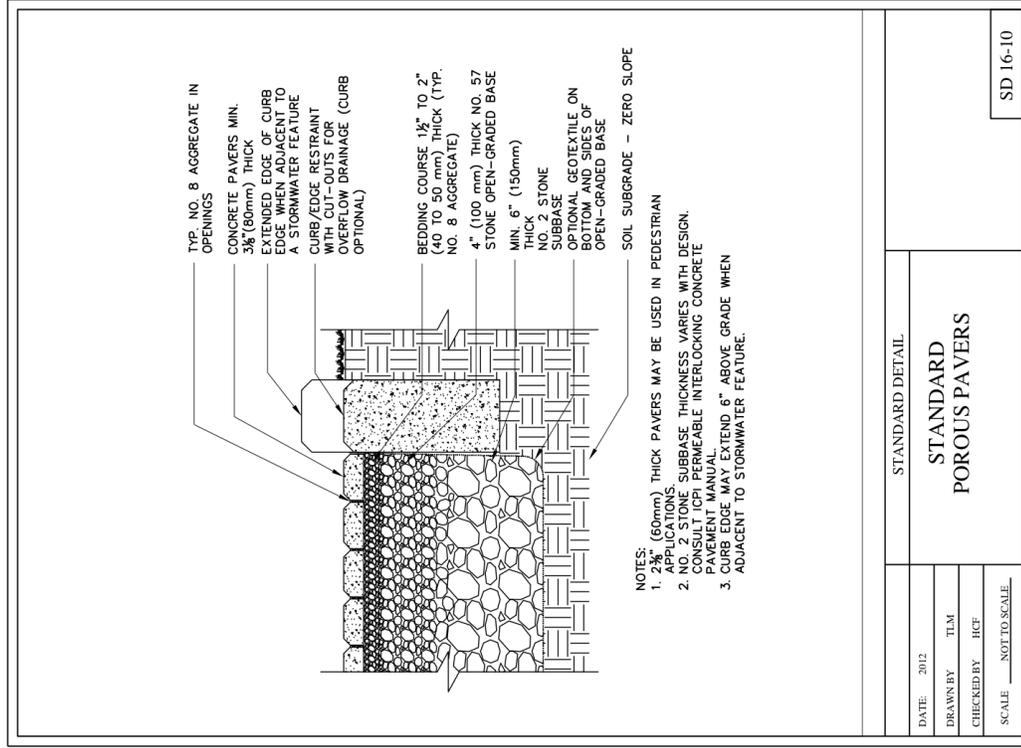
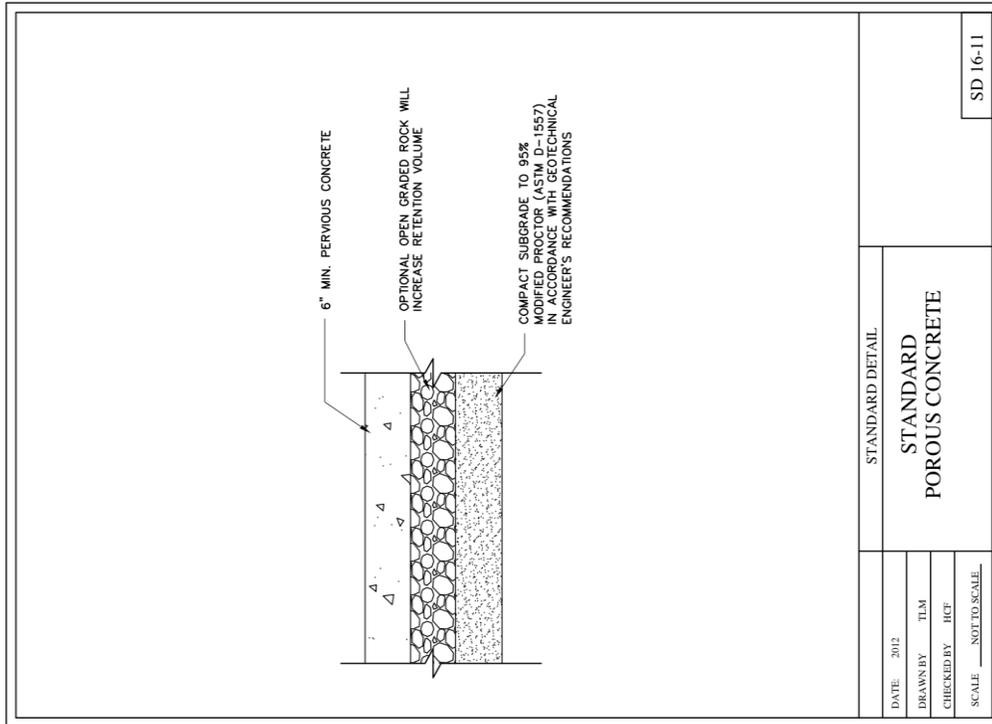
1. PEAT MOSS 15% BY VOLUME
 - a. LISTED MATERIALS REVIEW INSTITUTE
 - b. ORGANIC MATTER (NO COMPOSTED, SLUDGE, YARD OR LEAF WASTE)
 - c. TOTAL CARBON >85%
 - d. CARBON TO NITROGEN RATIO 15:1 TO 23:1
 - e. LIGNIN CONTENT 49% TO 52%
 - f. HUMIC ACID >18%
 - g. PH 6.0 TO 7.0
 - h. MOISTURE CONTENT 30% TO 50%
 - i. LOSS ON DRYING 15% TO 20% AT 100°C
 - j. > 80% PASSING 1.0MM SIEVE
2. POLLUTANT REMOVAL MINIMAL PERFORMANCE
 - a. TSS 80%
 - b. TOTAL NITROGEN 43%
 - c. HEAVY METALS 98-82%
 - d. AMMONIUM 95%
 - e. BACTERIA > 95%
3. GENERAL SAND PARTICLE SIZE DISTRIBUTION NECESSARY TO SUPPORT FLOW RATES OF > 50 INCHES / HOUR AT THE TIME OF INITIAL INSTALLATION.
 - a. SAND - FINE <5%
 - b. SAND - MEDIUM 10% - 15%
 - c. SAND - COARSE 5% TO 25%
 - d. SAND - VERY COARSE 10% TO 45%
 - e. GRAVEL 10% TO 20%
 - f. CLAY / SILTS < 2%

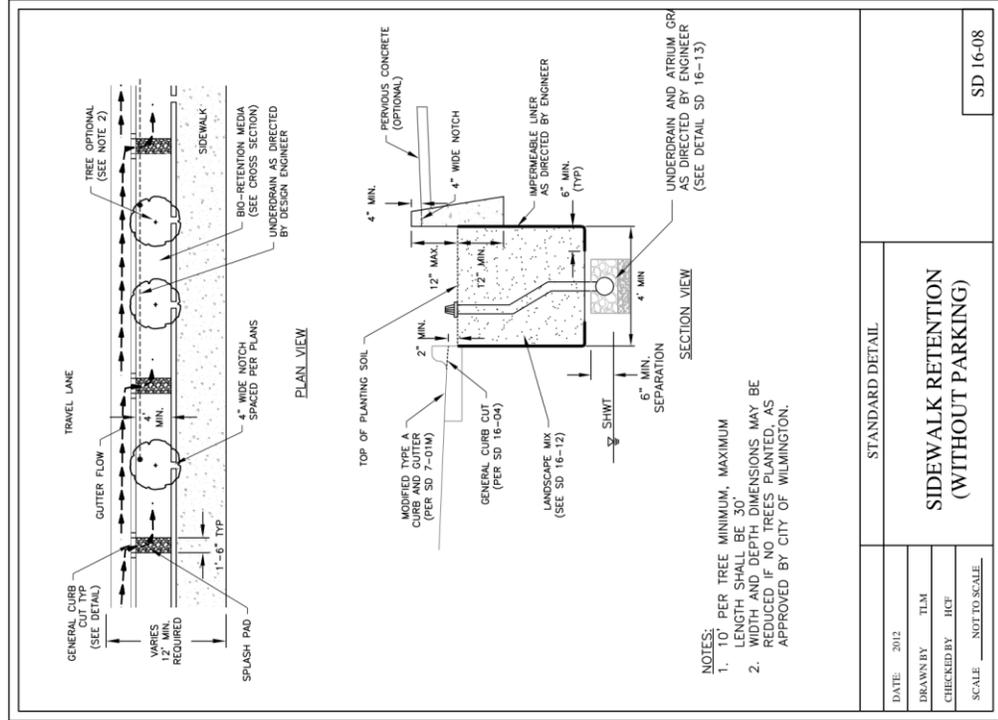
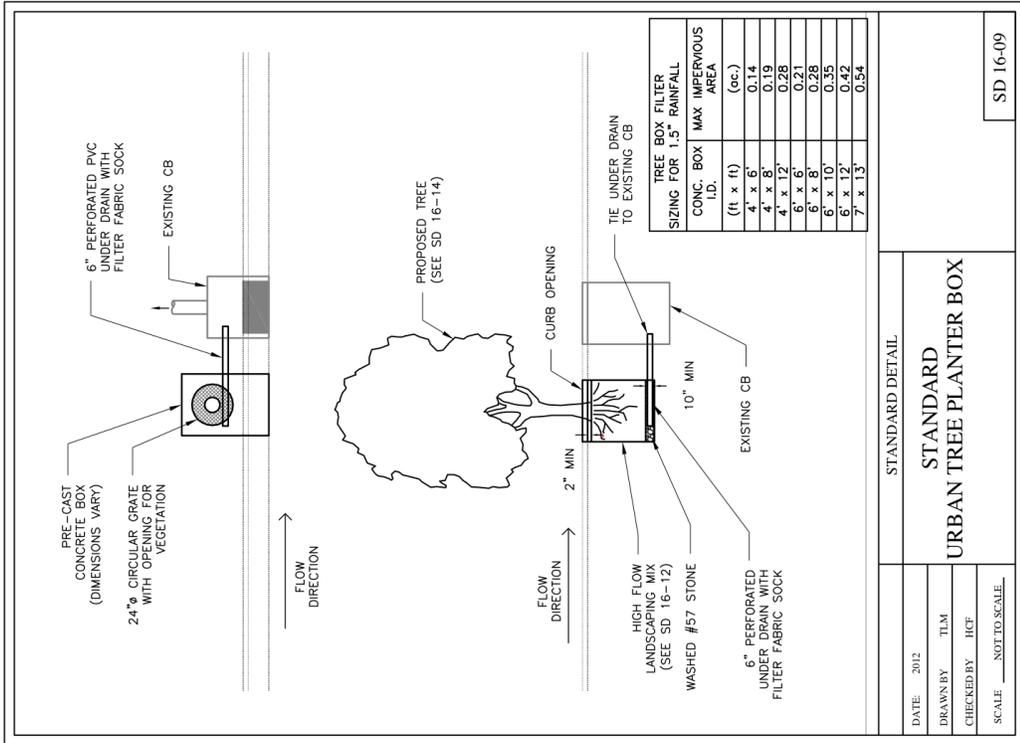
STANDARD UNDERDRAIN AND TRENCH

DATE: 2012
 DRAWN BY: TLM
 CHECKED BY: HCF
 SCALE: NOT TO SCALE

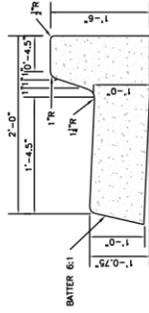
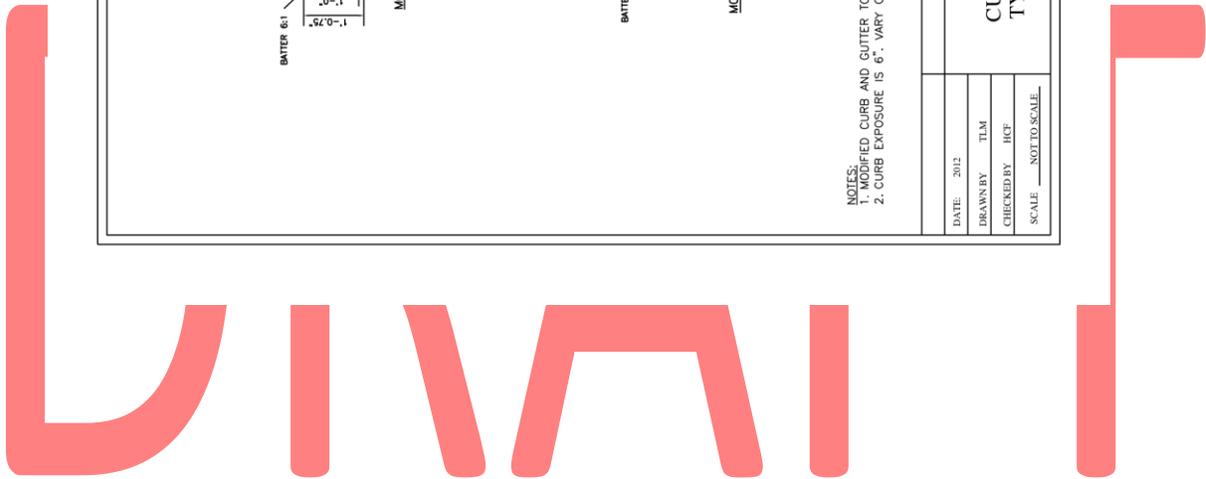
STANDARD DETAIL

SD 16-13

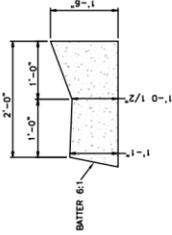




STANDARD DETAIL	
DATE	2012
DRAWN BY	TLM
CHECKED BY	HCF
SCALE	NOT TO SCALE
STANDARD SIDEWALK RETENTION (WITHOUT PARKING)	
SD 16-08	



MODIFIED TYPE "A" CURB AND GUTTER



MODIFIED TYPE "H" CURB AND GUTTER

- NOTES:
 1. MODIFIED CURB AND GUTTER TO BE USED WHEN ADJACENT TO SURFACE STORMWATER FACILITIES.
 2. CURB EXPOSURE IS 6". VARY ONLY AS SHOWN ON PLANS OR AS APPROVED.

STANDARD DETAIL		SD 7-01M
MODIFIED CURB AND GUTTER TYPES "A" AND "H"		
DATE: 2012	DRAWN BY: TLM	
CHECKED BY: HCF	SCALE: NOT TO SCALE	

**PLANNING STAFF REPORT
ZONING MAP AMENDMENT**

SUMMARY:

Hearing Date: November 7, 2017, Planning Board
December 4, 2017, Board of County Commissioners
Applicant: Michael Nadeau
Property Owner: Pratihtha Garg
Case Number: ZMA 729-2017

Rezoning Proposal: Michael Nadeau, applicant, on behalf of Pratihtha Garg, owner, is requesting approval of a Zoning Map Amendment for one (1) tract totaling approximately ±3.52 acres from PD, Planned Development zoning district to OI, Office & Institutional zoning district.

Property Record Number, Acreage, and Location: The subject property is located at 18676 US HWY 17, in the Topsail Township, along the east side of US HWY 17, approximately 200 feet north of the intersection of US HWY 17 and Long Leaf Drive (SR 1675) and may be further identified by Pender County PIN: 4204-41-2676-0000.

RECOMMENDATION

The application is for one (1) tract totaling approximately ±3.52 acres from PD, Planned Development zoning district to OI, Office & Institutional zoning district. As submitted, the request complies with the criteria set forth in Section 3.3.8.B of the Pender County Unified Development Ordinance. The request is consistent with two (2) policies in the 2010 Comprehensive Land Use Plan. The request does not conflict with any policies found in the 2010 Comprehensive Land Use Plan. Therefore, the Administrator respectfully recommends the approval of the rezoning request as described in this report.

DESCRIPTION

The subject property is currently occupied by a vacant 8,126 square feet commercial structure which has ingress and egress on both US HWY 17 and Azalea Drive (SR 1750). The site was formerly occupied by Pender County and served as the previous Hampstead Annex location. Prior to that, the subject parcel and associated commercial structure served as the Belvedere Plantation sales and administrative offices. It later was operated as the Hampstead Medical Mall and served as a location for numerous medical practitioners to aid the surrounding community.

Access

The subject property has direct access to US HWY 17 and Azalea Drive (SR 1750). Any future occupancy or improvements are subject to review and approval by NCDOT at the time of a site development application.

Utilities

Public water and Utilities Inc. wastewater services are currently available to the subject property. Any final zoning approvals are contingent upon review and approval by Pender County Environmental Health and appropriate local and state agencies.

Environmental Concerns

There are no Special Flood Hazard Areas (SFHA) located on the subject parcels according to FEMA Flood Insurance Rate Map Number 3720420400J, adopted February 16, 2007. Preliminary wetlands are identified on

the northern, undeveloped portion of the property according to the National Wetlands Inventory (NWI). Any development in these areas would be subject to review and approval by appropriate state and federal agencies.

EVALUATION

- A. **Public Notifications:** Public Notice of the proposal for map change has been advertised in the Pender-Topsail Post and Voice. Adjacent property owners within 500 feet of the proposal have been given written notice of the request, and a public notification sign has been placed on the property.
- B. **Existing Zoning in Area:** The existing zoning on the subject parcel is PD, Planned Development zoning district. The subject property is surrounded by PD, Planned Development zoning district properties in each direction.
- C. **Existing Land Use in Area:** The subject property is currently occupied by a vacant commercial structure with associated parking facilities. The northernmost and southernmost parcels are currently vacant. The subject parcel is bordered by residential uses to the east. Additional vacant land is across US HWY 17 to the west, with All Saints Catholic Church to the northwest across US HWY 17.
- D. **2010 Comprehensive Land Use Plan:** The 2010 Comprehensive Land Use Plan designates the subject property as Mixed Use. The Mixed Use land use classification designates locations where a mixture of higher density/intensity uses is to be encouraged. Mixed Use areas should be characterized by physically and aesthetically unified developments containing a mixture of commercial, office, institutional, and high- and medium-density residential uses, arranged in a walkable, compact, pedestrian and transit friendly manner. Mixed Use areas are intended to help reduce sprawl by concentrating a mix of uses in convenient locations; by promoting an efficient sustainable pattern of land uses, and by providing most of the goods and services needed by residents in a coordinated, concentrated manner. Mixed Use areas are intended to reduce the number and length of auto trips by placing higher-density housing close to shopping and employment center. They also should function to improve the quality of life for residents living in higher density housing by placing daily conveniences, shops, and employment within walking distance.

The OI, Office & Institutional zoning district is consistent with the Mixed Use future land use categorization. The purpose of this district is to provide for institutional and office areas for government, professional and medical purposes. This district is compatible with and supports adjacent residential and business uses. The existing neighboring residential uses and the proposed rezoning allow for a walkable, pedestrian friendly development that is encouraged by the Mixed Use land use classification. The general use rezoning may also be consistent with Sections 3.3.8.A and 3.3.8.D of the UDO, as the services typically provided in the OI, Office & Institutional zoning district could be in the surrounding public's interest and could be appropriate considering the surrounding uses and characteristics of the area.

This General Use Rezoning is consistent with two (2) policies found within the 2010 Comprehensive Land Use Plan and conflicts with none. The following policies within this plan may be relevant to support the proposed Zoning Map Amendment;

Policy 1A.1.2: Encourage development in areas where the necessary infrastructure – roads, water, sewer, and schools - are available, planned or can be most cost effectively provided and extended to serve existing and future development.

Policy 3A.1.4: Consistently use the Comprehensive Land Use Plan, as well as other plans and studies, to determine if a rezoning request is appropriate and consistent with local policies.

This General Use Rezoning request does not conflict with any policies of the 2010 Comprehensive Land Use Plan.

- E. Unified Development Ordinance Compliance:** Section 3.3 of the Unified Development Ordinance provides for standards that shall be followed by the Planning Board and Board of County Commissioners before a favorable recommendation of approval for a rezoning can be made. Section 3.3.8 states the Board must consider the availability of public water, wastewater, and roads for the subject parcel.

Utilities

Public water and private wastewater services are currently available to the subject property. Any final zoning approvals are contingent upon review and approval by Pender County Environmental Health and appropriate local and state agencies.

Traffic & Roadways

The subject property has direct access to US HWY 17 and Azalea Drive (SR 1750). Any improvements are subject to review and approval by NCDOT at the time of a site development application. The rezoning request is located within the boundary of the U5732 Hampstead Median Project, shown below. A development proposal is not required for a general use rezoning. Therefore, no impact to the roadway system can be anticipated.



Schools

There is no development proposal associated with this general use rezoning. A general use rezoning from the PD, Planned Development zoning district to the OI, Office & Institutional zoning district would likely not result in any measurable impact to Pender County Schools.

The purpose of OI, Office & Institutional zoning district is to provide for institutional and office areas for government, professional and medical purposes. This district is compatible with and supports adjacent residential and business uses and will allow multifamily residential uses above non-residential uses. Allowable uses in the OI, Office & Institutional zoning district include, but are not limited to:

- information services
- finance services
- educational services
- professional services
- social assistance programs
- fitness and recreation centers
- restaurants
- religious organizations

- scientific services
- technical services
- insurance offices
- ambulatory health care services
- electronic and household goods repair
- civic and social organizations
- public administration
- child care centers

The proposed rezoning is consistent with the Mixed Use future land use classification because the services and uses typically provided in the OI, Office & Institutional zoning district are those that are compatible with the surrounding area by providing increased connectivity to job centers and services of the community.

3.3.8 Review Criteria for Rezoning

The Planning Board and Board of Commissioners shall consider the following matters in considering a rezoning request:

- A. Whether the range of uses permitted by the proposed change would be appropriate to the area concerned (including not being detrimental to the natural environment, not adversely affecting the health or safety of residents or workers in the area, not being detrimental to the use or development of adjacent property, and not materially or adversely affecting the character of the general neighborhood);
- B. Whether adequate public facilities/services (i.e., water, wastewater, roads) exist, are planned, or can be reasonably provided to serve the needs of any permitted uses likely to be constructed as a result of such change;
- C. Whether the proposed change is consistent with the County’s Comprehensive Land Use Plan and CAMA Land Use Plan or any other adopted land use document.
- D. Whether the proposed amendment is reasonable as it relates to the public interest.

RECOMMENDATION

The application is for one (1) tract totaling approximately ±3.52 acres from PD, Planned Development zoning district to OI, Office & Institutional zoning district. As submitted, the request complies with the criteria set forth in Section 3.3.8.B of the Pender County Unified Development Ordinance. The request is consistent with two (2) policies in the 2010 Comprehensive Land Use Plan. The request does not conflict with any policies found in the 2010 Comprehensive Land Use Plan. Therefore, the Administrator respectfully recommends the approval of the rezoning request as described in this report.

PLANNING BOARD ACTION NEEDED:

TO APPROVE: Motion to approval the Zoning Map Amendment and to make a finding that the approval is consistent with the 2010 Comprehensive Land Use Plan. The proposal is consistent with the following policies:

- **Policy 1A.1.2**
- **Policy 3A.1.4**

The proposed rezoning is consistent with the Mixed Use future land use classification because the services and uses typically provided in the OI, Office & Institutional zoning district are those that are compatible with the surrounding area by providing increased connectivity to job centers and services of the community.

TO DENY: Motion to deny the Zoning Map Amendment and to make a finding that though the denial is inconsistent with the 2010 Comprehensive Land Use Plan, said denial is reasonable and in the public interest and does not further the goals of the 2010 Comprehensive Land Use Plan because...

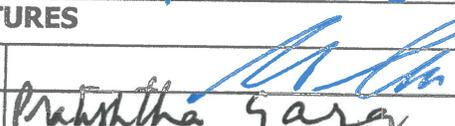
BOARD ACTION FOR ZONING MAP AMENDMENT REQUEST

Motion: _____ Seconded: _____

Approved: _____ Denied: _____ Unanimous: _____

Williams: _____ Fullerton: _____ Baker: _____ Carter: _____ Jordan _____ McClammy: _____ Nalee: _____

APPLICATION FOR REZONING (Zoning Map Amendment)

THIS SECTION FOR OFFICE USE			
Application No.	ZMA 729-2017	Date	9/27/17
Application Fee	\$ 500.00	Receipt No.	
Pre-Application Conference	9/14/17	Hearing Date	PB 11-7-17 Pac 12-4-17
SECTION 1: APPLICANT INFORMATION			
Applicant's Name:	MICHAEL NADEAU	Owner's Name:	PRATISHTHA GARO
Applicant's Address:	15894 Hwy 17	Owner's Address:	14905 Hwy 17 HAMPSTEAD
City, State, & Zip	HAMPSTEAD NC 28443	City, State, & Zip	HAMPSTEAD NC 28443
Phone Number:	910- 222 620 1237	Phone Number:	270-2722
Email Address:	MIKE@ CREATIVECOMMERCIAL.BIZ	Email Address:	
Legal relationship of applicant to land owner: AGENT			
SECTION 2: PROJECT INFORMATION			
Property Identification Number (PIN):	4204-41-2676-0000	Total property acreage:	2.79
Current Zoning District:	PD	Proposed Zoning District:	OI
Project Address :	18676 Hwy 17 HAMPSTEAD NC		
Description of Project Location:	JUST NORTH OF LONG LEAP DRIVE - FORMER COUNTY ANNEX		
SECTION 3: SIGNATURES			
Applicant's Signature		Date:	9/22/17
Owner's Signature	Pratishtha Garo	Date:	9/22/2017
NOTICE TO APPLICANT			
<ol style="list-style-type: none"> 1. Applicant must also submit the information described on the Rezoning Checklist. 2. Applicant or agent authorized in writing must attend the public hearing. 3. Once the public hearing has been advertised, the case will be heard unless the applicant withdraws the application or unless the Planning Board or other authorized person agrees to table or delay the hearing. 4. All fees are non-refundable 5. A complete application packet must be submitted prior to the deadline in order to be placed on the next Planning Board Agenda 			

Rezoning/Zoning Map Amendment Checklist

<input checked="" type="checkbox"/>	Signed application form					
<input checked="" type="checkbox"/>	Application fee					
<input checked="" type="checkbox"/>	A list of names and addresses, as obtained from the county tax listings and tax abstract, all adjacent property owners, including property owners directly across any road or road easement, and owners of the property under consideration for rezoning.					
<input checked="" type="checkbox"/>	Two (2) business size envelopes legibly addressed with first class postage for each of the adjacent and abutting property owners on the above list.					
<input checked="" type="checkbox"/>	Accurate legal description or a map drawn to scale showing the property boundaries to be rezoned, in sufficient detail to for the rezoning to be located on the Official Zoning Map.					
<input checked="" type="checkbox"/>	18 (11"x17") map copies to be distributed to the Planning Board					
<input checked="" type="checkbox"/>	20 (11"x17") map copies to be distributed to the Board of Commissioners					
<input checked="" type="checkbox"/>	Digital (.pdf) submission of all application materials					
<input checked="" type="checkbox"/>	A description and/or statement of the present and proposed zoning regulation or district boundary and stating why the request is being made and any information that is pertinent to the case. If the owner and applicant are different, the letter must be signed by both parties.					
Office Use Only						
<input checked="" type="checkbox"/>	ZMA Fees: (\$500.00 for first 5 acres; \$10/acre thereafter up to 1,000 acres; \$5/acre thereafter) Total Fee Calculation: \$ <u>500.00</u>					
Attachments Included with Application: (Please include # of copies)						
CD /other digital version	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	Plan Sets	# of large <u>20</u>	# of 11X17 <u>20</u>	Other documents/Reports	<input type="checkbox"/> Y <input type="checkbox"/> N
Payment Method:	Cash: <input type="checkbox"/> \$ _____	Credit Card: <input type="checkbox"/> Master Card <input type="checkbox"/> Visa		Check: <input checked="" type="checkbox"/> Check # <u>14239</u>		
Application received by:	<u>RD</u>				Date: <u>9/27/17</u>	
Application completeness approved by:	<u>RD</u>				Date: <u>9/27/17</u>	
Dates scheduled for public hearing:						
<input type="checkbox"/> Planning Board: <u>11-7-17</u>						
<input type="checkbox"/> Board of Commissioners: <u>12-4-17</u>						

RETURN COMPLETED APPLICATION TO:
Pender County Planning & Community Development
805 South Walker Street
P.O. Box 1519
Burgaw, NC 28425

NARRATIVE

We petition to change the zoning on the building at 18676 Highway 17 from the current PD designation to OI.

This 30 year old office building, part of Belvedere Plantation, was zoned PD by Pender County, without a PD plan even being approved by the Planning Board. In turn, no uses are permitted by right. We believe engaging the formal PD "Master Development Plan" process to place an office in this multi-tenant office facility is inappropriate and illogical.

The OI designation matches the facility as it has always been utilized for office use. Rezoning will allow the orderly occupancy of multiple businesses within this six suite building.

CURVE	DELTA	RADIUS	ARC	CHORD	TANGENT	CHORD BRG
1	34°34'00"	503.44	303.73	299.14	156.64 S	71°17'15"W

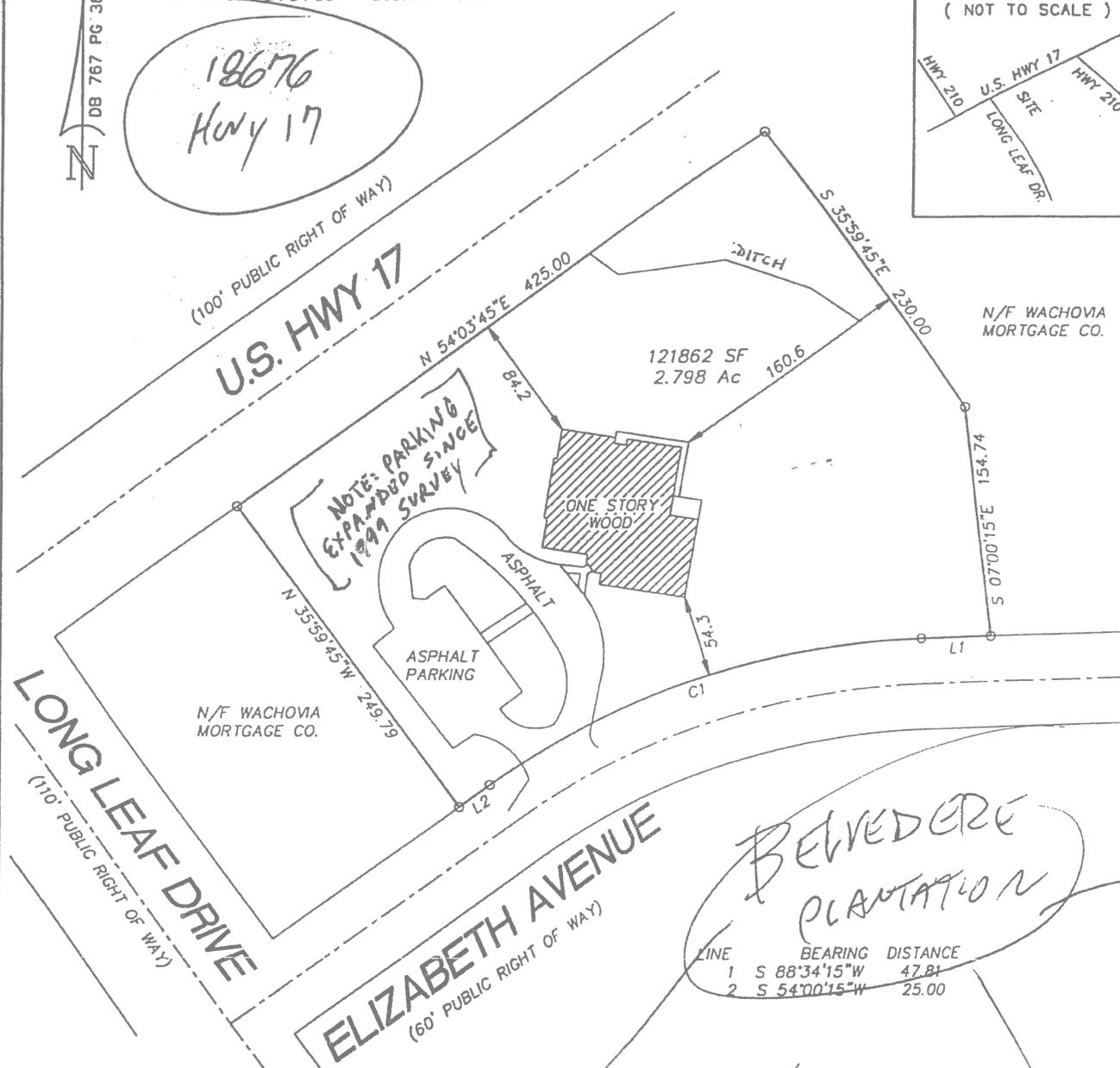
LOCATION MAP

(NOT TO SCALE)



DB 767 PG 369

18676
Hwy 17



BELVEDERE PLANTATION

LINE	BEARING	DISTANCE
1	S 88°34'15"W	47.81
2	S 54°00'15"W	25.00

NOTES

1. AREA COMPUTED BY D. M. D. METHOD
2. ALL DISTANCES ARE HORIZONTAL
3. FOR REFERENCE SEE AS NOTED

THIS PLAT REPRESENTS AN ACTUAL SURVEY THAT MEETS OR EXCEEDS THE REQUIREMENTS OF A CLASS B SURVEY IN ACCORDANCE WITH THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA.

THIS PROPERTY IS LOCATED IS NOT LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA ACCORDING TO FLOOD INSURANCE RATE MAP COMMUNITY PANEL # 370344 0393 B EFFECTIVE DATE FEB. 15, 1985.

501 LONG LEAF DRIVE
HAMPSTEAD, N. C.



2-11-99
GREG A. WAYNE PL 2876

THIS MAP IS NOT FOR RECORDATION

MAP FOR



Applicant:
Michael Nadeau

Owner:
Pratishtha Garg

General Use Rezoning:
#729-2017

Legend

 Subject Property



Vicinity





Applicant:
Michael Nadeau

Owner:
Pratishtha Garg

General Use Rezoning:
#729-2017

Legend

Zoning Districts

-  EC, Environmental Conservation
-  GB, General Business
-  IT, Industrial Transition
-  O&I, Office & Institutional
-  PD, Planned Development
-  RP, Residential Performance
-  Subject Property



Current Zoning





Applicant:
Michael Nadeau

Owner:
Pratishtha Garg

General Use Rezoning:
#729-2017

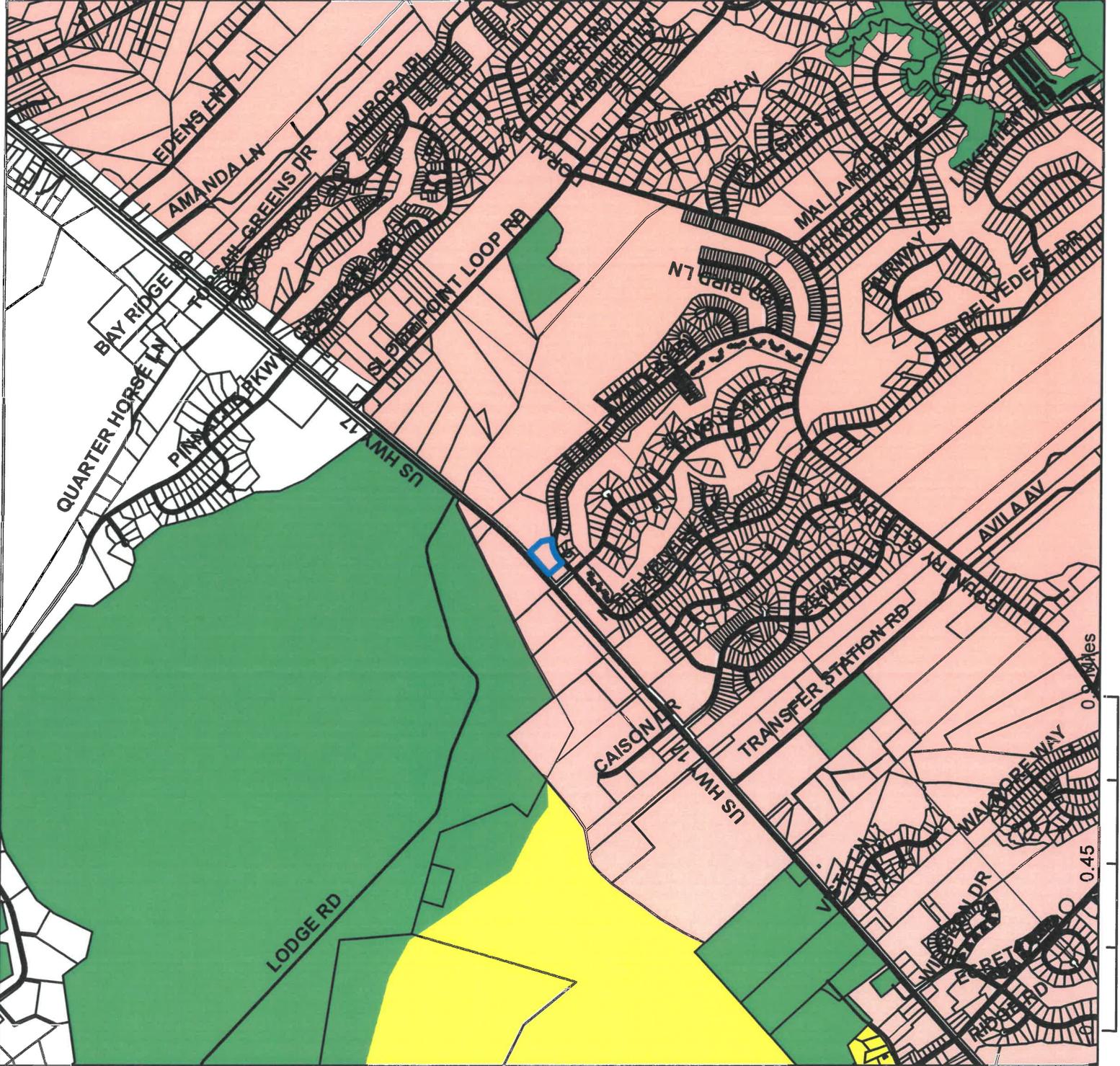
Legend

Future Land Use

-  Conservation
-  Industrial
-  Mixed Use
-  Office, Institutional, Commercial
-  Rural Growth
-  Suburban Growth
-  Subject Property



Future Land Use





Applicant:
Michael Nadeau

Owner:
Pratishtha Garg

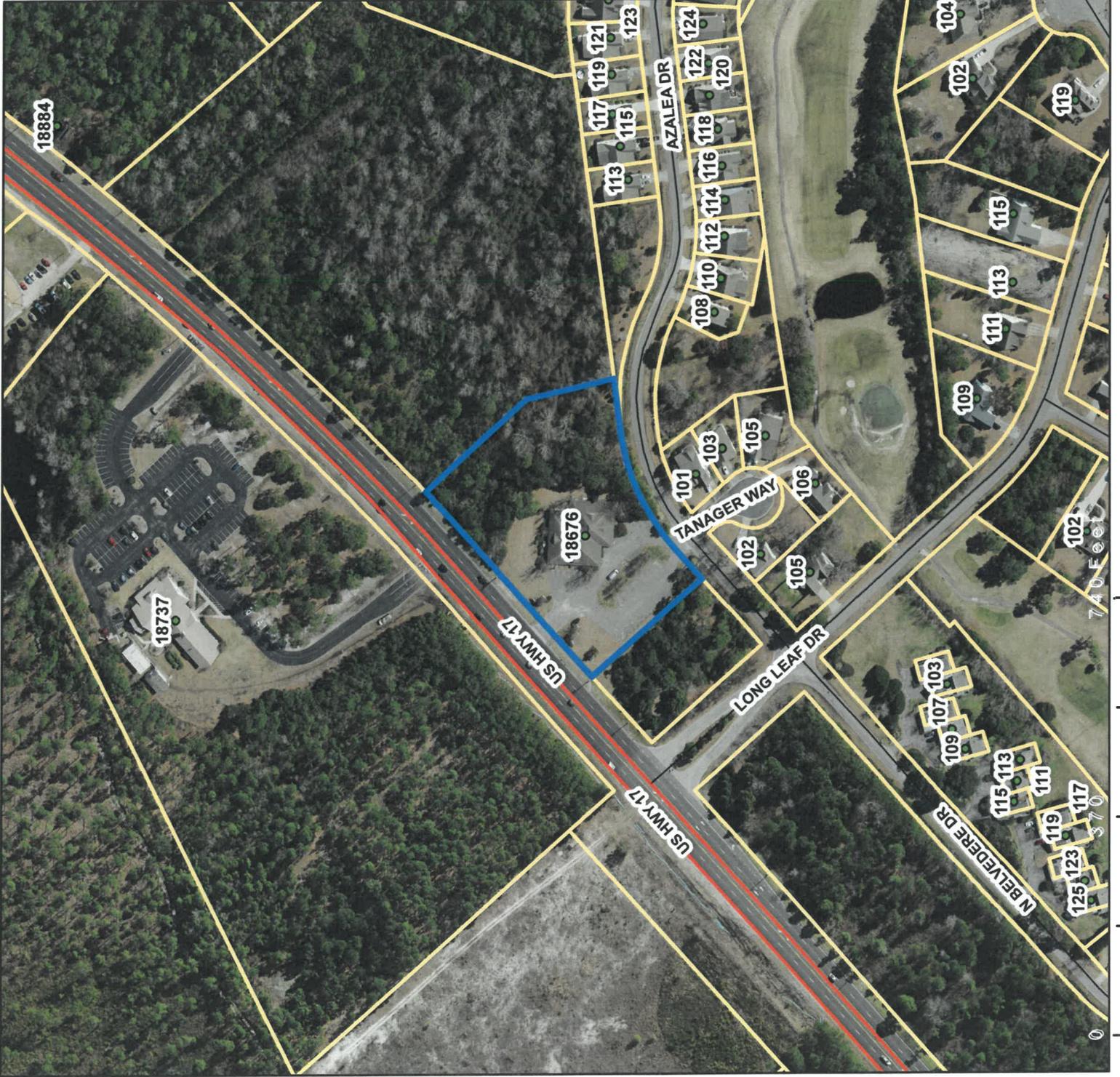
General Use Rezoning:
#729-2017

Legend

 Subject Property



2016 Aerial



**PLANNING STAFF REPORT
ZONING TEXT AMENDMENT**

SUMMARY:

Hearing Date: November 7, 2017 Planning Board
December 4, 2017 Board of Commissioners
Applicant: Trask Land Co.
Case Number: ZTA 757-2017

Text Amendment Proposal: Trask Land Company, applicant, is requesting the approval of a Zoning Text Amendment to the Pender County Unified Development Ordinance. Specifically, the request is to amend Section 8.3.2 'Interior Parking Islands' to revise the current requirements for parking terminals and landscape strips. A detailed description of the proposed changes is available in the Pender County Planning and Community Development Department Offices.

RECOMMENDATION

The Administrator respectfully recommends approval of the Zoning Text Amendment to the Unified Development Ordinance as described in this report, as the amendments are consistent with the Pender County Unified Development Ordinance and with the 2010 Pender County Comprehensive Land Use Plan.

AMENDMENT DESCRIPTION

The proposed Zoning Text Amendments to the Pender County Unified Development Ordinance submitted by the applicant provides flexibility and consistency for interior parking islands and landscaping strips for projects requiring off-street parking (non-residential).

The applicant requests to remove the requirement for single and double row landscape islands based on the number of contiguous parking spaces, and only require the landscape islands based on the length of each parking area, which will remain one-hundred and twenty (120) feet. Terminal landscape islands are raised curb areas that prevent excessively long, contiguous runs of parking spaces, shown below circled in red. Also shown below are examples of single row parking and double row head-to-head parking. An example of the proposed changes with the increased number of spaces is shown in *Figures 1 and 2*.

Figure 1: Single Row Parking, 13 spaces

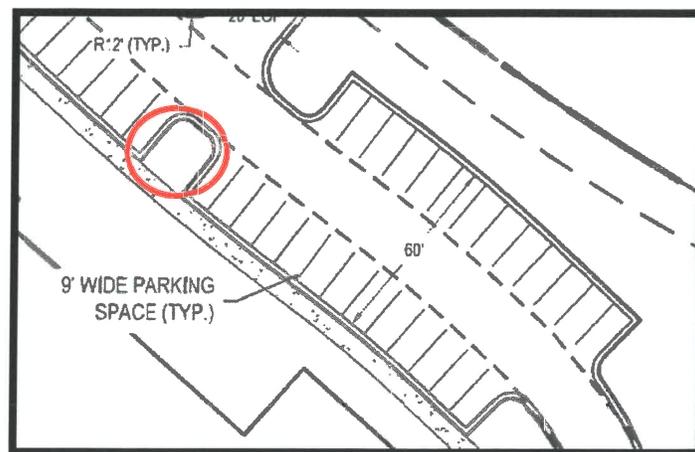
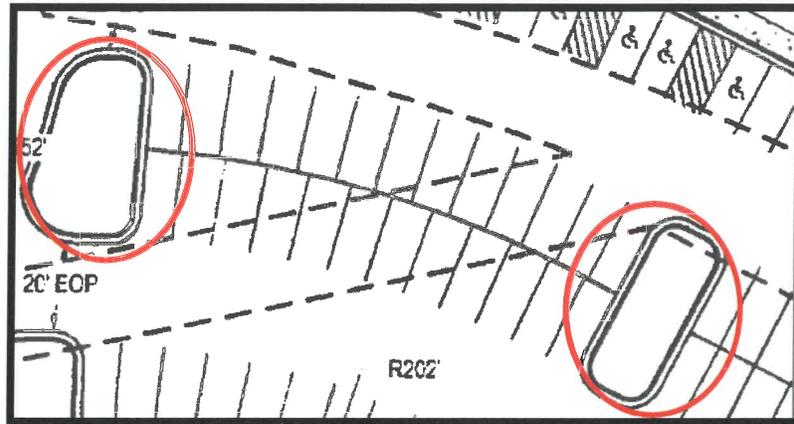


Figure 2: Double Row, Head-to-Head Parking, 26 spaces



For head-to-head parking, a seven (7) foot wide landscape strip can serve as the intermediate landscape island for every three hundred (300) square feet of pervious area provided. The applicant requests the addition of a ten (10) foot wide landscape strip for every three hundred (300) square feet of pervious area provided and the terminal island spacing can be increased to one hundred fifty (150) feet.

Additionally, the applicant proposes that canopy trees in parking terminal islands be counted towards the required perimeter canopy tree requirement. Currently, canopy trees within landscape buffers may be counted as perimeter trees so long as they are within thirty (30) feet of the from the edge of pavement or vehicular service area.

EVALUATION

As prescribed in the Pender County Unified Development Ordinance Section 3.18.5, in evaluating any proposed Ordinance text amendment, the Planning Board and the County Commissioners shall consider the following:

- 1) The extent to which the proposed text amendment is consistent with the remainder of the Ordinance, including, specifically, any purpose and intent statements;
- 2) The extent to which the proposed text amendment represents a new idea not considered in the existing Ordinance, or represents a revision necessitated by changing circumstances over time;
- 3) Whether or not the proposed text amendment corrects an error in the Ordinance; and
- 4) Whether or not the proposed text amendment revises the Ordinance to comply with state or federal statutes or case law.

In deciding whether to adopt a proposed Ordinance text amendments, the central issue before the Planning Board and County Commissioners is whether the proposed amendment advances the public health, safety or welfare and is consistent with any adopted County Land Use Plan documents and the specific intent of this Ordinance.

2010 Comprehensive Land Use Plan Compliance

The proposed changes allow for greater flexibility in parking design while still providing landscaped parking islands which prevent excessively long runs of contiguous parking spaces. A required off-street parking space shall be at least eight feet, six inches (8'6") in width and 18 feet in length according to the Pender County Unified Development Ordinance. By removing the maximum amount of spaces before a landscaping island is required,

more spaces can be provided within the required distances. For instance, with an allowance of one-hundred and twenty (120) feet, the maximum number of spaces for a single row parking area would be fourteen (14) spaces. The increased landscape strips and the allowance of canopy trees in terminal islands to be counted toward the perimeter canopy tree requirement also provide flexibility while maintaining consistency with the spirit and intent of the Unified Development Ordinance and Comprehensive Land Use Plan.

Additionally, the North Carolina Division of Water Resources (NCDWR) encourages proactive planning and the examination of zoning ordinances to limit large, unnecessary parking lots and allow for green spaces to limit and absorb stormwater runoff. This proposal seems to maintain these goals.

There are no conflicting policies within any adopted land use documents for the proposed Zoning Text Amendment. The proposed Zoning Text Amendment is providing clarification and flexibility to existing Ordinance language. The proposed Zoning Text Amendment is consistent with the spirit, purpose, and intent of the 2010 Comprehensive Land Use Plan and with the Pender County Unified Development Ordinance. There are no policies that directly conflict or support the proposal found within the 2010 Comprehensive Land Use Plan.

RECOMMENDATION

The Administrator respectfully recommends approval of the Zoning Text Amendment to the Unified Development Ordinance as described in this report, as the amendments are consistent with the Pender County Unified Development Ordinance and with the 2010 Pender County Comprehensive Land Use Plan.

PLANNING BOARD CONSISTENCY STATEMENT:

TO APPROVE: Motion to approve the Zoning Text Amendment and to make a finding that the approval is consistent with the 2010 Comprehensive Land Use Plan.

Generally, the 2010 Comprehensive Land Use Plan supports maintaining landscaping regulations. Community design standards should address all types of land uses allowed within the County – residential, office, commercial and industrial uses. Specific standards for each zoning district should be included in the UDO. Benefits include:

- Design standards can help soften the visual impacts of new development.
- Regulations can be tailored to the individual characteristics of the community.

There are no specific policies that conflict with the proposal. The proposed Zoning Text Amendment is consistent with the spirit, purpose, and intent of the 2010 Comprehensive Land Use Plan and with the Pender County Unified Development Ordinance.

TO DENY: Motion to deny the Zoning Text Amendment and to make a finding that proposal is not consistent with the 2010 Comprehensive Land Use Plan, said denial is reasonable and in the public interest and does not further the goals of the 2010 Comprehensive Land Use [INSERT REASONING].

BOARD ACTION FOR ZONING TEXT AMENDMENT

Motion: _____ **Seconded:** _____

Approved: _____ **Denied:** _____ **Unanimous:** _____

Williams: ___ **Fullerton:** ___ **Baker:** ___ **Carter:** _____ **Jordan:** ___ **McClammy:** ___ **Nalee:** _____

APPLICATION FOR TEXT AMENDMENT

THIS SECTION FOR OFFICE USE			
Application No.	ZTA 752-2017	Date	10-13-17
Application Fee	\$ 250.00	Receipt No.	540
Pre-Application Conference	—	Hearing Date	PB 11-7-17, 12-4-17
SECTION 1: APPLICANT INFORMATION			
Applicant's Name:	Trask Land Company		
Applicant's Address:	1202 Eastwood Rd.		
City, State, & Zip	Wilmington, NC 28403		
Phone Number:	910-799-8755		
Email Address:	tammy@trasklandco.com		
SECTION 2: UDO TEXT TO BE AMENDED			
Current Text to be Amended (Please site accurate Article number referenced):			
8.3.2			
Proposed Text to be added:			
see attached			
SECTION 3: SIGNATURE			
Applicant's Signature	Tammy M. Spivey		Date: 10-13-17
NOTICE TO APPLICANT			
If the applicant makes significant changes to the application for a text amendment after the Planning Board has made its recommendation, the Administrator may refer the modified request back to the Planning Board for an additional public hearing.			
TEXT AMENDMENT CHECKLIST			
<input checked="" type="checkbox"/>	Signed application form		
<input checked="" type="checkbox"/>	Application fee		
<input checked="" type="checkbox"/>	A letter describing, in detail the intent and purpose of the amendment presented, meeting the approval criteria set forth in Section 3.18.5 of the Pender County UDO (shown on page 1 of this application)		
Office Use Only			
<input checked="" type="checkbox"/> ZTA Fees: \$250		Total Fee Calculation: \$250	
Payment Method:	Cash: <input type="checkbox"/> \$ _____	Credit Card: <input checked="" type="checkbox"/> MasterCard <input type="checkbox"/> Visa	Check: <input type="checkbox"/> Check # _____
Application Received By:	[Signature]		Date: 10-13-17
Application completeness approved by:	[Signature]		Date: 10-13-17
Dates Scheduled for Public Hearings:	<input checked="" type="checkbox"/> Planning Board: 11-7-17	<input checked="" type="checkbox"/> BOC: 12-4-17	

Parking Text Amendment Request Narrative

In preparing the attached text amendment for landscape islands in parking lots, we researched the landscape regulations for four local municipalities and a fifth that seemed similar in nature to the current Pender County regulations. The four local municipalities are: Brunswick County, New Hanover County, Horry County and the City of Wilmington. The fifth municipality is the Town of Cary which includes consideration of perimeter trees and linear landscape which are addressed by your regulations.

Each municipality has different measures for interior landscaping and shading of parking areas. Some are similar and some measures are not. Below is a brief summary of each of the municipalities' requirements:

Brunswick County

- One 144 SF landscape island is required for every 20 spaces which must be located within 150' of every parking space.

New Hanover County

- No parking space shall be located more than 120' from a shade tree located in a 144 SF island. Interior landscaping shall be 8% of the total area used for parking, driveways, aisles, loading docks, etc.

Horry County

- No parking space shall be less than 50' from a shade tree in a 200 SF island. Vehicular use areas less than 3 acres shall have no more than 15 spaces between islands and areas greater than 3 acres shall not have more than 25 spaces between islands.

Wilmington

- No parking space shall be more than 120' from a 200 SF landscape island. Parking lot shading between 20% and 40% is required based on areas of shade assigned to each tree.

Town of Cary

- No more than 14 spaces between 300 SF islands. Upper story tree required for every seven parking spaces which can be evenly distributed throughout the parking area and perimeter. Linear planting strips are strongly encouraged rather than numerous small one tree islands.

We prepared parking island calculations for the three sets of plans submitted for major site plan review and we feel we meet the intent of the ordinance for reduction of heat island effect by providing the number of required islands. Our calculations are based on having an island for every ten spaces plus an island for multiples of twenty spaces in excess of eighty spaces. Please understand that our plans have island spacing of no more than 120' as we have suggested in the attached text amendment. We counted the double terminal islands as two islands for the purposes of these calculations:

Retail Site (Eight Extra Islands)

- $426 / 10$ spaces per required island = 43 spaces

- 346 spaces / 20 spaces per intermediate island = 18

Islands required = 61

Islands provided = 69.

Multifamily Site (Eight Extra Islands)

- 423 / 10 spaces per required island = 43 spaces

- 343 spaces / 20 spaces per intermediate island = 18

Islands required = 61

Islands provided = 69

Senior Living Site (One Additional Island Required)

- 290 / 10 spaces per required island = 29 spaces

- 210 spaces / 20 spaces per intermediate island = 11

Islands required = 40

Islands provided = 39

Our recommended text amendment is attached. We look forward to discussing this with you and appreciate your guidance.

Sincerely,

Loftee Smith, PE, LEED AP

Vice President

Withers & Ravenel

115 MacKenan Drive | Cary, NC 27511

137 S Wilmington Street | Suite 200 | Raleigh, NC 27601

Office: 919.469.3340 |

The intent of the requested text amendment is to allow flexibility in the design of parking lots and the placement of tree islands while providing the number of shade trees as prescribed by the current UDO. The one hundred twenty foot spacing is consistent with the current UDO requirement as a maximum terminal island spacing.

Additionally, the proposed incorporation of a ten foot wide landscape strip will provide incentive to create a larger contiguous landscape area to benefit the growth of the trees; the better growth environment of the wider landscape strips should allow trees to prosper and provide more shade at an increased rate of growth. It is anticipated that the one hundred fifty foot island spacing will provide flexibility of design and better shade for larger parking fields. One hundred fifty feet is sufficient for either sixteen parking spaces plus pedestrian cross access or a cart corral, or twelve parking spaces plus two handicap accessible spaces with an accessibility aisle.

8.3.2 Interior Parking Areas

- A. Landscape islands shall be provided within parking areas, except parking garages, as described below to prevent excessively long, contiguous runs of parking spaces. These areas shall use control measures to prevent encroachment or damage to trees and vegetation.
- B. Light poles, fire hydrants, or other necessary features are permitted to be located within landscape islands and parking areas.
- C. Single row terminal landscape island requirements
- 1) Single row parking terminals cannot extend more than ~~ten (10) contiguous parking spaces or more~~ than one-hundred and twenty (120) feet, ~~whichever is more restrictive.~~
 - 2) Each terminal island must include a minimum pervious area of three hundred (300) square feet with a minimum width of twelve (12) feet.
 - 3) Each single row terminal landscape island shall contain at least one (1) canopy tree.
 - 4) Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances.
- D. Double row terminal landscape island requirements
- 1) Double row parking terminals with head-to-head parking cannot extend more than ~~twenty (20) contiguous parking spaces, ten spaces by two rows (10 x 2), or extend more than one-hundred and twenty (120) feet, whichever is more restrictive.~~
 - 2) Each terminal island must include a minimum pervious area of six hundred (600) square feet and a minimum width of twelve (12) feet.
 - 3) Each double-row terminal landscape island shall contain at least two (2) canopy trees.
 - 4) Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances.
- E. Intermediate landscape islands requirements
- 1) Intermediate landscape islands shall be provided for any parking lot with eighty (80) or more parking spaces. Additional Intermediate landscape islands shall be provided for every additional twenty (20) parking spaces in excess of eighty (80).
 - 2) Each intermediate landscape island shall have a minimum pervious area of three hundred (300) square feet and a minimum width of twelve (12) feet, and
 - 3) Each intermediate landscape island shall contain at least one (1) canopy tree.
- F. Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances. Alternatively a minimum seven (7) foot wide landscape strip may be provided between head-to-head parking, which may count as the required Intermediate landscape island for every three hundred square feet (300) of pervious area provided. If a landscape strip is used, ornamental landscape trees and shrubs shall be planted within the landscape strip on minimum thirty (30) foot centers. ~~With the incorporation of a 10' wide landscape strip between head to head parking, the strip may count as the required intermediate islands for every three hundred (300) feet of pervious area provided and terminal island spacing can be increased to one hundred fifty (150) feet.~~
- G. Limited Off-Street Paved Parking areas. Interior portions of off-street parking facilities, which are not specifically designed as parking spaces or maneuvering areas, shall not be paved for vehicle use.
- H. Parking Lot Trees and Substitutions. All trees in the parking lots shall be canopy trees, unless otherwise provided.

- 1) **Perimeter Trees and Spacing.** Canopy trees shall be planted an average of fifty (50) foot centers around the total perimeter of the parking lot and all vehicular service areas. Clustering may be utilized but spacing shall not exceed one-hundred and fifty (150) foot spacing. The canopy trees shall be planted between eight feet (8) and thirty (30) feet from the edge of pavement. Canopy trees within the landscape buffers may be used if they fall within thirty (30) feet from the edge of paving or vehicular service area as shown in Figure C – Perimeter Trees and Spacing. **Terminal islands can be counted toward the perimeter canopy tree requirement.**
- 2) **Pervious Parking.** Parking spaces provided in excess of the minimum required shall be constructed to use low impact design of excess parking facilities. Additional low impact design may be provided, if not otherwise prohibited by other provisions of the UDO, in the following areas:
 - a) Adjacent to parking lot landscape islands to allow for the percolation of water and the exchange of oxygen for the tree roots.
 - b) Grass paving or turf block areas may be utilized in low impact areas or infrequent use areas such as churches or the outlying parking areas of malls or other shopping areas.
- I. **Internal Access Roads.** Developments with internal access roads shall be required to plant one (1) canopy tree on each side of the road approximately every fifty (50) feet. Access roads immediately in front of commercial structures and other buildings do not have to meet the access road tree requirement but do have to meet other parking landscape requirements. Parking lot island canopy trees may be used to meet this requirement if they fall within thirty (30) feet from the edge of the pavement along the internal access road
- J. **Low Impact Development Features.** Parking lot islands are encouraged to use curb breaks and create swale or depression areas to allow for the percolation of rainwater and parking stormwater. Attention shall be given to the selection, placement and durability of landscape material within rain garden areas to ensure their long-term viability. Any proposed rain garden areas must comply with all stormwater requirements as deemed by the NC DWQ rules and regulations for Low Impact Design. Smaller rain gardens that serve as landscape islands shall adhere to all canopy and understory requirements for landscape islands.

8.3.1 Interior Parking Areas

- A. Landscape islands shall be provided within parking areas, except parking garages, as described below to prevent excessively long, contiguous runs of parking spaces. These areas shall use control measures to prevent encroachment or damage to trees and vegetation.
- B. Light poles, fire hydrants, or other necessary features are permitted to be located within landscape islands and parking areas.
- C. Single row terminal landscape island requirements
- 1) Single row parking terminals cannot extend more than ~~ten (10) contiguous parking spaces or more than~~ one-hundred and twenty (120) feet, ~~whichever is more restrictive.~~
 - 2) Each terminal island must include a minimum pervious area of three hundred (300) square feet with a minimum width of twelve (12) feet.
 - 3) Each single row terminal landscape island shall contain at least one (1) canopy tree.
 - 4) Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances.
- D. Double row terminal landscape island requirements
- 1) Double row parking terminals with head-to-head parking cannot extend more than ~~twenty (20) contiguous parking spaces, ten spaces by two rows (10 x 2), or extend more than~~ one-hundred and twenty (120) feet, ~~whichever is more restrictive.~~
 - 2) Each terminal island must include a minimum pervious area of six hundred (600) square feet and a minimum width of twelve (12) feet.
 - 3) Each double-row terminal landscape island shall contain at least two (2) canopy trees.
 - 4) Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances.
- E. Intermediate landscape islands requirements
- 1) Intermediate landscape islands shall be provided for any parking lot with eighty (80) or more parking spaces. Additional intermediate landscape islands shall be provided for every additional twenty (20) parking spaces in excess of eighty (80).
 - 2) Each intermediate landscape island shall have a minimum pervious area of three hundred (300) square feet and a minimum width of twelve (12) feet, and
 - 3) Each intermediate landscape island shall contain at least one (1) canopy tree.
- F. Required maximum two (2) foot high screening shrubs shall be utilized the entire length of the landscape island, or as limited by sight distances. Alternatively a minimum seven (7) foot wide landscape strip may be provided between head-to-head parking, which may count as the required intermediate landscape island for every three hundred square feet (300) of pervious area provided. If a landscape strip is used, ornamental landscape trees and shrubs shall be planted within the landscape strip on minimum thirty (30) foot centers. ~~With the incorporation of a ten (10') wide landscape strip between head-to-head parking, the strip may count as the required intermediate islands for every three hundred (300') feet of pervious area provided and terminal island spacing can be increased to one hundred fifty (150') feet.~~
- G. Limited Off-Street Paved Parking areas. Interior portions of off-street parking facilities, which are not specifically designed as parking spaces or maneuvering areas, shall not be paved for vehicle use.

H. Parking Lot Trees and Substitutions. All trees in the parking lots shall be canopy trees, unless otherwise provided.

- 1) Perimeter Trees and Spacing. Canopy trees shall be planted an average of fifty (50) foot centers around the total perimeter of the parking lot and all vehicular service areas. Clustering may be utilized but spacing shall not exceed one-hundred and fifty (150) foot spacing. The canopy trees shall be planted between eight feet (8) and thirty (30) feet from the edge of pavement. Canopy trees within the landscape buffers may be used if they fall within thirty (30) feet from the edge of paving or vehicular service area ~~as shown in Figure C —Perimeter Trees and Spacing~~. Terminal islands can be counted toward the perimeter canopy tree requirement.

Pender County Planning and Community Development

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MEMORANDUM

To: Pender County Planning Board
From: Planning Staff
Date: November 7, 2017
RE: Comprehensive Land Use Plan

Comprehensive Land Use Plan Update

Planning Staff, along with the consultants from the Cape Fear Council of Governments, has distributed a draft version of the entire plan to the Commissioners Advisory Committee (CAC). Final comments and changes are being made to Chapters 5 and 6 and the CAC has recommended approval of the plan with the suggested edits from the October 26, 2017 CAC meeting. Planning Staff intends to open a 30-day comment period for public input. Planning Board members will receive a draft version of the entire plan tonight. An overview of the draft plan will be presented to the Planning Board for discussion at the December 5, 2017 work session. Once the Planning Board is ready to recommend the plan to the Board of Commissioners, the plan must first be reviewed by the North Carolina Division of Coastal Management. Staff will then present the project to the Board of Commissioners prior to a final vote of approval. A draft of the plan of the entire document will be available for review at www.PlanPender.org. A tentative timeline is provided below:

- **10/26/17:** CAC Approval
- **11/7/17:** Planning Board receipt of final draft plan
- **12/5/17:** Planning Board review of final draft plan
- **1/3/18:** Planning Board Public Hearing and possible recommendation
- **January – March 2018:** Mandatory 75 day review per 15A NCAC 7B.0801 by Division of Coastal Management and State/Federal agencies.
- **January/February 2018:** Deliver Planning Board recommended plan to Board of Commissioners for initial review
- **March – May/June 2018:** Board of Commissioners Public Hearing and possible adoption
- **June - August 2018:** Coastal Resources Commission Certification

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Technical Review Committee Agenda
November 1, 2017

Pender County's Technical Review Committee meeting will be held on Wednesday November 1, 2017 at 9am in the Board of County Commissioners Conference Room, in the Pender County Government Administration Building at 805 S. Walker Street, in Burgaw to review the cases below. Documents for reviewing these cases are available on the Pender County TRC website.

9:00 AM Case 778-2017 Wyndwater Phase 6 Preliminary Plat

Signature Top Sail NC LP, applicant and owner, is requesting the approval of a Preliminary Plat for the for a mixed-use development proposal known as Wyndwater Phase 6. The proposed Preliminary Plat includes 45 single family residential lots on approximately ± 16.11 acres The Master Development Plan revision was conditionally approved September 7, 2016 to include 529 units with future development and commercial development to be determined at a later date. At current the development has recorded Phase I (42 lots), Phase 1A (3 lots) Phase IIA (56 lots), Phase IIB (27 lots), and Phase IIIA revision (13 lots). The request consists of Phase VII revision (42 lots). The proposed Preliminary Plat is located to the north west of Doral Drive (SR 1693), west of Sloop Point Loop Road (SR 1563), south of the formally approved Cardinal Pointe Master Development Plan, and east of US Highway 17 in Hampstead. The current proposal for Phase VII is east of US Highway 17. The subject property may be further identified by PIN 4214-04-9161-0000. The property is zoned PD, Planned Development zoning district.

The applicant requesting review of Preliminary Plat for Phase 6. Phase I was previously recorded on MB 57 PG 14, Phase IA was previously recorded on MB 58 PG 72, phase IIA was previously recorded on MB 57 PG 145-146, phase IIB was previously recorded on MB 58 PG127, Phase IIIA was previously on MB 59 PG 116, Phase IIIB MB 60 PG 30, and Phase IIIC-1 MB 60 PG 134 located in the Pender County Register of Deeds.

Zoning District: PD, Planned Development zoning district

Water Service: PCU

Sewer Service: Pluris Hampstead LLC

Road Designation: Public for some of the MDP area however Private for the proposed Phase

Units/Lots: 45

TIA: Approved

9:15 AM Case 779-2017 Brittan Tract Preliminary Plat

2 Home LLC, applicant, on behalf of Brittan Woodlands, LLC, owner, is requesting the approval of a Preliminary Plat for a by-right residential development proposal. The Britton Tract Preliminary Plat includes; 52 single family residential lots on approximately ± 149.9 Ac acres. The proposed development is located with direct access on NC HWY 210 is west NC HWY 210, north of the previously approved subdivision of Avendale, and east of the previously approved subdivision of Equine Acres. The subject property may be further identified by Pender County PIN: 3274-30-8671-0000.

Site Plan Data:

Zoning District: RA, Rural Agricultural zoning district

Water Service: Pender County Utilities

Wastewater Service: Private Septic

Road Designation: Public and Private

Units/Lots: 52

Acreage: ± 149.9 Ac acres

TIA: NA

9:30 AM Case 781-2017 Harrison Cove Phase 4 Master Development Plan revision and Preliminary Plat submittal

Parks Family Forestry LLC, applicant and owner is requesting the approval of a Preliminary Plat for a by-right residential development proposal. The future phase of the proposed Harrison Cove Preliminary Plat includes; 46 single family residential lots on approximately ± 39.2 acres. The proposed development has indirect access through the previously approved subdivision of Harrison Cove to Harrison Creek Road and NC HWY 210. The subject parcel is located east of the previously approved Harrison Cove subdivision and located west of the proposed Hardison tract CZMA. The subject property may be further identified by Pender County PIN: 3273-10-7328-0000.

Site Plan Data:

Zoning District: RP, Residential Performance zoning district

Water Service: Pender County Utilities

Wastewater Service: Private Septic

Road Designation: Public and Private

Units/Lots: 46

Acreage: ± 39.2 Ac acres

TIA: Required to be scoped with Harrison Creek and the proposed development Island Creek North.

10:00 AM Case 783-2017 Island Creek North Master Development Plan revision and Preliminary Plat submittal

Parks Family Forestry LLC, applicant and owner is requesting the approval of a Preliminary Plat for a by-right residential development proposal. The proposed Island Creek North Master Development Plan and Preliminary Plat includes; 52 single family residential lots on approximately ± 48.17 acres. The proposed development has direct access NC HWY 210. The subject parcel is located north of the previously approved Harrison Cove subdivision and located north west of the Proposed Hardison tract CZMA. The subject property may be further identified by Pender County PIN: 3273-33-4865-0000 and 3273-33-7028-0000.

Site Plan Data:

Zoning District: RP, Residential Performance zoning district

Water Service: Pender County Utilities

Wastewater Service: Private Septic

Road Designation: Public and Private

Units/Lots: 52

Acreage: ± 48.17 Ac acres

TIA: Required to be scoped with Harrison Creek and the proposed development Island Creek North.

10:30 AM Case 522-2017 Major Site Plan Sloop Point Mini-Storage

AJ McGirt Land Management, LLC, applicant and owner is requesting the approval of Phase I of the Major Site Development plan for a self-storage facility. The proposed development includes; 7 mini-storage buildings totaling ± 119,675 square feet, ± 1,720 square feet of office building, a stormwater pond, parking, and landscaping on ± 6.44 acres. The proposed development has direct access US HWY 17 and Quarter Horse Lane (private). The subject parcel was previously approved as a Conditional Zoning Map Amendment to GB-CD2, General Business Conditional District 2 and is located approximately 350 feet north east of the Topsail Greens Drive (private). The subject property may be further identified by Pender County PINs: 4204-76-8504-0000 and 4204-86-1659-0000.

Site Plan Data:

Zoning District: GB-CD2, General Business Conditional District 2

Water Service: Pender County Utilities

Wastewater Service: Pluris

Road Designation: Public and Private

Units/Lots: 2

Acreage: ± 6.43 acres

TIA: TBD

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MEMORANDUM

To: Pender County Planning Board
From: Planning Staff
Date: November 7, 2017
RE: Stormwater Ordinance Update

Stormwater Ordinance Update

The Zoning Text Amendment Subcommittee met on October 19, 2017 to discuss the most recent changes to the proposed amendment with Planning Staff and the consultant, Michael Gallant, P.E.. Upon further review and discussion, the subcommittee determined that the requirements for single lot development be addressed through a broader, more holistic approach rather than through ordinance language. This approach, based on the desire of the members present, included a coordinated effort to advocate for further resources and studies of stormwater issues in Pender County.

In addition to this broader approach, the committee and staff agreed that education and outreach need to occur between staff and property owners in subdivisions that were constructed prior to North Carolina Department of Environmental Quality permit requirements. This approach, coupled with regulatory efforts, could create change in a manner that is possibly more effective than single lot regulations.

A draft of the proposed text amendment recommended by the subcommittee for Planning Board review is attached. If the Planning Board desires, staff will begin public outreach on the proposed zoning text amendment as described in the attachment.

PENDER COUNTY DRAFT STORMWATER ORDINANCE REVISION

1) Applicability

- a) This ordinance shall be applicable to all new development projects from the date of the adoption of this ordinance that fit the following criteria.
 - i) New development of any tract of land or subdivision that requires a North Carolina Department of Environmental Quality (NCDEQ) Stormwater Permit.
- b) Pre Development Exclusion
 - i) Any portion of a project area that is granted a pre-development exclusion by the NCDEQ from having to obtain a standard NCDEQ stormwater permit requiring the project meet existing rules and regulations is excluded from this rule.
 - (1) Determination of pre-development exclusion obtained from the NCDEQ shall be submitted by the applicant prior to issuance of zoning approval.
 - ii) Single lots that do not require an NCDEQ stormwater permit but have previously existing impervious areas will be allowed to remove those areas from consideration of this ordinance. For lots with pre-existing impervious surfaces that will be redeveloped the existing impervious areas on those lots would not be subject to this ordinance. Impervious areas proposed over and above pre-existing impervious areas must meet the requirements of this rule. For instance if a lot has 5,000 square feet of impervious surfaces and wishes to expand that area by either adding to the existing impervious areas or by demolishing the existing structures and creating new impervious areas, the only impervious surfaces subject to this ordinance would be those that were in excess of the original 5,000 square feet. So if the lot had 5,000 square feet of existing impervious surfaces and was proposing a new total of 6,000 square feet of impervious surfaces then only the difference of 1,000 square feet would be required to meet the requirements of this ordinance.

2) Definition of Terms

- a) NCDEQ – The North Carolina Department of Environmental Quality
- b) NCDOT - The North Carolina Department of Transportation
- c) PCPD – Pender County Planning Department
- d) NOAA – National Oceanic and Atmospheric Administration
- e) Time of Concentration – The calculated time of travel for runoff to flow across a project area from the farthest distance from the outfall to that outfall, expressed as a unit of time.
- f) Peak Flow – The calculated maximum flow generated by a specific design storm as calculated by the rational method or other industry standard methodologies, expressed in cubic feet per second.
- g) Impervious Surface - Any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, and includes non-permeable pavement structures, sidewalks, rooftops or any other structure or improvement that impedes rainfall from entering the ground surface.
- h) Pervious Surface – Any bare or vegetated soil or surface that allows the penetration of rainfall. This includes but is not limited to permeable pavement structures, drip through decks not covered by a roof structure, gravel surfaces meeting the standard of pervious surfaces as described by NCDEQ.
- i) Post Development – Site conditions including impervious surface coverage that exist after the proposed development has been completed. occurred.
- j) Pre Development – Site conditions that exist prior to the proposed land development.
- k) Design Storm – A specified storm event consisting of the return period, expressed in years.

- l) Rainfall Depth – The depth of a specific storm event, expressed in inches.
- m) Intensity – The rate at which rain falls, expressed in inches per hour.
- n) Design Storm Duration – The length of time over which a storm event occurs, expressed in units of time.
- o) Design Storm Return Period – The statistically expected occurrence of a given storm event, expressed in years.

3) Design Standards

i) New Development Projects Requiring a NCDEQ Stormwater Permit

(1) Pre Development and Post Development Peak Flow Comparisons for Design Storm Events

- (a) All projects shall be designed so that the post development runoff from the project be no more than ten (10) percent more than the pre development runoff.
- (b) All projects shall meet this requirement for the 10, 25 and 50 year return period events.

{Narrative on this item: Specifying 3 different storm events prevents the rapid discharge of stormwater in the smaller events. If this is not done then it is possible to design the outlet structure and or spillway so that in the smaller events the peak flow from the BMP well exceeds pre-development conditions and causes flooding downstream. For instance, if the Pre development flows for the 10, 25 and 50 year events were 2 cfs, 5 cfs, and 10 cfs respectively and you only specified the 50 year event, it would be permissible to discharge up to the 50 year event flow of 10 cfs during a 10 or 25 year event. The 10 year event is the smallest specified here because water quality permitting usually limits the outfall during smaller events.}

- (c) Peak Flows shall be calculated using the rational method or other industry standard methods for doing so.
 - (d) The time of concentration for defined pre and post development shall be calculated for each storm event using standard methods as set out in TR-55 or other industry standard methodology. These time of concentrations shall be used to determine the duration for each storm event which will yield the intensity used to calculate peak flows for each individual event.
 - (e) All rainfall data for rainfall depth and intensity shall be determined by the National Oceanic and Atmospheric Administration (NOAA) for the specific project location.
 - (f) For NCDEQ determined low density projects or projects that do not require detention of stormwater, the sum of all outfalls shall be used to determine the post development peak flow.
 - (g) For projects with detention structures, the post development flow will be calculated using industry standard methods to route storm events through the detention device to illustrate the compliance with the pre and post development requirements. These calculations shall provide outlet structure details along with the retention basin geometry and peak stage calculations for each storm event.
 - (h) All NCDEQ stormwater requirements shall apply.
- ##### (2) On-Site Collection System Requirements
- (a) All stormwater collection and conveyance systems shall convey the runoff from the 10 year storm event.
 - (b) Road drainage design shall meet the standards set out in the NCDOT Subdivision Manual (latest edition) and the North Carolina Division of Highways Guidelines for Drainage Studies and Hydraulic Design.

- (c) All other project areas including parking lots and green spaces shall be designed to limit ponding of water during the 10 year event.
 - (3) Low Impact Development (LID) as determined by the NCDEQ, shall be encouraged to reduce peak flows. LID devices shall be designed according to NCDEQ requirements using industry standard methodology.
 - (4) Off-Site Runoff
 - (a) Runoff that is tributary to the project area but is not generated on the project may be bypassed around the collection, conveyance and treatment systems and discharged. Off-site runoff that is not bypassed must be accounted for in the calculations for conveyance systems, retention systems and pre and post development calculations.
 - (b) Conveyances for off-site runoff shall be designed for the 10 year event.
 - (5) Plan Submittal Requirements
 - (a) All details of the stormwater collection, retention and discharge systems shall be included on the plans including pipe sizes, locations of all structures and devices, all proposed inverts and grades and any other typical details required to construct the system. Calculations and specifications are not required to be submitted.
 - (b) The plans shall include a statement that the proposed system meets the criteria of this ordinance.
 - (c) The plans shall be signed, dated and sealed by a NC licensed design professional in accordance with industry standards for doing so. Plans may be marked preliminary or with other indications that they are for review and permitting.
 - (d) All Plans shall be produced on D – size drawing sheets (24" x 36") at an appropriate and legible scale.
 - (e) Typical industry standards of care shall be used in the design, analysis and preparation of plans in accordance with rules and requirements of the applicable licensing board.
 - (6) Plan Certification Requirements
 - (a) Upon completion of the construction of the stormwater control system in part or in phases a design certification letter shall be submitted to the Pender County Planning Department (PCPD) stating that the system was inspected and installed in accordance with the plans. Any discrepancies from the original design shall be noted. The certification shall include a statement that the system, as installed, meets the requirements of this ordinance.
 - (b) If the system installation differs from the proposed plans a record drawing showing all discrepancies shall be submitted to the PCPD.
- 4) Design Professional Requirements
 - a) All stormwater analysis, design and preparation of plans shall be performed by or under the direct supervision of a NC licensed professional. A NC licensed professional is considered any individual licensed by the State of North Carolina to perform such work as defined by their respective licensing board. The design professional shall date, sign and seal all design documents according to the requirements and standards as set out by their licensing board.
 - b) Typical industry standards of care shall be used in the design, analysis and preparation of plans in accordance with rules and requirements of the applicable licensing board.