

## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:42 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: Proposed Wetlands and Water Resources and Buffers Changes Needed

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**From:** margaret furlong <noreply@forms.email>  
**Sent:** Monday, January 10, 2022 7:11 AM  
**To:** Doug Hudson  
**Subject:** Contact Form: Proposed Wetlands and Water Resources and Buffers Changes Needed

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Name: margaret furlong  
Email: mfurlongdesign@gmail.com  
Phone: 6176868475  
Subject: Proposed Wetlands and Water Resources and Buffers Changes Needed

Message: Good Morning Councilman Hudson,

I am writing to urge you to consider the additions to the ordinance that were recommended in the Cape Gazette by Chris Bacon of the Delaware Center for Inland Bays. It's extremely important that development is handled in a thoughtful way that protects the environment. Developers must be held accountable for their respect for the environment and enforcement of the reforestation and wetlands protection should be specific. Thank you very much.

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JAN 10 2022

SUSSEX COUNTY  
PLANNING & ZONING

SUPPORT EXHIBIT





## Jamie Whitehouse

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**From:** Robin Griffith  
**Sent:** Monday, January 10, 2022 3:06 PM  
**To:** Michael H. Vincent; John Rieley; Cynthia Green; Doug Hudson; Mark Schaeffer  
**Cc:** Jamie Whitehouse  
**Subject:** FW: Buffer ordinance

Forwarding...

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**From:** Karen Beck <k3beck@gmail.com>  
**Sent:** Monday, January 10, 2022 2:58 PM  
**To:** Doug Hudson <doug.hudson@sussexcountyde.gov>; Cynthia Green <cgreen@sussexcountyde.gov>; jlriley@sussexcountyde.gov; mschaeffer@sussexcountyde.gov; Michael H. Vincent <mvincent@sussexcountyde.gov>; Robin Griffith <rgriffith@sussexcountyde.gov>  
**Subject:** Buffer ordinance

As a resident of Sussex County, one of the most environmentally fragile areas in the country, I am writing to urge you to follow the advice of the Centers for the Inland Bays in defining the conditions and limits of the buffer ordinance. It is in the best interests of every one of us, and of our children, to use best practices to protect our county. Thank you

Karen Beck  
23601 Elmwood Ave West  
Lewes DE 19958

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SUSSEX COUNTY  
PLANNING & ZONING

Opposition  
Exhibit



10 January 2022

Mr. Michael H. Vincent, President  
Sussex County Council  
2 The Circle, P.O. Box 589  
Georgetown, Delaware 19947

Re: Buffer Ordinance to Amend Chapters 99 and 115

Dear Council President Vincent:

Please enter into the record that I oppose the adoption of the Buffer Ordinance in its current form. While the ordinance purports to achieve protection of wetlands it will fail in this objective and not meet Goal 5.1 because of multiple shortcomings including the following:

1. Buffers that are far too narrow and inadequate. A 15-foot buffer is practically no buffer at all. Table 1 in this ordinance should provide minimum required buffers. If the wetland resource deserves protection because it is larger, a larger buffer should be required. Furthermore no explanation is given as to why or how these buffers were developed. For something this complex a basis and background document and regulatory impact analysis document should accompany the ordinance explaining it to the public. That is a fundamental failure of process here in addition to the inadequate buffers.
2. Overly generous buffer avoidance provisions. At first the efforts at wetlands protection in the ordinance appear laudable until you realize that the averaging provisions and section G resource protection options undermine everything else the ordinance tries to do. The ordinance should not be adopted with this section G in it. We also understand that section G was added after the work group broke up at the start of the pandemic thereby unfairly leaving some members out of the development process.

Thank you for your consideration of these comments. If they require further clarification, please feel free to contact me.

Sincerely,

Richard Craig  
29500 Patrick Henry Circle  
Millsboro, Delaware 19966

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SUSSEX COUNTY  
PLANNING & ZONING

Oppositio  
Exhibit



## Jamie Whitehouse

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**From:** Robin Griffith  
**Sent:** Monday, January 10, 2022 3:27 PM  
**To:** Michael H. Vincent; John Rieley; Cynthia Green; Doug Hudson; Mark Schaeffer  
**Cc:** Todd F. Lawson; Jamie Whitehouse; Tracy Torbert  
**Subject:** FW: Buffer Hearing Testimony for Public Record from Center for the Inland Bays (1/2)  
**Attachments:** CIB MARKUP TO Sussex County - Drainage and Resource Buffer - PZ Recommendations 010622.pdf; CIB Justification for Markups to County Buffer Ordinance to Council 011122.pdf; Recommendations-for-an-Inland-Bays-Watershed-Buffer-System-Final.pdf

Forwarding ...

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**From:** Chris Bason <chrisbason@inlandbays.org>  
**Sent:** Monday, January 10, 2022 3:06 PM  
**To:** Robin Griffith <rgriffith@sussexcountye.gov>; Todd F. Lawson <tlawson@sussexcountye.gov>  
**Subject:** Buffer Hearing Testimony for Public Record from Center for the Inland Bays (1/2)

Hi Robin and Todd,

This is part 1 of 2 part email. Please find attached a number of items to be submitted to the record for the hearing on buffers tomorrow morning:

1. Requested amendments as a marked up version of the proposed ordinance.
2. Justification for the requested amendments.
3. The Center's Recommendations for Water Quality Buffers.

The second email will contain:

4. A pdf copy of the presentation i will deliver in person tomorrow at the hearing.

Because the presentation includes slide animations, I plan on presenting as a powerpoint that I will bring on a thumb drive tomorrow. Thank you for preparing these items for the record and please let me know if there is anything I can do to prepare otherwise.

---  
*Chris Bason*  
Executive Director  
Delaware Center for the Inland Bays



**Get on Board with the Bays!**

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PLANNING & ZONING

Opposition  
Exhibit





1    **AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7,**  
2    **99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-**  
3    **25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE**  
4    **FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS**  
5    **THERE TO.**

6  
7    WHEREAS, Pursuant to the provisions of Title 9, Chapters 68 and 69 of the  
8    Delaware Code, the Sussex County Government has the power and authority to  
9    regulate the use of land and to adopt a Comprehensive Land Use Plan; and

10   WHEREAS, Pursuant to Chapters 99 and 115 of the Code of Sussex County, the  
11   Sussex County Government has undertaken to regulate the use of land; and

12   WHEREAS, the existing Section 115-193 of the Code of Sussex County currently  
13   regulates the use of land adjacent to certain wetlands and water bodies; and

14   WHEREAS, the existing Section 115-193 of the Code of Sussex County is in need  
15   of improvement regarding its interpretation, application and protection of Resources;  
16   and

17   WHEREAS, certain Resources are in need of substantial enhancements to ensure  
18   that Sussex County's drainage network is improved now and maintained in the  
19   future; and

20   WHEREAS, the 2019 Sussex County Comprehensive Plan contemplates the review  
21   and improvement of the protection of wetlands and waterways in Sussex County;  
22   and

23   WHEREAS, Goal 4.3 and Objective 4.3.1 of the Future Land Use Element of the  
24   2019 Sussex County Comprehensive Plan states that Sussex County should  
25   "Consider strategies for preserving environmental areas from development and the  
26   protection of wetlands and waterways", and this Ordinance carries out that  
27   Objective; and

28   WHEREAS, Goal 4.6 and Strategy 4.6.2 of the Future Land Use Element of the 2019  
29   Sussex County Comprehensive Plan states that Sussex County should "Recognize  
30   the Inland Bays, their tributaries and other waterbodies as valuable open space areas  
31   of ecological importance", and this Ordinance carries out that Strategy; and

WHEREAS, Goal 5.1 of the Conservation Element of the 2019 Sussex County Comprehensive Plan states that Sussex County should “Encourage development practices and regulations that support natural resource protection”, and this Ordinance carries out that Goal; and

WHEREAS, Strategy 5.1.2.2 of the Conservation Element of the 2019 Sussex County Comprehensive Plan states that Sussex County should “Review appropriate sections of Sussex County’s zoning and subdivision codes to determine if amendments are needed that will better help protect groundwater, waterways, sensitive habitat areas and other critical natural lands in Sussex County”, and this Ordinance carries out that Strategy; and

WHEREAS, Goal 5.3 of the Conservation Element of the 2019 Sussex County Comprehensive Plan calls for the protection of the natural functions and quality of the County’s surface waters, groundwater, wetlands and floodplains, and as part of that Goal, the Plan includes Strategies 5.3.1.1, 5.3.1.2 and 5.3.1.6, which respectively state that Sussex County should “Consider developing a program for wetlands and waterways protection”, “Identify an appropriate range of wetlands buffer distances based upon location and context”, and “Recognize the Inland Bays, their tributaries and other waterbodies as valuable open space areas of ecological and economic importance”, and this Ordinance carries out these Goals and Strategies; and

WHEREAS, in adopting this Ordinance, it is the intent of Sussex County Council to balance the protection of land equity with the protection of the Resources defined in the Ordinance and their associated functions; and

WHEREAS, in adopting this Ordinance, it is the intent of Sussex County to establish a framework under which future property owners and Owners Associations will maintain the Resources, Resource Buffers, the properties they are on or adjacent to, and the systems that they are a part of in the future and to ensure the ongoing positive conveyance of drainage features; and

WHEREAS, it has been determined that this Ordinance promotes and protects the health, safety, convenience, orderly growth and welfare of the inhabitants of Sussex County.

**NOW, THEREFORE, THE COUNTY OF SUSSEX HEREBY ORDAINS:**



66 **Section 1. The Code of Sussex County, Chapter 99, Article I, §99-5**  
67 **“Definitions,” is hereby amended by inserting the italicized and underlined**  
68 **language alphabetically:**

69  
70 **§99-5 Definitions.**

71 For purposes of this Chapter, certain terms and words are hereby defined:

72  
73 . . .  
74

75 **EPHEMERAL STREAMS**

76 *A feature, excluding laterals draining agricultural fields, that carries only runoff in*  
77 *direct response to precipitation with water flowing only during and shortly after*  
78 *large precipitation events. An Ephemeral Stream may or may not have a well-defined*  
79 *channel, its aquatic bed is always above the water table during a year of normal*  
80 *rainfall, and runoff is its primary source of water. An Ephemeral Stream typically*  
81 *lacks the biological, hydrological, and physical characteristics commonly*  
82 *associated with the continuous or intermittent conveyance of water.*

83  
84 . . .  
85

86 **INTERMITTENT STREAMS**

87 *A well-defined channel, excluding laterals draining agricultural fields, that contains*  
88 *flowing water for only part of the year, typically during winter and spring when the*  
89 *aquatic bed is below the water table, connecting otherwise isolated Non-Tidal*  
90 *Wetlands to downstream Tidal/Perennial Waters/Streams. The flow may be heavily*  
91 *supplemented by runoff. An Intermittent Stream often lacks the biological and*  
92 *hydrological characteristics commonly associated with the continuous conveyance*  
93 *of water.*

94  
95 . . .  
96

97 **MAJOR SUBDIVISION**

*Any subdivision of land creating six or more new Lots [involving a proposed new street or the extension of an existing street].*

...

### MINOR SUBDIVISION

*Any subdivision creating five or less Lots [fronting on an existing street and not involving any new street] and not adversely affecting the development of the remainder of the parcel or adjoining property and not in conflict with any provisions or portion of the County Comprehensive Plan, Official Map, Zoning Ordinance, or this chapter. Only one such subdivision shall be approved per year per parcel. The maximum number of lots created in the minor subdivision process shall not exceed four plus one for each 10 acres of original parcel size.*

...

### NON-TIDAL WETLANDS

*Non-Tidal Wetlands are those wetlands, not classified by this Chapter as Tidal Wetlands, which lie contiguous or abutting to Tidal Waters, Tidal Wetlands, Perennial Streams or those Intermittent Streams providing a surface water connection between adjacent Wetlands and ultimately downstream navigable waters. Non-Tidal Wetlands also include those Wetlands only separated from otherwise contiguous or abutting Wetlands by constructed dikes, barriers, culverts, natural river berms and beach dunes.*

...

### ORDINARY HIGH WATER MARK DELINEATION

*The boundary of Perennial Non-Tidal Rivers or Streams, Intermittent Streams or Ephemeral Streams shall be defined by the Ordinary High Water Mark. Ordinary High Water Mark means the line on a shore or bank established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of*



terrestrial vegetation, the presence of litter and debris, or other similar physical characteristics indicating the frequent presence of flowing water.

...

## **PERENNIAL NON-TIDAL RIVERS AND STREAMS**

A well-defined channel that contains flowing water year-round during a year of normal rainfall with the aquatic bed located below the water table for most of the year and which is not subject to tidal influence. Groundwater is the primary source of water for a Perennial Stream, but it also carries runoff. A Perennial Stream exhibits the typical biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water.

...

## **RESOURCE BUFFER - WETLANDS AND WATERS**

A managed area between residential land uses and Resources that is not subdividable once established, with the exception of a subdivision boundary resulting from an approved phase. Resource Buffers function to:

- Protect the Resources and their associated functions.
- Improve/protect water quality via sediment filtration, reduce impact of nutrient loading on Resources, moderate water temperature, and enhance infiltration and stabilization of channel banks.
- Provide wildlife habitat via nesting, breeding, and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge.
- Enhance and/or maintain the flood plain storage functionality via reduction of flood conveyance velocities as well as dissipation of stormwater discharge energy.

...

## **RESOURCES**

Those Wetlands and waters to be provided with a Resource Buffer due to their importance to Sussex County. These Resources include Tidal Waters, Tidal Wetlands, Non-Tidal Wetlands, Perennial Streams, and those Intermittent Streams providing a surface water connection between Wetlands.

...

## **TAX DITCH**

A Tax Ditch is a drainage channel or conveyance and the corresponding right-of-way established and/or formed in accordance with Title 7, Chapter 41 of the Delaware Code, and approved by a "ditch order" entered by the Superior Court of the State of Delaware and County of Sussex.

...

## **TIDAL WATERS (MEAN HIGH-WATER LINE)**

Those waters occurring below the mean high-water line of any tidal water body, tidal stream, or tidal marsh, which is defined as the average height of all the high-tide water recorded over a nineteen-year period as defined by the National Oceanic and Atmospheric Administration.

...

## **TIDAL WETLANDS**

Areas under the jurisdiction of Title 7, Chapter 66 of the Delaware Code, as regulated and mapped by the Department of Natural Resources and Environmental Control.

...

## **WATER DEPENDENT ACTIVITIES**

Activities that are approved through federal and state permit programs that meet the definition of water dependent activities included in those programs. Water-



*dependent uses are uses that can only be conducted on, in, over, or adjacent to the water; each involves, as an integral part of the use, direct access to and use of the water. Examples include marinas, boat ramps/launches, docks, piers, water intakes, aquatic habitat restoration, and similar uses.*

...

## **WATER RELATED ACTIVITIES**

*Water Related Activities are those considered ancillary to and supporting permitted Water Dependent Activities completed on adjacent uplands. Examples include utility connections, limited points of access, loading/unloading areas, and similar uses.*

...

## **WETLANDS**

*Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Agricultural land consisting of "Prior Converted Croplands" as defined by the National Food Security Act Manual (August 1988), are not wetlands. The procedure for delineating the boundary of all wetlands, except for Tidal Wetlands as defined by this ordinance, shall be the methodology provided in the Corps of Engineers Wetland Delineation Manual (January 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (November 2010).*

**Section 2. The Code of Sussex County, Chapter 99, Article I, §99-6 "General Requirements and Restrictions", is hereby amended by deleting the language in brackets and inserting the italicized and underlined language in existing subsection J. and as a new subsection K. thereof as follows:**

### **§99-6 General Requirements and Restrictions.**

...

J. A forested and/or landscape buffer, as defined in § 99-5, Subsections A through J must be depicted on the preliminary and final plot plans for each major subdivision of lands [into four or more lots] and must be established in accordance with all the requirements of the definition of "forested and/or landscaped buffer strip," Subsections A through J in § 99-5.

...

*K. Resources and Resource Buffers, as defined in § 99-5 must be depicted on the preliminary and final plot plans for each major subdivision of lands and must comply with the requirements of §115-193.*

**Section 3. The Code of Sussex County, Chapter 99, Article II, §99-7 "Preliminary Conference", is hereby amended by deleting the language in brackets in subsection C. thereof as follows:**

**§99-7 Preliminary Conference.**

...

C. If the Director determines that the proposed subdivision represents a minor subdivision of a parcel, existing as of the effective date of this amended provision, on a street other than a major arterial roadway, and if the Director determines that review by the Commission is not necessary or desirable, he may waive the requirement of preparing a preliminary plat and may authorize the preparation of a record plat for purposes of recordation. He may, however, request review assistance from other concerned agencies prior to authorizing preparation of the plat. Lots in any minor subdivision plat approved by the Director, without review by the Commission, shall have a minimum area of 3/4 of an acre and a minimum width of 150 feet and shall utilize entrances as approved by the Delaware Department of Transportation. [Such a minor subdivision shall be limited to four lots per parcel, as well as one additional lot for each 10 acres of parcel size, with a maximum of four subdivided lots approved for recordation per calendar year.]



Section 4. The Code of Sussex County, Chapter 99, Article IV, §99-23 “Information to Be Shown”, is hereby amended by inserting the italicized and underlined language as a new subsection T. thereof:

**§99-23 Information to Be Shown.**

The preliminary plat shall be drawn in a clear and legible manner and shall show the following information”

...

*T. The location of all Water and Wetland Resources and their Resource Buffers.*

*(1)The boundary and type of any Non-Tidal/Tidal Wetland or water resources (Tidal, Perennial, Intermittent) which require a Resource Buffer. The boundary will be shown per methods identified in the definitions of Wetlands and Ordinary High Water Line Delineation.*

*(2)All existing (i.e., at the time of application) natural forest, managed forest and non-forest meadow within the future Resource Buffer shall be identified.*

*(3) The area limits of the required Resource Buffers.*

*(4)Calculations supporting Resource Buffer width averaging (§115-193B).*

*(5)Calculations supporting Resource Buffer enhancement calculations and corresponding Forested and/or Landscaped Buffer reductions, if applicable (§115-193F).*

*(6)Proposed access easement layout for access to Resource Buffers and the adjacent Resources with a note that such access easements are “public access easements for maintenance purposes”. For purposes of this requirement, “public” shall mean, and be limited to, those parties requiring access for maintenance purposes.*

*(7)A reference by title, author and date, to the “Drainage Assessment Report” required by Section 115-193.F.2.*

*(8)Any walking trails, including the method of construction and the materials used to establish the trails.*

**Section 5. The Code of Sussex County, Chapter 99, Article IV, §99-24 “Supporting Statements”, is hereby amended by inserting the italicized and underlined language as a new subsection G thereof:**

**§99-24 Supporting Statements**

The preliminary plat shall be accompanied by the following written and signed statements in support of the subdivision's application for tentative approval:

...

*G. A Resource and Resource Buffer Management Plan that describes measures for managing the Resource and Resource Buffer(s) required pursuant to Chapter 115, Article XXV, Section 115-193 on the site. The Resource and Resource Buffer Management Plan shall be included as part of the recorded declaration for the subdivision.*

**Section 6. The Code of Sussex County, Chapter 99, Article V, §99-26, “Information to Be Shown”, is hereby amended by inserting the italicized and underlined language as a new subsection A.(21) and C thereof:**

**§99-26 Information to Be Shown.**

A. The final plat shall be legibly and accurately drawn and show the following information:

...

*(21)The location of all Resource Buffers.*

*(a) The boundary and type of any Non-Tidal/Tidal Wetland or water resources (Tidal, Perennial, Intermittent) which require a Resource Buffer. The boundary will be shown per methods identified in the definitions of Wetlands and Ordinary High Water Line Delineation.*

*(b) All existing (i.e., at the time of application) native forest **and areas to be reforested** ~~non-forest meadow~~ within the future Resource Buffer shall be identified.*

*(d) The area limits of the required Resource Buffer.*

*(e) Calculations supporting Resource Buffer width averaging (§115-193B).*



(f) Calculations supporting Resource Buffer enhancement calculations and corresponding Forested and/or Landscaped Buffer reductions, if applicable (§155-193F).

(g) Proposed access easement layout for access to Resource Buffers and the adjacent Resources with a note that such access easements are “public access easements for maintenance purposes”. For purposes of this requirement, “public” shall mean, and be limited to, those parties requiring access for maintenance purposes.

(h) A statement incorporating the Resource and Resource Management and Maintenance Plan by reference.

(i) A reference by title, author and date, to the “Drainage Assessment Report” required by Section 115-193.F.2.

(22)Any walking trails, including method of construction and the materials used to establish the trails.

...

C. An AutoCAD drawing file containing all items required in Section A above shall be submitted in electronic format. The data shall be referenced in NAD 1983 StatePlane Delaware FIPS 0700 (U.S. Feet) Projected Coordinate System.

**Section 7. The Code of Sussex County, Chapter 99, Article VI, §99-30, “Plans”, is hereby amended by inserting the italicized and underlined language as a new subsection J. and K. thereof:**

**§99-30 Plans.**

Plans, profiles and specifications for the required improvements shall be prepared by the subdivider and submitted for approval by the appropriate public authorities prior to construction. No construction shall commence prior to the issuance of a notice to proceed by the County Engineer or his or her designee for the required improvements. All plans, profiles and specifications approved by the County Engineer or his or her designee with the issuance of a notice to proceed shall remain valid or, if substantial construction is not actively and continuously underway, they shall expire upon the expiration of the final site plan. Prior to the issuance of a notice to proceed, the County Engineer may require the owner and/or his designee to

execute an agreement addressing the required improvements. The plans and profiles submitted for all new construction shall include the following:

...

J. Resources and Resource Buffers.

K. Proposed access easement layout with a note that such access easements are “public access easements for maintenance purposes”. For purposes of this requirement, “public” shall mean, and be limited to, those parties requiring access for maintenance purposes.

**Section 8. The Code of Sussex County, Chapter 115, Article I, §115-4 “Definitions and Word Usage,” is hereby amended by inserting the italicized and underlined language alphabetically in Subsection B thereof:**

**§115-4 Definitions and Word Usage.**

....

B. General definitions. For the purpose of this chapter, certain terms and words are hereby defined as follows:

....

#### **EPHEMERAL STREAMS**

A feature, excluding laterals draining agricultural fields, that carries only runoff in direct response to precipitation with water flowing only during and shortly after large precipitation events. An Ephemeral Stream may or may not have a well-defined channel, its aquatic bed is always above the water table during a year of normal rainfall, and runoff is its primary source of water. An Ephemeral Stream typically lacks the biological, hydrological, and physical characteristics commonly associated with the continuous or intermittent conveyance of water.

...



## INTERMITTENT STREAMS

A well-defined channel, excluding laterals draining agricultural fields, that contains flowing water for only part of the year, typically during winter and spring when the aquatic bed is below the water table, connecting otherwise isolated Non-tidal Wetlands to downstream Tidal/Perennial Waters/Streams. The flow may be heavily supplemented by runoff. An Intermittent Stream often lacks the biological and hydrological characteristics commonly associated with the continuous conveyance of water.

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## NON-TIDAL WETLANDS

Non-Tidal Wetlands are those Wetlands, not classified by this Chapter as Tidal Wetlands, which lie contiguous or abutting to Tidal Waters, Tidal Wetlands, Perennial Streams or those Intermittent Streams providing a surface water connection between adjacent Wetlands and ultimately downstream navigable waters. Non-Tidal Wetlands also include those Wetlands only separated from otherwise contiguous or abutting Wetlands by constructed dikes, barriers, culverts, natural river berms and beach dunes.

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## ORDINARY HIGH WATER MARK DELINEATION

The boundary of Perennial Non-Tidal Rivers or Streams, Intermittent Streams or Ephemeral Streams shall be defined by the Ordinary High Water Mark. Ordinary High Water Mark means the line on a shore or bank established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other similar physical characteristics indicating the frequent presence of flowing water.

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## PERENNIAL NON-TIDAL RIVERS AND STREAMS

A well-defined channel that contains flowing water year-round during a year of normal rainfall with the aquatic bed located below the water table for most of the year and which is not subject to tidal influence. Groundwater is the primary source of water for a perennial stream, but it also carries runoff. A Perennial Stream exhibits the typical biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water.

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## **RESOURCE BUFFER - WETLANDS AND WATERS**

A managed area between residential land uses and Resources that is not subdividable once established, with the exception of a subdivision boundary resulting from an approved phase. Resource Buffers function to:

- Protect the Resources and their associated functions.
- Improve/protect water quality via sediment filtration, reduce impact of nutrient loading on Resources, moderate water temperature, and enhance infiltration and stabilization of channel banks.
- Provide wildlife habitat via nesting, breeding, and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge.
- Enhance and/or maintain the flood plain storage functionality via reduction of flood conveyance velocities as well as dissipation of stormwater discharge energy.

...

## **RESOURCES**

Those wetlands and waters to be provided with a Resource Buffer due to their importance to Sussex County. These Resources include Tidal Waters, Tidal Wetlands, Non-Tidal Wetlands, Perennial Streams, and those Intermittent Streams providing a surface water connection between Wetlands.

...



**TAX DITCH**

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...

**TIDAL WATERS (MEAN HIGH-WATER LINE)**

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...

**TIDAL WETLANDS**

Areas under the jurisdiction of Title 7, Chapter 66 of the Delaware Code, as regulated and mapped by the Department of Natural Resources and Environmental Control.

...

**WATER DEPENDENT ACTIVITIES**

Activities that are approved through federal and state permit programs that meet the definition of water dependent activities included in those programs. Water-dependent uses are uses that can only be conducted on, in, over, or adjacent to the water; each involves, as an integral part of the use, direct access to and use of the water. Examples include marinas, boat ramps/launches, docks, piers, water intakes, aquatic habitat restoration, and similar uses.

...

**WATER RELATED ACTIVITIES**

Water Related Activities are those considered ancillary to and supporting permitted Water Dependent Activities completed on adjacent uplands. Examples include utility connections, limited points of access, loading/unloading areas, and similar uses.

...

### **WETLANDS**

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Agricultural land consisting of "Prior Converted Croplands" as defined by the National Food Security Act Manual (August 1988), are not wetlands. The procedure for delineating the boundary of all wetlands, except for Tidal Wetlands as defined by this ordinance, shall be the methodology provided in the Corps of Engineers Wetland Delineation Manual (January 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (November 2010).

**Section 9. The Code of Sussex County, Chapter 115, Article IV, §115-25 "Height, Area and Bulk Requirements," is hereby amended by deleting the language in brackets and inserting the italicized and underlined language in Subsection F(3)(a)[4] thereof:**

### **§115-25 Height, Area and Bulk**

#### **F. Review procedures for cluster development**

...

(3) The Planning & Zoning Commission shall determine that the following requirements are met before approving any preliminary plan and such application shall be reviewed on an expedited basis.

(a) The cluster development sketch plan and the preliminary plan of the cluster subdivision provides for a total environment and design which are superior, [and] in the reasonable judgment of the Planning Commission, to that which would be allowed under the regulations for the standard option. For the purposes of this subsection a proposed



cluster subdivision which provides for a total environment and design which are superior to that allowed under the standard option subdivision is one which, in the reasonable judgment of the Planning Commission meets all of the following criteria:

...

[4] [A minimum of 25 feet of permanent setback must be maintained around the outer boundaries of all wetlands, except for tidal waters, tidal tributary streams and tidal wetlands and from the ordinary high water line of perennial nontidal rivers and nontidal streams as provided for in §115-193B under Ordinance No. 774 where a fifty-foot permanent setback is required. No buildings or paving shall be placed within these setbacks.] *The preliminary plan shall comply with the requirements of §115-193.*

**Section 10. The Code of Sussex County, Chapter 115, Article XXV, §115-193 “Buffer Zones for Wetlands and Tidal and Nonperennial Waters,” is hereby amended by amending the Title thereof to state “Resource Protection” and deleting the language in brackets and inserting the italicized and underlined language:**

**§115-193 [Buffer Zones for Wetlands and Tidal and Nonperennial Waters] Resource Protection**

[A.

Definitions. As used in this section, the following terms shall have the meanings indicated:

**BUFFER ZONE**

An existing naturally vegetated area or an area purposely established in vegetation which shall not be cultivated in order to protect aquatic, wetlands, shoreline and upland environments from man-made encroachment and disturbances. The "buffer zone" shall be maintained in natural vegetation, but may include planted vegetation where necessary to protect, stabilize or enhance the area.

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571 MEAN HIGH-WATER LINE OF TIDAL WATER

572 The average height of all the high-tide water recorded over a nineteen-year  
573 period as defined by the National Oceanic and Atmospheric Administration  
574 tidal datum.

575 PERENNIAL NONTIDAL RIVERS AND STREAMS

576 Any body of water which continuously flows during a year and which is not  
577 subject to tidal influence.

578 TIDAL TRIBUTARY STREAM

579 A stream under tidal influence, either connecting fresh or salt water.

580 TIDAL WETLANDS

581 Areas under the jurisdiction of Title 7, Chapter 66, of the Delaware Code, as  
582 the chapter appears as of the date of the adoption of this Article, as regulated  
583 and mapped by the Department of Natural Resources and Environmental  
584 Control.

585 WETLANDS

586 A private or state wetland as defined by the Delaware Department of Natural  
587 Resources and Environmental Control regulations and maps as promulgated  
588 pursuant to Chapter 66, Title 7, of the Delaware Code, as the chapter appears  
589 upon the date of the adoption of this Article.

590 B. A fifty-foot buffer zone is hereby established landward from the mean high  
591 water line of tidal waters, tidal tributary streams and tidal wetlands and from the  
592 ordinary high water line of perennial nontidal rivers and nontidal streams in Sussex  
593 County.

594 C. Excluded from buffer zone designation are farm ponds, tax ditches and other  
595 man-made bodies of water where these waters are not located on or within perennial  
596 streams. A buffer zone shall not be required for agricultural drainage ditches if the  
597 adjacent agricultural land is the subject of a conservation farm plan established with  
598 the Sussex Conservation District.

599 D. Excluded from buffer zone regulations are facilities necessarily associated  
600 with water-dependent facilities (maritime, recreational, educational or fisheries  
601 activities that cannot exist outside of the buffer by reason of the intrinsic nature of  
602 their operation) and the installation, repair or maintenance of any stormwater



management facility, sanitary sewer system, culvert, bridge, public utility, street, drainage facility, pond, recreational amenity, pier, bulkhead, boat ramp, waterway improvement project or erosion-stabilization project that has received the joint approval of the County Engineering Department and the appropriate federal, state and local agencies. An existing public storm-drain system may be extended in order to complete an unenclosed gap or correct a drainage problem, subject to receiving the approval of the County Engineering Department and the appropriate federal, state and local agencies.

E. Grandfathering provision. The following types of land uses may be developed notwithstanding the provisions of this section:

(1) Existing improvements and construction as of the date of the approval of this section may continue. Alterations or expansions which shall be attached to a preexisting structure built on nonconforming land, pursuant to this section, will not be permitted unless proven that such improvement is constructed at an equal distance or landward of the preexisting structure which is most proximate to the wetland area and a variance is granted as provided below.

(2) Subdivision plats and site plans approved and of record in the office of the Director of Planning and Zoning or in the office of the Recorder of Deeds in and for Sussex County prior to the adoption of this section, originally adopted July 19, 1988, or approved and similarly of record as of the effective date of this amendment, adopted July 2, 1991, may be developed as of record and shall be subject to setbacks or buffer restrictions established for the use when originally approved. Any previously approved and similarly recorded subdivision plats and site plans, if approved prior to the original date of this section on July 19, 1988, or prior to this amendment, adopted July 2, 1991, may be amended if it is determined by the Planning and Zoning Commission that the amended plan represents an equal or less intrusive use on the buffer area or setback area.

F. Variances to the provisions of this section will be considered by the Board of Adjustment under the following conditions:

(1) That findings are made by the Board of Adjustment which demonstrate that special conditions or circumstances exist that are peculiar to the land or structure within the county and that a literal enforcement of provisions within the buffer zone as designated by this section would result in unwarranted hardship.

(2) That the variance request is not based upon conditions or circumstances which are the result of actions by the applicant, nor does the request arise from any condition relating to land or building use, either permitted or nonconforming, on any neighboring property.

(3) That the granting of a variance will not adversely affect water quality or adversely impact fish, wildlife or plant habitat within the designated buffer zones and in waters adjacent to buffer zones. Variances will be in harmony with the general spirit and intent of the section and any subsequent regulations.

(4) That applications for a variance will be made, in writing, to the Board of Adjustment, with a copy to the County Administrator.

(3) Any land upon which development has progressed to the point of pouring of a foundation or the installation of structural improvements as of the date of the approval of this section shall be permitted to be developed, provided that there shall be no further encroachment upon the buffer zone, as required in Subsection E(1) above.]

*A. Resource Buffer Widths.*

*1. Resource Buffer Widths shall be established in accordance with Table 1, with Zone A being closest to the Resource.*

*2. Resource Buffers are not required landward/adjacent to those portions of Resources to be filled or developed with a valid U. S. Army Corps of Engineers or Delaware Department of Natural Resources and Environmental Control permit.*

*3. No Resource Buffer shall overlay a Tax Ditch or Tax Ditch Right of Way. If a proposed development contains a Tax Ditch, with a right-of-way of less than the total Resource Buffer Width, then that area of the Resource Buffer outside of the right-of-way shall be designated as Zone B.*



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| <u><b>Table 1: Resource Buffer Widths</b></u>                           |   |                           |                           |
|---|---|---------------------------|---------------------------|
| <u><b>Resource Type</b></u><br><u><b>(See Definitions, §115-4B)</b></u> | <u><b>Full Buffer</b></u><br><u><b>Width (ft)</b></u> | <u><b>Zone A (ft)</b></u> | <u><b>Zone B (ft)</b></u> |
| <u><i>Tidal Waters</i></u>  | <u><i>100</i></u>                                     | <u><i>50</i></u>          | <u><i>50</i></u>          |
| <u><i>Tidal Wetlands</i></u>  | <u><i>100</i></u>                                     | <u><i>50</i></u>          | <u><i>50</i></u>          |
| <u><i>Perennial Non-tidal Rivers and Streams</i></u>                    | <u><i>50</i></u>                                      | <u><i>25</i></u>          | <u><i>25</i></u>          |
| <u><i>Non-tidal Wetlands</i></u>  | <u><i>30</i></u>                                      | <u><i>15</i></u>          | <u><i>15</i></u>          |
| <u><i>Intermittent Streams</i></u>                                      | <u><i>30</i></u>                                      | <u><i>15</i></u>          | <u><i>15</i></u>          |
| <u><i>Ephemeral Streams</i></u>   | <u><i>0</i></u>                                       | <u><i>0</i></u>           | <u><i>0</i></u>           |

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674 *B. Resource Buffer Width Averaging.*

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676 1. Resource Buffer width averaging may be utilized to adjust the required  
 677 Zone B Resource Buffer width thereby allowing flexibility for the  
 678 proposed development, so long as the overall square footage of the  
 679 Zone B Resource Buffer is maintained.

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681 2. Criteria for utilizing Resource Buffer width averaging:

682 (a) Resource Buffer width averaging is not available for Zone A.

683 (b) The overall square footage of Zone B Resource Buffer must be  
 684 achieved within the boundaries of the proposed development ~~unless a~~  
 685 Resource Buffer Option permitted under subsection G is utilized.

686 (c) Resource Buffer width averaging may be used on all of the Zone  
 687 B Resource Buffers within the boundaries of the proposed development.

(d) Zone B Resource Buffer averaging shall not be expanded more than double the width of Zone B Resource Buffer as referenced in Section 115-193A.

(e) The overall square footage of Zone B Resource Buffer must be calculated based upon the entire length of the Resource borderline that is located within the boundaries of the proposed development.

**(f) Resource buffer width averaging of buffers on tidal wetlands and/or waters shall be limited to buffers of tidal wetlands and/or tidal waters within the boundaries of the proposed development and not extend to buffers of other feature types.**

### C. Permitted Activities.

Activities in Zone A and B shall be “Permitted” or “Not Permitted” as set forth in the following Table. Uses not specifically identified shall be prohibited, unless the contrary is clear from the context of the Table, as determined by the Commission.

| <b><u>Table 2: Resource Buffer Activities by Zone</u></b>   |                      |                      |
|---|----------------------|----------------------|
| <b><u>ACTIVITY</u></b>  | <b><u>ZONE A</u></b> | <b><u>ZONE B</u></b> |
| <u>1. Impacts to resource buffers resulting from State and/or Federally permitted disturbances to Resources (wetlands/waters) such as maintenance of Resources and Resource Buffers, utilities, roads, bridges, docks, piers, boat ramps, bulkheads, shoreline stabilization, and resources authorized to be filled or disturbed for development.</u> | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>2. Water-related facilities and ancillary uses required to support water-dependent projects approved by a federal or state permit, including but not limited to: marinas, wharfs, community docking facilities, boat ramps, and canoe/kayak launches.</u>  | <u>PERMITTED</u>     | <u>PERMITTED</u>     |

|   |                  |                  |
|---|------------------|------------------|
| <u>3. Repair or maintenance of existing infrastructure or utilities, including roads, bridges, culverts, water lines, and sanitary sewer lines.</u> | <i>PERMITTED</i> | <i>PERMITTED</i> |
| <u>4. Temporary impacts resulting from installation of utilities by trenching</u>   | <i>PERMITTED</i> | <i>PERMITTED</i> |



| <b><u>Table 2: Resource Buffer Activities by Zone</u></b>  |                      |                      |
|--|----------------------|----------------------|
| <b><i>ACTIVITY</i></b>   | <b><i>ZONE A</i></b> | <b><i>ZONE B</i></b> |
| <u>methods which are part of State or Federally approved utility installation projects or the installation of utilities by directional boring methods.</u>   |                      |                      |
| <u>5. Stormwater Management conveyances as approved by the Sussex Conservation District.</u>   | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>6. Tax Ditch Maintenance as approved by DNREC Drainage Program.</u>   | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>7. Maintenance or repair of drainage conveyances not within a Tax Ditch Right of Way as approved by the Sussex County Engineering Department or Sussex Conservation District.</u>                               | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>8. Structural crossings of Resources such as bridges or boardwalks which may not require a State or Federal permit.</u>   | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>9. Maintenance or modification to previously existing structures and improvements within existing footprint.</u>  | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>10. State or Federally approved wetland restoration, creation, and enhancement projects.</u>  | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>11. State or Federally approved flood plain restoration, or Resource restoration projects involving the maintenance, repair, restoration, creation, or enhancement of Resources and their Resource Buffers.</u> | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>12. Soil Erosion and Sediment Control measures as approved by Sussex Conservation District.</u>   | <u>PERMITTED</u>     | <u>PERMITTED</u>     |
| <u>13. Forest Management Activities conducted under the guidance and direction of a Licensed Forester.</u>   | <u>PERMITTED</u>     | <u>PERMITTED</u>     |

| <u><b>Table 2: Resource Buffer Activities by Zone</b></u>  |  |                      |
|--|--|----------------------|
| <b>ACTIVITY</b>  | <b>ZONE A</b>  | <b>ZONE B</b>        |
| <u>Arborist, Landscape Architect, or Qualified Resource Buffer Professional.</u>   |  |                      |
| <u>14. Invasive Species Control (plant, insect, animal) conducted in accordance with State and Federal law.</u>  | <u>PERMITTED</u>   | <u>PERMITTED</u>     |
| <u>15. Planting/establishment of non-invasive native species (as listed by DNREC).</u>   | <u>PERMITTED</u>   | <u>PERMITTED</u>     |
| <u>16. Installation, repair, maintenance, and removal of wells (potable, monitoring, injection as approved by state/federal agencies).</u>                               | <u>PERMITTED</u>   | <u>PERMITTED</u>     |
| <u>17. Walking Trails where any impervious area runoff is managed under a Sussex Conversation District Permit</u>  | <u>PERMITTED</u>   | <u>PERMITTED</u>     |
| <u>18. Extended Detention dry and wet stormwater management ponds.</u>   | <u>NOT PERMITTED</u>   | <b>NOT PERMITTED</b> |
| <u>19. Removal of any dead, dying, damaged, or unstable live tree from a Resource or Resource Buffer which presents an imminent danger to property or public safety.</u> | <u>PERMITTED</u>   | <u>PERMITTED</u>     |
| <u>20. Stormwater Management Water Quality BMPs as approved by the Sussex Conservation District.</u>   | <u>PERMITTED</u><br>(Limited to 10% of Total square footage of Zone A in a proposed development) | <u>PERMITTED</u>     |
| <u>21. Sewage disposal facilities.</u>   | <u>NOT PERMITTED</u>   | <u>NOT PERMITTED</u> |
| <u>22. Storage of hazardous materials and siting of industrial sites, landfills, or junkyards.</u>   | <u>NOT PERMITTED</u>   | <u>NOT PERMITTED</u> |



**Table 2: Resource Buffer Activities by Zone**

| <b>ACTIVITY</b>  | <b>ZONE A</b>        | <b>ZONE B</b>        |
|--|----------------------|----------------------|
| <b><u>23. Swimming pools, community clubhouses, and all Non-Water-Dependent or Non-Water Related improvements not specifically permitted under this section.</u></b> | <b>NOT PERMITTED</b> | <b>NOT PERMITTED</b> |

**D. Resource Buffer Standards.**

1. All existing (i.e., at the time of application) conditions, including the vegetative land features, and the proposed conditions within the proposed Resource Buffer shall be identified on the Preliminary Site Plan.
2. If a proposed development contains a Resource, then the associated Resource Buffer shall conform with the following criteria based on vegetative features existing at the time of Preliminary Site plan Submission:

(a) Established native forests and non-forest meadows including all existing trees and understory constituting a Resource Buffer shall be preserved and maintained in their natural state. "Selective Cutting" (Subsection E) activities may be implemented. Invasive species are encouraged be removed from the Resource Buffer.

(i) Forest: Subject to §115-193C, all existing trees and understory constituting a proposed Resource Buffer shall be preserved and maintained in their natural state. "Selective Cutting" (Subsection E) activities may be implemented. Invasive species may be removed from the Resource Buffer.

(ii) Non forest Meadow: Subject to §115-193C, all existing meadows constituting a proposed non forested Resource Buffer that are composed of herbaceous and shrub species shall be preserved and maintained in their natural state. Non forest meadow may also include old field areas with a mixture of herbaceous vegetation, shrubs and trees transitioning to



- ecession. Invasive species may be removed from the Resource Buffer.*
- (b) *Grazed pasture, meadows, fallow fields, managed turf, active cropland or areas of bare earth not stabilized with vegetative cover shall be re-established as native forest or non-forest meadow prior to determination of substantial completion of the proposed development phase where that "unstabilized" area is located by planning and planting of a diverse mixture of trees and shrubs native to Delaware and by controlling invasive species. non invasive species or through the process of natural succession augmented with invasive species control.*
- (i) **A reforestation plan including species, planting rates, planting schedule, planting survival standards, and maintenance actions during reestablishment shall be designed by a Licensed Forester, ISA Certified Arborist, Registered Landscape Architect, or Qualified Resource Buffer Professional and included in the Resource and Resource Buffer Management Plan under Section H.**
- (ii) **Mulch or native ground cover must cover the area until buffer plantings are established.**
- (iii) **Plantings must include canopy trees, understory trees, and shrubs and be distributed throughout the buffer to optimize buffer function under §99-5**
- (iv) **A diversity of Delaware native species of no less than 5 species of trees and 2 species of shrubs normally found in and adapted to the conditions in the buffer must be planted.**
- (v) **Flexibility of tree stock is allowed based on the following survival standards over a period of 2 years:**
- | Stock Size<br>(Trees Only)            | Number per Acre | Required Survival Rate |
|---------------------------------------|-----------------|------------------------|
| Bare-root seedling or whip            | 700             | 50%<br>350 per acre    |
| ½" to 1" Container grown trees        | 450             | 75%<br>338 per acre    |
| More than 1-inch container grown tree | 350             | 80%<br>280 per acre    |
- (vi) **Natural regeneration of native forest is permitted in place of planting within 25 feet of a mature forest that contains a seed bank of native species adequate for natural regeneration. The reforestation plan**

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an to be implemented if, at the end of 5 years, the areal coverage of the Buffer does not contain, on a per-acre basis, at least 300 native woody stems at least 4 feet in height.

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(c) *Grazed pasture, managed turf, active cropland or areas of bare earth not stabilized with vegetative cover shall be re-established as native forest or*

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E. Removal of Invasive Species.

1. Invasive species control shall be completed under the guidance and approval of a Licensed Forester, ISA Certified Arborist, Registered Landscape Architect, or Qualified Resource Buffer Professional.

F. Maintenance of Drainage Conveyances

1. All Resource Buffers identified on a Final Site Plan shall be designated as a drainage and access easement permitting access by any future owners' association, federal, state or local agency and the public, for the limited purpose of maintenance or monitoring of drainage capacity or conveyance by any future owners' association; federal state or local agency; and the public. In addition, a corresponding easement for access into each individual Resource Buffer established on the site shall, whenever possible, be provided from a public road or street within a proposed development.

2. If a Resource Buffer abuts or contains features such as ephemeral, intermittent or perennial streams which are not part of an established Tax Ditch and which convey drainage from or through a site proposed for development, a "Drainage Assessment Report" shall be prepared by a registered Delaware Professional Engineer. As part of the pre-application process, Sussex County will determine the information to be included in the Drainage Assessment Report. At a minimum, the Drainage Assessment Report shall identify the following concerning measures needed for drainage conveyances:

(a) Identification of any unstable or eroding stream banks or conveyance requiring stabilization or restoration measures.

(a) The location of any stream blockages such as debris jams, ~~fallen or unstable trees~~, beaver dams or similar impediments to conveyance that pose a credible and impending threat of flooding to nearby landuses or property.



(c) The location of any sand or gravel deposition within a channel or conveyance which impedes the flow of water produced by a storm having an annual probability of occurrence of 10%.

(d) A discussion of all recommended measures to remedy any impediment to drainage conveyance or drainage stability.

(e) A summary of required local, state or federal permits required to remedy any impediment to drainage conveyance.

(f) The easement width and a sufficient number of easements to provide adequate access to the Resource for maintenance.

3. Remedies required by Sussex County as a result of the Drainage Assessment Report shall be shown on the Final Site Plan.

#### G. Resource Buffer Options

1. A proposed development shall be permitted to utilize the following options, consistent with §115-193, Section B. Resource Buffer Width Averaging, to incentivize the retention of forests:

(a) When the preservation of a forest within the Resource Buffer that has been in existence for at least five years prior to the date of application as identified by a Licensed Forester, Arborist, Landscape Architect, or Qualified Resource Buffer Professional is achieved, then a corresponding area reduction of either the Resource Buffer Zone B along the entire or part of that Resource; or the Forested and/or Landscaped Buffer required in Chapter 99 in areas adjacent to like-zoned land is permitted.

(b) When the Preservation of a natural forest connected to (but not within) a Resource Buffer in excess of the requirements listed in Section 115-193.A. is achieved by adding the area to Zone B, then a corresponding area reduction of either non Forest Resource Buffer Zone B on the same Resource, or Forested and/or Landscaped Buffer required in Chapter 99 in areas adjacent to like-zoned land is permitted.



~~(c) When the provision of Resource Buffer area in excess of the requirements listed in Section 115 193.A. is achieved, then a corresponding area reduction of the Forested and/or Landscaped Buffer required in Chapter 99 in areas adjacent to like-zoned land is permitted.~~

~~2. A proposed development shall be permitted to utilize the following options to incentivize the retention or expansion of Resource Buffers or provide additional functional benefit of Resource Buffers:~~

~~(a)(i) When the creation of an off site Resource Buffer is protected under a perpetual conservation easement, then a 75 percent corresponding area reduction of the Resource Buffer Zones A and/or B in the same Resource within the development is permitted. The upland line of that new off site Resource Buffer and perpetual conservation easement shall be considered the edge of the Resource for locating a Resource Buffer in the event that the off site land is developed in the future. The perpetual conservation easement shall be for the benefit of a conservation organization approved by Sussex County, and it must be located within the same twelve digit hydrologic unit code as defined by the United States Geological Survey as the proposed development.~~

~~(ii) When the creation of an off site Resource Buffer for forest preservation is protected under a perpetual conservation easement, then a 125 percent corresponding area reduction of the Resource Buffer Zones A and/or B in the same Resource within the development is permitted. The upland line of that new off site Resource Buffer and perpetual conservation easement shall be considered the edge of the Resource for locating a Resource Buffer in the event that the off site land is developed in the future. The perpetual conservation easement shall be for the benefit of a conservation organization approved by Sussex County, and it must be located within the same twelve digit hydrologic unit code as defined by the United States Geological Survey as the proposed development.~~

~~(b) Funding, partially or entirely, an off site restoration project under the Sussex County Clean Water Enhancement Program, subject to approval of the Sussex Conservation District, with completion of the restoration~~



by Sussex County prior to final acceptance of the first phase of the proposed development by the Sussex County Engineering Department in the same twelve digit hydrologic unit code as defined by the United States Geological Survey as the proposed development with a corresponding Resource Buffer Zone A and/or B reduction equal to the Resource Buffer area on that same resource created in the off site project.

(c) (i) When a proposed development has a pre-existing property boundary that is located in the center of an Intermittent or Perennial Stream and the entire Resource (including the off site portion of it) including an off-site Resource Buffer Zone A is protected under a perpetual conservation easement, then a corresponding area reduction of the Resource Buffer Zones B on the same Resource development is permitted. The upland line of that new off site Resource Buffer Zone A and perpetual conservation easement shall be considered the edge of the Resource for locating a Resource Buffer in the event that the off site land is developed in the future. The perpetual conservation easement shall be for the benefit of a conservation organization approved by Sussex County.

(ii) When a proposed development has a pre-existing property boundary that is located in the center of an Intermittent or Perennial Stream and the entire Resource (including the off site portion of it) including an off-site Resource Buffer Zone A in the form of a natural forest is protected under a perpetual conservation easement, then a corresponding 125% area reduction of the Resource Buffer Zones B on the same Resource within the development is permitted. The upland line of that new off site Resource Buffer Zone A and perpetual conservation easement shall be considered the edge of the Resource for locating a Resource Buffer in the event that the off site land is developed in the future. The perpetual conservation easement shall be for the benefit of a conservation organization approved by Sussex County.

3. For purposes of this Subsection G., "Forest" shall mean: A vegetative community dominated by trees and other woody plants covering a land area of 10,000 square feet or greater. Forest includes: (1) areas that have at least 100 trees per acre with at least 50% of those having a two inch or greater



diameter at 4.5 feet above the ground and larger, and (2) forest areas that have been cut but neither stumps were removed nor the land surface regraded.

#### H. Resource and Resource Buffer Maintenance and Management.

##### 1. Resource and Resource Buffer Management Plan

Any proposed development where Resource Buffers are required shall submit a Resource and Resource Buffer Management Plan, prepared by a Qualified Resource Buffer Management Professional, that describes measures for maintaining or improving the Resource and the Resource Buffer(s) on the site. The Resource and Resource Buffer Management Plan shall be proffered as part of the Supporting Statement requirements of §99-24, or at the time of Preliminary Site Plan approval for any residential conditional use. The maintenance standards or management actions associated with the Resource and Resource Buffer Management Plan shall be included as an obligation of the owners' association in the recorded declaration for any new development. The Resource and Resource Buffer Management Plan shall describe how the Resource Buffer will be managed to maintain its functions and cite any measures to be implemented for the enhancement of Resource Buffers or their functions including reforestation plans. It shall also include a narrative discussing the overall plan for access easements sufficient for expected short- and long-term maintenance and management needs.

2. Any Perennial or Intermittent Stream within a proposed development that does not exhibit a positive conveyance (regardless of whether it is part of a Tax Ditch) shall be identified by phase on the Detailed Grading Plan as follows:

(a) If the deficient Perennial or Intermittent Stream has adjacent Non-Tidal Wetlands, the applicant shall restore the conveyance channel to a positive conveyance (i.e. the removal of conveyance impediments) within the entire site prior to the issuance of substantial completion of the final approved phase. This restoration shall be in compliance with all applicable federal, state and county requirements.

(b) If the deficient Perennial or Intermittent Stream has no adjacent Non-Tidal Wetlands, the applicant shall restore the conveyance

channel to a positive conveyance (i.e. the removal of conveyance impediments) within the entire site prior to the issuance of substantial completion of the first approved phase. This restoration shall be in compliance with all applicable federal, state and county requirements.

I. Modifications and Exceptions.

The Planning and Zoning Commission shall be authorized, as part of the site plan review process, to grant preliminary or final site plan approval with modifications of, or exceptions to, the foregoing requirements upon the submission of a detailed and specific written request from the applicant with supporting documentation from a Qualified Wetland Resource Professional or Qualified Resource Buffer Management Professional, but only upon the satisfaction of all of the following conditions:

1. When the Commission finds that special conditions or circumstances exist that are peculiar to the land or structure and that a literal enforcement of a specific requirement of this section would result in unwarranted hardship.

2. That the modification or exception request is not based upon conditions or circumstances which are the result of actions by the applicant, nor does the request arise from any condition relating to land or building use, either permitted or nonconforming, on any neighboring property.

3. That the granting of a modification or exception will not adversely affect the functions of the Resource or its Resource Buffer as set forth in the definition of that term. Waivers shall be in harmony with the general spirit and intent of this section and any subsequent regulations.

4. That the basis for the modification or exception cannot be achieved through Resource Buffer Width Averaging as provided by §115-193B.

5. That in no event shall there be a modification or exception to the width requirements of Zone A.

The date of any modification or exception by the Commission shall be noted on the final site plan.

J. These requirements shall only apply to subdivisions governed by Chapter 99, Residential Planned Communities and uses identified in §115-219A(1) and (2).



950

951 **Section 11. The Code of Sussex County, Chapter 115, Article XXVIII, §115-220**  
 952 **“Preliminary Site Plan Requirements”, is hereby amended by inserting the**  
 953 **italicized and underlined language as a new Subsection B(17) thereof:**

954 **§115-220 Preliminary Site Plan Requirements**

955 . . .

956 B. The preliminary site plan shall show the following:

957 . . .

958 (17) In the case of a proposed development with the uses identified in §115-  
 959 219A(1) and (2) or Residential Planned Communities, the site plan shall include all  
 960 required Resource Buffers and the following:

961 (a) The boundary and type of any Non-Tidal/Tidal Wetland or water resources  
 962 (Tidal, Perennial, Intermittent) which require a Resource Buffer. The boundary will  
 963 be shown per methods identified in the definitions of Wetlands and Ordinary High  
 964 Water Line Delineation.

965 (b) All existing (i.e., at the time of application) natural forest, managed forest and  
 966 non-forest meadow within the future Resource Buffer shall be identified.

967 (c) The limits of the required Resource Buffers.

968 (d) Calculations supporting Resource Buffer width averaging (§115-193B).

969 (e) Calculations supporting Resource Buffer enhancement calculations and  
 970 corresponding Forested and/or Landscaped Buffer reductions, if applicable (§115-  
 971 193F).

972 (f) Proposed access easement layout for access to Resource Buffers and the  
 973 adjacent Resources with a note that such access easements are “public access  
 974 easements for maintenance purposes”. For purposes of this requirement, “public”  
 975 shall mean, and be limited to, those parties requiring access for maintenance  
 976 purposes.

977 (g) A reference by title, author and date, to the “Drainage Assessment Report”  
 978 required by Section 115-193.F.2.



979 (h)Any walking trails, including the method of construction and the materials  
980 used to establish the trails.

981  
982 **Section12. The Code of Sussex County, Chapter 115, Article XXVIII, §115-221**  
983 **“Final Site Plan Requirements”, is hereby amended by inserting the italicized**  
984 **and underlined language as a new Subsections B(19) and E. thereof:**

985 **§115-221 Final Site Plan Requirements**

986 . . .

987 B. The final site plan shall show the following:

988 (19) In the case of a proposed development with the uses identified in §115-  
989 219A(1) and (2) or Residential Planned Communities, the site plan shall include all  
990 required Resources and Resource Buffers including the following, where applicable:

991 (a)The boundary and type of any Non-Tidal/Tidal Wetland or water resources  
992 (Tidal, Perennial, Intermittent) which require a Resource Buffer. The boundary will  
993 be shown per methods identified in the definitions of Wetlands and Ordinary High  
994 Water Line Delineation.

995 (b)All existing (i.e., at the time of application) natural forest, managed forest and  
996 non-forest meadow within the future Resource Buffer shall be identified.

997 (c)The limits of the required Resource Buffers.

998 (d)Calculations supporting Resource Buffer width averaging (§115-193B).

999 (e) Calculations supporting Resource Buffer enhancement calculations and  
1000 corresponding Forested and/or Landscaped Buffer reductions, if applicable (§115-  
1001 193F).

1002 (f) Proposed access easement layout for access to Resource Buffers and the  
1003 adjacent Resources with a note that such access easements are “public access  
1004 easements for maintenance purposes”. For purposes of this requirement, “public”  
1005 shall mean, and be limited to, those parties requiring access for maintenance  
1006 purposes.

1007 (g)A statement incorporating the Resource and Resource Management and  
1008 Maintenance Plan by reference.

1009 (h) A reference by title, author and date, to the "Drainage Assessment Report"  
1010 required by Section 115-193.F.2.

1011 (g) Any walking trails, including the method of construction and the materials  
1012 used to establish the trails.

1013 . . .

1014 E. An AutoCAD drawing file containing all items required in Section A above  
1015 shall be submitted in electronic format. The data shall be referenced in NAD 1983  
1016 StatePlane Delaware FIPS 0700 (U.S. Feet) Projected Coordinate System.

1017

1018 **Section 13. Effective Date.**

1019 This Ordinance shall take effect upon six (6) months from the date of adoption by  
1020 Sussex County Council. Provided however, that it shall not apply to any completed  
1021 applications on file with the Sussex County Office of Planning & Zoning.







TO: Sussex County Council

FROM: Chris Bason, Executive Director, Delaware Center for the Inland Bays

DATE: January 11, 2022

SUBJECT: Markup and Justification for AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7, 99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO.

Please find attached the following requested changes to the above ordinance with justification provided herein on behalf of the Center for the Inland Bays. I am a biologist with over 20 years of local experience in the field of wetlands and estuarine research, management, and restoration and I had the pleasure of serving on the County's Wetlands and Buffers Workgroup. Part of my past professional experience involved assessing the condition of wetlands within Sussex County and I have published multiple times on wetlands in the peer-reviewed scientific literature as well as through the Center's extensive technical publications. I previously provided in person testimony and reports from the Center to the Planning and Zoning Commission on the day of the hearing of this ordinance. The marked up ordinance I am providing was converted to a word document from pdf and thus there are some formatting inconsistencies that I hope you may forgive. While there are markups throughout the document I am presenting my justification in major areas of focus below.

#### Buffer Widths

The buffer widths proposed in this ordinance were developed by the consensus of the Wetlands and Buffer Working Group. However, most of these widths are much less than what is generally recommended in the scientific literature to protect the functions of the resources covered by the ordinance. For example, buffers on small streams are generally recommended to be at least 100 feet<sup>1</sup> to protect the water quality, habitat, and biology of the stream, whereas the buffers of streams proposed in this ordinance are 30 to 50 feet. This means that buffers proposed in this ordinance will continue to allow the degradation of the streams in Sussex County where water quality is already poor and wildlife habitat is rapidly disappearing near the coast (see appendix for supporting information).

The Center's science-based recommendations for buffer widths based upon water quality protection alone are provided in our 2008 report<sup>2</sup>. Buffers designed for all the purposes in this

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<sup>1</sup> Sweeney, Bernard W. and J. Denis Newbold, 2014. Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review. Journal of the American Water Resources Association (JAWRA) 50(3): 560-584. DOI: 10.1111/jawr.12203

<sup>2</sup><https://www.inlandbays.org/wp-content/uploads/2011/01/Recommendations-for-an-Inland-Bays-Watershed-Buffer-System-Final.pdf>

ordinance are often wider than our recommendations particularly when considering the protection of wildlife habitat. This is born out through a comparison of the proposed ordinance to similar ordinances of other nearby jurisdictions (appendix). Should the Commission seek to increase the width of the buffers, we suggest reference to these resources.

#### Resource Buffer Width Averaging

The Center supports buffer width averaging which was a point of consensus reached by the Workgroup. However, we request that averaging for buffers of tidal wetlands and waters and for buffers of freshwater mill ponds be limited to within these resource buffers. In other words, a reduced buffer width on a tidal resource could only be compensated for with a wider buffer on another tidal resource and not on an intermittent stream for example.

This will help prevent potential misuse of this provision to minimize buffer width in the highly-desirable for building yet ecologically-sensitive nearshore areas of tidal wetlands and waters and of freshwater mill ponds. There are multiple examples around the County of what can happen when homes are sited too close to sensitive resources in regards, and I offer one from Ellis Point below. Maintaining adequate widths of buffers on tidal areas is particularly important because tidal waters and wetlands migrate inland, often rapidly, with sea level rise. Rates of migration of tidal wetlands over uplands in the Indian River Bay watershed range from 1.44 to 5.25 feet per year on average depending on the slope of the adjacent upland.

This small change will continue to allow flexibility in site design, while discouraging misuse of the provision, and ensure that minimum protections for one type of resource are not exchanged for additional, but less beneficial, protection of a different resource.



*Homes on Ellis Point located very close to tidal waters.*

#### Resource Buffer Activities By Zone

The Center is supportive of all the Activities which were achieved by the consensus of the Working Group except for Activity 18. Extended Detention dry and wet stormwater management ponds. Stormwater management ponds provide hydrologic retention and some



water quality improvement benefits. However they clearly do not provide the wildlife habitat function that is one of the purposes of the buffer (see below and an example of Love Creek).

*"Provide wildlife habitat via nesting, breeding , and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water 's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge."*



*Dry stormwater detention feature in buffer on Love Creek.*

Removal of a forest to install a stormwater feature in the buffer would be counter to the purpose of the ordinance by resulting in a net reduction in the total desired function of the buffer. And it is unnecessary because stormwater features can be installed elsewhere on a proposed development.

#### Resource Buffer Standards

*Remove the non-forested meadow option and require both maintenance of existing forests and reforestation of non-forested areas.*

In addition to the buffer extent and width, the vegetation required within the buffer is the most important aspect to determine its function. Forested buffers clearly provide superior function than do non-forested buffers through 1) their capacity to sequester nutrients within their above



and below ground biomass, 2) their provision of multi-layered animal habitat, 3) their capacity to control flooding and intercept precipitation within their multiple layers, 4) and their provision of a physical buffer between human activities and sensitive aquatic life. For more supporting information, please to the appendix of these comments on forests (page 14).

The inclusion of non-forested meadows as a vegetation option will not protect existing forests and will result in similar situations seen across the County today where highly functioning buffers are torn down. As written, the proposed ordinance will allow a landowner to completely remove a buffer, seed it with a grass mix and then submit an application for development. As written, there is no requirement to reforest the buffer. In fact, the vegetation within the non-forested meadow does not even have to be native. This runs counter to the intent of a buffer ordinance and in fact would be a step backward in protection from the existing code which states:

*"BUFFER ZONE — An existing naturally vegetated area or an area purposely established in vegetation which shall not be cultivated in order to protect aquatic, wetlands, shoreline and upland environments from man-made encroachment and disturbances. The "buffer zone" shall be maintained in natural vegetation, but may include planted vegetation where necessary to protect, stabilize or enhance the area."*

In Sussex County, forest is the natural vegetation community for nearly all upland areas, and if uplands are left to grow without interference they eventually will undergo natural ecological succession to a forest. Allowing non-forested meadows clarifies any ambiguities of the current code to allow forested buffers to be cut down prior to application and to perpetuate poorly-functioning non-forested buffers. Furthermore, the non-forested meadow section is unclear and seemingly contradictory. For example D.2.a. states that non-forested meadows must be retained but then later D.2.a.ii and D.2.b. state that non-forested meadows be allowed to undergo natural succession or be planted to a forest.

The solution to this is to both require maintenance of existing forested buffers and require the reforestation of buffers using a detailed set of standards where forests do not exist. This makes clear that any forested buffer removed prior to an application will have to be reforested as a part of the development project. This takes away any perceived incentive to remove the buffer prior to application. In fact, it creates a disincentive to removing the forest of the buffer because reforestation is costly and takes additional effort to achieve within required timeframes. This approach is similar to that taken in the County code for forested and landscape buffers (perimeter buffer) and is standard in buffer ordinances of nearby jurisdictions.

### Maintenance of Drainage Conveyances

We request that the report to identify measures needed for drainage conveyances clarify measure "(b) the location of any stream blockages such as debris jams, fallen or unstable trees, beaver dams or similar impediments to conveyance." Debris dams, fallen trees, and beaver dams are naturally occurring and important components of stream ecosystems that provide important contributions to the functions that this ordinance seeks to protect. These features slow the flow of water, create and enhance zones of sediment pollution trapping and nutrient pollution filtration, and provide essential wildlife habitat diversity. These features have long been known as essential components of healthy streams that improve pollution removal and unless they pose a credible and imminent threat to property or safety should be left in place and not be identified as problems.

### Resource Buffer Options

We request that this section be completely removed from the proposed ordinance on the basis that the already narrow widths of the buffers proposed relative to the recommendations in the scientific literature for minimum buffer widths and relative to the greater widths of buffers required by nearby jurisdictions should in no way be reduced. Furthermore, the fact that water quality continues to be poor in Sussex County and the fact that flooding and wildlife habitat loss are increasing dramatically do not support reduction in buffer widths. We believe the opposite should occur and that incentives for increasing widths of buffers be desired, exploration of win-win solutions including the allowance for a few extra lots be considered in exchange.

The options also inexplicably allow reduction of forested and landscape buffers which were established for a different purpose. Very simply this doesn't make any sense. The section continues to raise important questions such as, how can the County demonstrate that the areas protected in exchange for reduced buffers wouldn't already be protected? (This is the tricky concept of additionality which must be clearly demonstrated for such a program of trade offs to be successful.) How does the County demonstrate functional equivalence of one area being protected by conservation easement in another part of the County in exchange for a buffer being destroyed and the associated loss of protection of water resources that are seriously in need of protection?

Finally, this very simply would allow buffers of 25 feet on tidal waters just as a starting point, and this would constitute a significant roll-back in environmental protection from the current ordinance. How does this relate to the Comprehensive Plan or the Inland Bays Comprehensive Conservation and Management Plan? Could you imagine the public outcry?

### Resource and Resource Buffer Maintenance and Management

Under Section G.2., the definition of positive conveyance is not provided and needs to be made clear prior to inclusion. It is completely unclear what the County would be requiring a developer to do to the water resources. We look forward to providing comments once clarity

is provided. In the meantime, it seems like this is an unnecessary part of the code and that in rare situations where a stream is not flowing a condition of approval could be placed on the development.

#### Enforcement

Numerous instances of vegetation removal in buffers of HOAs have occurred over the past few years around the Inland Bays. HOAs are often not equipped or educated to understand and properly manage a buffer. In such situations, the County needs to be able to ensure that buffers are maintained to provide their functions to protect public resources through a program of inspection and enforcement. This is a critical part of ensuring this ordinance is successful. It is requested that the proposed ordinance include a clear statement of the County's authority and responsibility to enforce the maintenance of the buffer including level of penalties and mitigation requirements in the instance when an HOA does not.



## APPENDIX: SUPPLEMENTARY INFORMATION

### Buffer Policy Comparison

| Characteristic                       | Sussex Co.<br>Current | Sussex Co.<br>Proposed | Inland Bays<br>Recommends | Kent Co.        | New Castle Co.                    | State of NJ                      | State of MD<br>Critical Areas. |
|--------------------------------------|-----------------------|------------------------|---------------------------|-----------------|-----------------------------------|----------------------------------|--------------------------------|
| Tidal Wetlands & Waters Width        | 50 ft.                | 100 ft.                | 80 - 500 ft.              | 100 ft.         | 100 ft.                           | 300 ft.                          | 100 - 200 ft.                  |
| Nontidal Wetlands Width              | 0 ft.                 | 30 ft.                 | 50 - 100 ft.              | 25 ft.          | 50 ft.                            | 0 - 150 ft.                      | 25 ft.                         |
| Smaller / Intermittent Streams Width | 0 ft.                 | 30 ft.                 | 35 - 150 ft.              | 50 ft.          | 100 ft.                           | 300 ft.                          | ≥100 ft.                       |
| Larger / Perennial Streams Width     | 0 - 50 ft.*           | 50 ft.                 | 80 - 150 ft.              | 100 ft.         | 100 ft. or 50 ft. from floodplain | 300 ft.                          | ≥100 ft.                       |
| Variable Width Buffer Allowance      | No                    | Yes**                  | No                        | No              | No                                | Yes***                           | No                             |
| Vegetation Type                      | Natural               | Forest or meadow****   | Natural/ Forest           | Natural/ Forest | Natural/ Forest                   | Existing Veg. or Natural/ Forest | Natural/ Forest                |
| Protects Existing Forest             | Yes*                  | Yes and No             | Yes                       | Yes             | Yes                               | Yes                              | Yes                            |
| Replanting of Trees                  | No                    | No                     | Yes                       | Yes             | Yes                               | Yes                              | Yes                            |

*Note: Some variation may exist within a jurisdiction due to overlapping regulations and site considerations. Based upon 2/14/20 version of Sussex County draft ordinance.*

*\*Currently interpreted and enforced irregularly*

*\*\*By right, buffer can be reduced to half its width with equal square footage compensation to twice the width of any other buffered feature.*

*\*\*\* Through a highly conditioned waiver process*

*\*\*\*\* Non-native species allowed*

# Buffer Facts & Rationale for Improvement

## What is a Buffer and What Do They Do

In general, buffers are natural areas between developments and wetlands and waters that are managed to protect these features from human encroachment and pollution. Buffers improve the health of wetlands, protect water quality, prevent flooding, and provide wildlife habitat.

- Buffers remove large amounts of pollutants from groundwaters and surface water runoff while improving the ecological health of the wetland and waterway they buffer.
- Buffers protect wetlands and waters from the impacts of an adjacent development. And buffers also help absorb and treat flood waters and pollution originating from far away (upstream).
- Buffers on tidal wetlands and waters allow the natural inland migration of these dynamic resources with sea level rise.
- Buffers protect against hazards of climate change including more extreme storm events, more intense floods, and sea level rise.
- Buffers serve as habitat for aquatic and wetland-dependent species of wildlife (particularly bird species) that rely on complementary upland habitat for critical stages of their life. They also screen adjacent human disturbance and serve as habitat corridors through the landscape.<sup>3</sup>
- Buffers protect shallow water habitats such as baygrass meadows and oyster reefs.
- Buffers sustain open space, property values and the rural character of Sussex County.

## Why Should Sussex Require Better Buffers?

### Better Buffers Will Protect Sussex County's Wetland Resources

Sussex County has 47% of all of Delaware's wetlands. Wetlands protect the quality of our drinking water and our streams, rivers, and bays by filtering pollutants. They also protect property by storing flood waters and buffering coastal storm surge. Wetlands are biologically diverse and hold high concentrations of rare species: 41% of wetland plant species in Delaware are rare.

But Sussex is losing its wetlands. About half of this area's original wetlands have been lost due to drainage, conversion to other landuses, and sea level rise. Wetlands and their beneficial functions continue to be lost: 1,434 acres of Sussex County's wetlands were lost from 1992 to 2007<sup>4</sup>. At that rate another 1,147 acres would have been lost from 2007 to 2019. Saltmarshes

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<sup>3</sup> Environmental Law Institute. 2008. Planner's Guide to Wetland Buffers for Local Governments.

<sup>4</sup> Tiner et al. 2011. Delaware Wetlands: Status and Changes from 1992 to 2007



in particular continue to disappear. Saltmarshes around the Inland Bays have decreased from 10,838 acres in 1938 to 7,300 acres in 2007<sup>5</sup>.

Many of the wetlands that remain are in poor condition. For example, the health of streamside wetlands and saltmarshes in the Inland Bays watershed have received a grade of D<sup>6</sup>. Loss and degradation of wetlands have contributed to flooding and poor water quality in Sussex. Better buffers will reduce further degradation and loss of wetlands and their beneficial functions.

### **Better Buffers will Help with Sussex County's Poor Water Quality**

Sussex County has poor water quality. The most recent DNREC assessment of water pollution found that 87% streams, ponds, and bays in Sussex were polluted due to high bacteria levels, high levels of nutrients or low dissolved oxygen levels. Forty-four percent of waters (44%) were polluted by bacteria, 18% had low dissolved oxygen, and 78% had high nutrient levels.

In the Inland Bays Watershed, all assessed waters were found to be polluted by excess nutrients, 50% by bacteria, and 11% had low dissolved oxygen. While improvements to the water quality of the Inland Bays have been realized, measured pollutant loads from the watershed to the Bays have not decreased despite decades of voluntary and regulatory action. Many of the tributaries of the Inland Bays have very high pollutant levels and very poor water quality. The situation is so bad in the Indian River, that dissolved oxygen can fall to zero during the summer months.

Better buffers are an important part of the strategy to protect and restore the water quality of the Inland Bays and other ecologically and economically important waterways of the County.

### **Better Buffers Will Prevent Flooding in Sussex County**

Sussex County is prone to flooding due to its low elevation, high ground water table and proximity to sea level. Flooding of property and infrastructure can have significant costs to individuals, businesses and governments. Just one inch of water in an average home can cost more than \$25,000 in damage<sup>7</sup>.

Coastal and areal flooding is increasing. Flooding that decades ago usually happened only during a powerful or localized storm can now happen when a steady breeze or a change in coastal current overlaps with a high tide. From 1950-2018, nearly half of all major and moderate flooding events in Lewes occurred since the year 2000. Lewes recorded an average number of 4 flood days in 2000. In 2017, 15 flood days were recorded. In 2030, between 15-30 high tide flood days are projected.

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<sup>5</sup> Center for the Inland Bays. 2016. State of Delaware's Inland Bays 2016.

<sup>6</sup> Center for the Inland Bays & DNREC. 2010. Wetland Health Report Card.

<sup>7</sup> Delaware Seagrant. 2019. Homeowner's Handbook To Prepare for Natural Hazards.

Despite increases in flooding, building in Sussex County is happening in floodprone areas. From 2010 to 2017, Sussex County had the third highest number of homes (1,233) built in 10-year flood risk zones of any county in the United States.<sup>8</sup>

Buffers not only provide areas designed to absorb floodwaters, they keep residences out of areas most prone to flooding. By doing so they will reduce the tax-payer burden for addressing community drainage and flooding issues. As of 2018, there were over \$28 million worth of unmet needs to resolve community drainage problems in Sussex County<sup>9</sup>.

### **Better Buffers will Protect from Hazards Associated with Climate Change**

Sussex County is highly vulnerable to climate-change driven sea-level rise. Sea-level rise increases the average sea level over time, which in turn increases the height of high tides and increases the height of low tides. Sea-level rise also amplifies the risks of flooding from storms that bring heavy rain and waves.

Sea level off Lewes and Ocean City, Maryland has risen at a rate of 1.3 to 2.2 inches per decade since record keeping began<sup>10</sup>. Our coast is a global hotspot for sea level rise and the rate of sea level rise is increasing while the land of Delaware is sinking. Global greenhouse gas emissions are contributing significantly to the rise. Projections for sea level rise off Lewes under continued trends in greenhouse gas emissions are 9 inches by 2030, 1.5 feet by 2050, 3.3 feet by 2080, and 4.7 feet by 2100.

Three to five feet of sea level rise in Sussex County is projected to result in the inundation of 4 to 11% of businesses, 8 to 13% of residences, over half of parkland acreage, 7 to 10% of road miles, 31 to 37% of wastewater pumping stations, and 32 to 36% of sites where hazardous substances have been released<sup>11</sup>. The loss of nearly all saltmarshes due to drowning is projected.

Groundwater tables in coastal Delaware have also been projected to rise significantly in response to sea level rise<sup>12</sup>. This will expand the boundaries of existing freshwater wetlands and create new wetlands in areas that were formerly uplands.

We are already experiencing significant increases in the frequency and severity of tidal flooding as well as increased flooding from more intense precipitation events. Many of our saltmarshes are already disappearing. Already underway are expensive adaptation measures including frequent beach replenishment, shoreline stabilization, elevation of homes and roads, and avoidance of areas prone to flooding.

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<sup>8</sup> Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea, 2019 Edition. *10-year flood risk zone defined as area exposed to at least a ten year flood threat in 2050 under moderate global greenhouse gas emission cuts and corresponding median projections for sea level rise.*

<sup>9</sup> DNREC. 2018. Resource, Conservation & Development Projects 21st Century Fund Annual Report

<sup>10</sup> Callahan et al. 2017. Recommendation of Sea-Level Rise Planning Scenarios for Delaware.

<sup>11</sup> Delaware Coastal Programs. 2012. Preparing for Tomorrow's High Tide.

<sup>12</sup> McKenna. 2014. Presentation to the Center for the Inland Bays Scientific & Technical Advisory Committee.



Buffers not only provide areas designed to absorb floodwaters, they keep residences out of areas most prone to flooding. Buffers on tidal wetlands also provide wetlands areas to migrate into under conditions of rising sea level.

### **Better Buffers Protect and Improve Economic Value**

Buffers function to directly and indirectly provide benefits to the public including flood control, water quality improvement, recreation, wildlife habitat, and carbon storage. Delaware's wetlands in total have been estimated to provide \$1 billion to \$3 billion in annual economic value and support to 25,000 jobs with \$568 million in wages.<sup>13</sup> Economists estimate buffers in the Delaware River Watershed provide over \$10,000 per acre per year of benefits to the public<sup>14</sup>. Because buffers help to keep new residences further from areas more likely to flood, less public expenditures will be needed for drainage issues and disaster relief associated with acute flooding events. For example, east coast wetlands avoided \$625 million in direct flood damages during Hurricane Sandy<sup>15</sup>.

Better buffers will function as an important part of protected community open space in Sussex County. Open space enhances home values and homeowners are willing to pay a premium to live next to open space. In Chester County PA, there is an average increase of over \$11,000 in the value of homes that are located up to a half mile from protected open space. When added together, this proximity to protected open space totals \$1.65 billion and increases property and transfer tax revenues a total of \$27.4 million per year<sup>16</sup>.

### **Better Buffers are Supported by the Sussex Comprehensive Plan and the Inland Bays Comprehensive Conservation & Management Plan**

Better buffers are central to achieving multiple goals, objectives, and strategies of the County's 2018 Comprehensive land use plan, a priority of which is to "better preserve the rural character and natural resources of the County," including "considering larger buffers in sensitive environmental areas." Some Goals, Strategies, and Objectives of the Plan that support better buffers are as follows:

Conservation Chapter Goal 5.1. Preserve, maintain, and enhance natural resources and natural systems. Objective 5.1.1 Encourage development practices and regulations that support natural resource protection.

Goal 5.2: Encourage protection of farmland and forestland.

Goal 5.3: Ensure the protection of the natural functions and quality of surface waters, groundwater, wetlands, and floodplains. Objective 5.3.1 Protect surface water and drinking water quality.

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<sup>13</sup> Kauffman, G.J. 2018. Socioeconomic Value of Delaware Wetlands.

<sup>14</sup> Econorthwest. 2018. The Economic Value of Riparian Buffers in the Delaware River Basin.

<sup>15</sup> Narayan et al. 2017. Scientific Reports.

<sup>16</sup> RETURN ON ENVIRONMENT The Economic Value of Protected Open Space in Chester County, Pennsylvania. 2019.

Strategy 5.3.1.3 Identify an appropriate range of wetlands buffer distances based on location and context. Objective 5.3.5 Reduce flooding and erosion.

And strategy 12.1.3.2 Consider creating an ordinance designed to protect established, mature, healthy trees during the construction of new developments to better preserve existing trees and green spaces.

Better buffers have also been an important action of the Inland Bays Comprehensive Conservation and Management Plan since the original 1995 version to which Sussex County is signatory. This plan is the blue print of actions needed to successfully restore the water quality and habitat of the Bays.

### **Better Buffers are Supported by the Public**

A 2018 online survey of 395 individuals by the Sussex Alliance for Responsible Growth found that Future Land Use and Conservation were the top two priority elements of the Sussex Comprehensive Plan.

In 2019, the Sussex Alliance for Responsible Growth distributed an online petition for the County to increase the extent and width of forested buffers that garnered 508 signers.

A 2014 survey of Delawareans found that 77% support avoiding building new structures in areas at risk from sea level rise, 64% support allowing beaches and wetlands to naturally migrate inland, and 85% support changing building codes and regulations to reduce risk in flood prone areas.

### **Better Buffers will Help Manage Extraordinary Growth in Sussex**

Sussex is Delaware's fastest growing county with a current estimated population of 336,634 people<sup>17</sup>. Over the past decade, an additional 47,705 people are projected to have moved to Sussex. An additional 48,457 to 159,167 people are projected to be living here within 25 years.

From 2008 to 2015 over 13,500 building permits were issued in Sussex. From 2017 to 2019, 66 new subdivisions with 5,827 units were given preliminary approval by Sussex Planning and Zoning. Over the same time period, another 20 developments with a total of 1,294 residential units were approved as conditional uses or changes of zone by County Council.<sup>18</sup> These developments would be grandfathered under a new ordinance and receive minimal buffers relative to science based recommendations.

A significant portion of this development has been in areas at risk of flooding. From 2010 to 2017, Sussex County had the third highest number of homes (1,233) built in 10-year flood risk zones of any county in the United States.<sup>19</sup>

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<sup>17</sup> Sussex County. 2019. Sussex County Comprehensive Plan.

<sup>18</sup> Sussex County 2020. Application data provided Feb. 2020.

<sup>19</sup> Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea, 2019 Edition. *10-year flood risk zone defined as area exposed to at least a ten year flood threat in 2050 under moderate global greenhouse gas emission cuts and corresponding median projections for sea level rise.*



The growth drives up impervious surface coverage that contributes to flooding and poor water quality. In 2010, the Inland Bays Watershed surpassed 10% impervious surface coverage, the threshold at which many estuaries begin to express noticeable degradation in response. Better buffers are needed to protect residents and the environment from the effects of rapid population growth in the County.<sup>20</sup>

## **What are the Important Characteristics of Better Buffers?**

### **Wider Buffers are Better**

The benefits of a buffer are based on its width. Wider buffers ensure that the greatest amount of pollution is kept out of the wetland or waterway buffered to a certain extent. Wider buffers also offer more habitat for wildlife that rely on both the wetland or water buffered and the buffer area itself.

The Center for the Inland Bays recommended adequate and optimum buffer widths for the protection of water quality based on the type of wetland or waterway buffered<sup>20</sup>. Adequate widths were 80 feet for non-tidal streams, 80 to 300 feet for tidal waters and wetlands, 80 feet for streamside wetlands, and 50 feet for other non-tidal wetlands. Optimum widths were 150 feet for non-tidal streams, 150 to 500 feet for tidal waters and wetlands, 150 feet for streamside wetlands, and 100 feet for other non-tidal wetlands. Another recent comprehensive study recommended a minimum of 98 foot forested buffers on small streams<sup>21</sup>. Adequate widths for buffers to protect wildlife habitat can be in the 1000s of feet.

## **Why Forested Buffers are Essential**

### **Benefits of Native Forested Buffers**

Forests are crucial to maintaining the water quality of streams, rivers, and bays. They also are essential habitat for wildlife, they protect public health, they provide recreation opportunities, they increase property values, and they enhance quality of life.

Nowhere are forests more important than where they are close to water. Research has demonstrated that the amount of forest in an estuary's watershed, particularly near the water, has a significant influence on the health of the estuary's baygrasses, crabs, and marsh birds.<sup>22</sup>

Forested buffers are also especially important to a wide variety of bird species. These include raptors such as bald eagles and osprey. Colonial waterbirds such as great blue herons, which often establish groups of nests in mature trees, use the forested buffers for food, cover, and nesting. Numerous species of migratory birds depend on coastal areas to rest and feed during their long flights from Central and South America. A range of mammal, amphibian, and reptile species also use these areas near shore. The number and variety of species are highly dependent on the amount and type of vegetation within the buffer. The more natural the

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<sup>20</sup> Center for the Inland Bays. 2008. Recommendations for an Inland Bays Water Quality Buffer System.

<sup>21</sup> Sweeney & Newbold. 2014. Journal of the American Water Resources Association.

<sup>22</sup> Li et al. 2007. Estuaries and Coasts. 30, 840-854; and references therein.

condition of the Buffer is, the greater the number of species that will use it. A fertilized and manicured lawn that leads to a bulkheaded shoreline provides none of the important habitat benefits found in a naturally forested Buffer.

Birds are ecological indicators of healthy ecosystems. There are now 432 species of North American birds at risk of extinction, more than a third of all species<sup>23</sup>. Almost all North American terrestrial birds rear their young on insects, and most of those insects are caterpillars. It takes 6,000-9,000 caterpillars to rear one clutch of Carolina chickadees to fledging<sup>24</sup> and many more to bring chicks to independence. So, to have birds, we need to plant the species that make caterpillars (bird food). Essential land stewardship entails reducing lawn area and transitioning from alien ornamental plants to native ornamental plants. Native oaks, cherries, willows, birches, maples, elms, blueberries, alders, and pines produce about 75% of the insect food that drives food webs in Delaware<sup>25</sup>.

Forested buffers provide superior water quality, habitat, and flood mitigation benefits than do non-forested buffers. Forested buffers have been shown to retain over 30% more nitrogen pollution than grassed buffers. Forested buffers provide extensive vertical structure to hold precipitation and thus prevent runoff. Non-forested buffers do not provide this structure. Forested buffers provide multiple layers of vertical habitat and food sources for insects, bats, mammals, and particularly birds, that meadows or grassed buffers do not provide. Forests also provide physical structure to stream channels through their roots and contribute to the food web of stream channels through provision of organics such as leaves and sticks. Forested buffers also regulate the temperature of streams. The quality of streamside forests has been cited as the single most important factor altered by humans that affects...water quality of the streams providing water to coastal bays<sup>26</sup>.

### Disappearing Sussex Forests

Despite these benefits forests are at risk. Forest cover in Delaware is at its lowest level since 1907<sup>27</sup>. It has been estimated that by 2050, 43% of Delaware's remaining forestland will be converted to urban areas. Only four other states are expected to experience a greater degree of forest conversion to expanding urban areas.

Forests are disappearing rapidly from Sussex County due to development. From 1992 to 2012, upland forests decreased by 14 square miles in the Inland Bays watershed. In Sussex County, over half of the forests within proposed developments are intended for clearing.<sup>28</sup> Forested ecosystems are replaced by non-native lawns with little value for native wildlife. In Delaware suburbs, 92% of the area that could be landscaped (not hardscape) is lawn, 79% of the plants are introduced species, and only 10% of the tree biomass that could be in our developments is actually there<sup>29</sup>.

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<sup>23</sup> North American Bird Conservation Initiative. 2016. The State of North America's Birds 2016.

<sup>24</sup> Brewer. 1961. The Wilson Bulletin.

<sup>25</sup> Narango et al. 2018. Proceedings of the Natural Academy of Sciences.

<sup>26</sup> Sweeney, B.W. 1992, Water Science and Technology.

<sup>27</sup> Delaware Wildlife Action Plan and references therein.

<sup>28</sup> State of Delaware. 2020. Preliminary Landuse Service Data 2017 to 2019. accessed Jan. 2020.

<sup>29</sup> Delaware Statewide Ecological Extinction Task Force. 2017. Final Report.



### Public Preference for Forested Buffers

The peer reviewed scientific literature shows that landowners on the rural/urban fringe prefer forested buffers to corridors with little vegetation, and they best preferred more extensive forested buffers.<sup>30</sup>

Another study found residents preferred forested buffers over grassed buffers in both rural and suburban areas.<sup>31</sup> Additionally, in a recent study of nearly 12,000 Americans, seven out of 10 kids surveyed said they "would rather explore woods and trees than play on neat-looking grass."<sup>32</sup>

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<sup>30</sup> Sullivan, W.C., et al. 2004. *Landscape and Urban Planning*. 69, 299–313.

<sup>31</sup> Kenwick, R. a., et al. 2009. *Landscape and Urban Planning*, 91, 88–96.

<sup>32</sup> Kellert, S. and DJ Case and Associates. 2017. *The Nature of Americans National Report: Disconnection and Recommendations for Reconnection*.

### Benefits of Native Forested Buffers

Forests are crucial to maintaining the water quality of streams, rivers, and bays. They also are essential habitat for wildlife, they protect public health, they provide recreation opportunities, they increase property values, and they enhance quality of life.

Nowhere are forests more important than where they are close to water. Research has demonstrated that the amount of forest in an estuary's watershed, particularly near the water, has a significant influence on the health of the estuary's baygrasses, crabs, and marsh birds.<sup>33</sup>

Forested buffers are also especially important to a wide variety of bird species. These include raptors such as bald eagles and osprey. Colonial waterbirds such as great blue herons, which often establish groups of nests in mature trees, use the forested buffers for food, cover, and nesting. Numerous species of migratory birds depend on coastal areas to rest and feed during their long flights from Central and South America. A range of mammal, amphibian, and reptile species also use these areas near shore. The number and variety of species are highly dependent on the amount and type of vegetation within the buffer. The more natural the condition of the Buffer is, the greater the number of species that will use it. A fertilized and manicured lawn that leads to a bulkheaded shoreline provides none of the important habitat benefits found in a naturally forested Buffer.

Birds are ecological indicators of healthy ecosystems. There are now 432 species of North American birds at risk of extinction, more than a third of all species<sup>34</sup>. Almost all North American terrestrial birds rear their young on insects, and most of those insects are caterpillars. It takes 6,000-9,000 caterpillars to rear one clutch of Carolina chickadees to fledging<sup>35</sup> and many more to bring chicks to independence. So, to have birds, we need to plant the species that make caterpillars (bird food). Essential land stewardship entails reducing lawn area and transitioning from alien ornamental plants to native ornamental plants. Native oaks, cherries, willows, birches, maples, elms, blueberries, alders, and pines produce about 75% of the insect food that drives food webs in Delaware<sup>36</sup>.

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<sup>40</sup> Delaware Statewide Ecological Extinction Task Force. 2017. Final Report.

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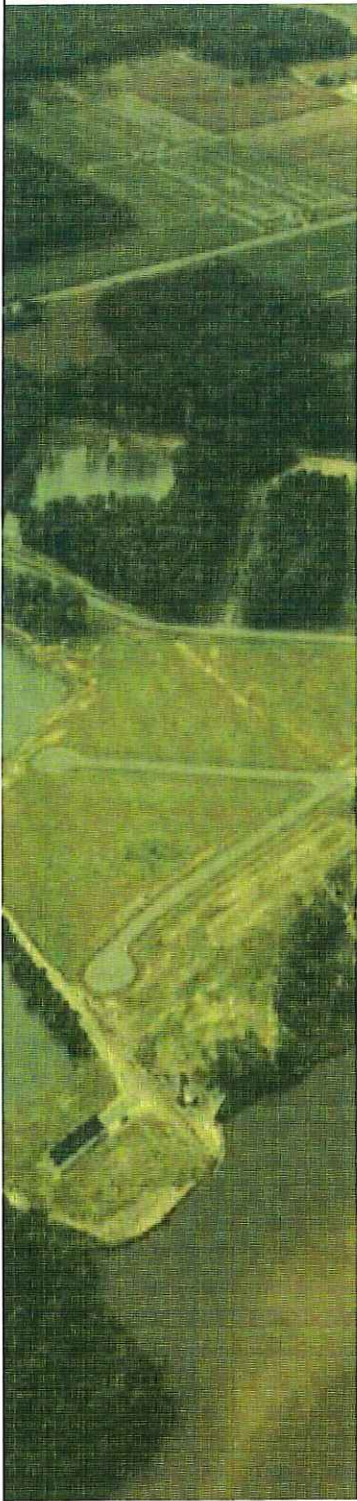
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# Recommendations for an Inland Bays Watershed Water Quality Buffer System

by Christopher Bason  
June 2008



The Delaware Center for the Inland Bays



**The Delaware Center for the Inland Bays**

# **Recommendations for an Inland Bays Watershed Water Quality Buffer System**

**by Christopher Bason, Science & Technical Coordinator, the Delaware Center for the Inland Bays**

**on behalf of the Scientific and Technical Advisory Committee of the Delaware Center for the Inland Bays,**

**Dr. Sergio Huerta, Chair**

**June, 28 2008**

**This report may be found at [/www.inlandbays.org/cib\\_pm/pub\\_reports.php](http://www.inlandbays.org/cib_pm/pub_reports.php)**

**Cover: Aerial photography of Dirickson Creek, Inland Bays Watershed, Sussex County, Delaware.**



**Recommendations for an Inland Bays Watershed Water Quality Buffer System**  
**by Christopher Bason, Science & Technical Coordinator, the Delaware Center for the Inland Bays**

This document provides science-based recommendations for a water quality buffer system designed to protect and restore the quality of wetlands and waterbodies of the Inland Bays watershed located in coastal Sussex County, Delaware. The document focuses on the long-term nutrient removal and retention function of buffers with respect to the total maximum daily load (TMDL) reductions of nitrogen and phosphorus needed for the Inland Bays and their tributaries. A Pollution Control Strategy (PCS) is being developed to meet these reductions in a timely fashion. The PCS is also a major tactic of the Inland Bays Comprehensive Conservation and Management Plan (CCMP) which has among its major goals 1) requiring the maximization of open space in developments, 2) establishing shoreline setbacks regulations that maintain tidal marshes, and 3) securing maximum protection for wetlands and waterways. Literature focused on Atlantic Coastal Plain buffers was reviewed to recommend buffer alternatives by waterbody type and by buffer system characteristics. The alternatives were then applied to eleven randomly selected developments to determine acreage of buffer zones in buildable areas. Further recommendations based on these results are then provided.

**Executive Summary**

1. Water quality buffers are natural areas between waterbodies and active landuses that are managed for the primary purposes of 1) sustainable removal and retention of excess nutrients entering waterbodies, 2) protecting waterbodies against encroachment and physical alterations and 3) allowing waterbodies themselves to maximize their own capacity to ameliorate pollution.
2. Buffers in small watersheds of the coastal plain have been shown to remove 23 to 65 lbs. of nitrogen and 1.1 to 2.6 lbs of phosphorus per acre of buffer per year. Buffers can remove pollutants from groundwater, surface water runoff, and from in-stream flow while improving the condition of the waterbody they buffer.
3. The 40 to 85% reductions of nitrogen and phosphorus loads needed to restore the water quality and habitats of the Inland Bays, combined with uncertainty in their achievement due to changes in landuse and climate suggests that an extensive and effective riparian buffer system should be included in the PCS.
4. Forested buffers are on average 36% more effective at nitrogen removal than grassed buffers and can improve instream processing of nutrients.
5. Wider buffers remove higher levels of nutrients, and buffers over 150 feet are more likely to meet their maximum potential for nitrogen removal. Variable width buffers remove lower levels of pollutants than fixed width buffers of the same average width.
6. To maximize the efficiency and sustainability of a buffer system, buffers should a) be required on all new subdivisions and redevelopments, b) be forested, c) begin from the wetland-upland boundary of a riparian area, d) and be of sufficient width to allow tidal wetlands to migrate inland with sea level rise.
7. Two buffer system alternatives with different pollution removal performances based on differences in buffer width are provided. The adequate protection alternative provides buffers of 80' on non-tidal waterways, 80' on riparian wetlands, 80' on tidal areas by steep uplands, 300' on tidal areas by gradual uplands, and 50' on freshwater flats and depressional wetlands. The optimum protection alternative provides buffers of 150' on non-tidal waterways, 150' on riparian wetlands, 150' on tidal areas by steep uplands, 500' on tidal areas by gradual uplands, and 100' on freshwater flats and depressional wetlands.
8. An analysis of the buffer systems applied to developments in the watershed revealed that buffer acreage was highly variable and controlled by the type, amount, and distribution of waterbodies within a development. On average, buffer area fell within the range of Sussex County open space requirements (adequate protection = 13.8% and optimum protection = 33.2% of buildable area). Those developments with tidal areas by gradual uplands, those in the southern region of the watershed, and those that are smaller, will often have to modify site design to accommodate buffer acreage. Governments should cooperate to refine their codes to enable and encourage site design that accommodates buffers.
9. To better accommodate buffers of more functionally important wetlands and waterways, shallow ditches should be disconnected from the drainage network where feasible, or alternatively afforded narrower buffers. Narrow buffers on shallow ditches substantially reduced total buffer area while likely retaining much functionality. Governments should encourage cooperation within and among developments to reduce ditch networks and further improve nutrient reduction in remaining ditches.

## Table of Contents

|  |    |
|--|----|
| Introduction.....  | 5  |
| Why A Comprehensive System of Riparian Buffers is Necessary for Clean Water.....                       | 5  |
| Factors Affecting TMDL Achievement.....  | 5  |
| Condition of the Watershed Stream Network.....   | 6  |
| Effects of Development on Waterways.....   | 6  |
| The Case for Riparian Buffers.....   | 8  |
| Planning Buffers for the Whole Watershed: Why Different Waterbody Types Require Different Buffers..... | 8  |
| Sources of Water and Pollution to Riparian Ecosystems.....   | 10 |
| Groundwater.....   | 11 |
| In-stream Processing of Nutrients.....   | 11 |
| Direct Precipitation.....  | 11 |
| Developing A Buffer System One Characteristic at a Time.....   | 11 |
| Buffer Extent.....   | 12 |
| Buffer Vegetation Type .....   | 13 |
| Buffer Width.....  | 14 |
| The Two Regions of the Watershed and What They Mean for Riparian Buffer Width.....                     | 17 |
| Tidal Wetland & Waters.....  | 18 |
| Freshwater Flats and Depressional Wetlands.....  | 19 |
| Restoration and Management.....  | 19 |
| Recommendations.....   | 20 |
| Development Analysis.....  | 20 |
| Additional Recommendations.....  | 36 |
| References.....  | 37 |
| Appendices 1 – 5   |    |

**Abbreviations:** CCMP, Comprehensive Conservation and Management Plan; CIB, Center for the Inland Bays; DNREC, Department of Natural Resources and Environmental Control; ERES Exceptional Recreational and Ecological Significance; PCS, Pollution Control Strategy; PLUS, Preliminary Land Use Service



### **Introduction**

The Inland Bays are degraded Waters of Exceptional Recreational and Ecological Significance (ERES) that are committed to being restored, by both government and stakeholder groups, to a healthy condition. The ERES designation affords the Bays a level of protection that goes beyond most other waters of the State. Commitments to the protection and restoration of the Bays are detailed in the Comprehensive Conservation and Management Plan (CCMP) for these estuaries of national significance. In this guiding document, buffers for waterways and wetlands are essential to CCMP tactics including implementing the Pollution Control Strategy (PCS), maximizing open space for environmentally sensitive development, and establishing shoreline setbacks to protect tidal ecosystems. Specifically, the CCMP has as one of its most important goals requiring maximum protection of waterways, groundwater, natural areas, open space, and tidal and non-tidal wetlands. Buffers are a necessary component of protecting the Inland Bays because they maintain critical habitat and are highly effective at removing and retaining pollutants for the long-term, with little maintenance costs or risk of failure.

Water quality buffers are natural areas between active landuses and wetlands or waterways that are managed for the primary purposes of 1) sustainable removal and retention of excess nutrients entering waterbodies, 2) protecting wetlands or waterways against encroachment and physical alterations and 3) allowing wetlands or waterways to maximize their own natural capacities to ameliorate pollution. Buffers vary in their capacity to improve and protect water quality based on a number of different factors including buffer vegetation type, buffer width, and physiographic region of the country or world.

Despite the large number of studies on the water quality functions of buffers [3], regulations requiring buffers have been developed using little scientific input or using studies from regions with different physical and ecological characteristics. This report develops science based alternatives for a water quality buffer system in the Inland Bays watershed by reviewing studies conducted in the Atlantic Coastal Plain,<sup>1</sup> and complemented, where needed, by wider reviews of buffer effectiveness. While buffers are best managed to maximize the host of ecological services that they provide, the recommendations here were developed to maximize the efficiency of pollution reduction from buffers implemented at the development of land, per the regulatory intent of the Inland Bays PCS.

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<sup>1</sup> The Atlantic Coastal Plain is a physical region of the United States where similar geology, hydrology, and resulting patterns of landuse makes ecological comparisons more relevant.

The alternatives are intended to provide options for implementing the recommendations. This report recognizes that all environmental regulations are developed within the framework of past and present legal, social, and economic conditions, and it at times refers to these factors specific to the Inland Bays watershed. It is hoped that this approach proves educational for others developing recommendations under other such conditions, and should not limit the use of the report as a reference for other watersheds of the Atlantic Coastal Plain.

### **The Condition of the Inland Bays and the Strategy to Restore Them**

“The ecology of the Bays has changed... from a clear water system that supported bay grasses, bay scallops and a variety of shellfish, finfish, and waterfowl to a murky water system that no longer supports a healthy ecology but one that engenders toxic algal blooms, nuisance seaweed blooms, low oxygen episodes, and one that suppresses bay grasses, bay scallops, and the variety and abundance of shellfish, finfish and waterfowl seen earlier [4].” This eutrophic system now contains very high levels of nitrogen and phosphorus which promotes excessive algal blooms including harmful red tides, brown tides, nuisance seaweeds, and dangerous and sometimes fatal levels of oxygen for fish and shellfish. Reductions of nitrogen and phosphorus loads of 40 – 85% are needed to meet the standards selected for the restoration of bay water quality. The reductions were modeled through a Total Maximum Daily Load (TMDL) analysis using baseline data from 1988 to 1990 and they include a margin of safety to account for uncertainty [5, 6].

To meet the reductions in a timely manner, a PCS has been drafted by DNREC based on input by the CIB, DNREC, and the public. The draft PCS includes sections addressing water quality buffers, the reduction of agricultural and urban sources, onsite wastewater systems, stormwater management, government accountability, and the elimination of point sources [7].

#### *Factors Affecting TMDL Achievement*

To put the development of a buffer system as a part of the PCS into context, a number of influential factors affecting TMDL achievement are considered. First, an implicit margin of safety to account for uncertainty related to field data interpretation and modeling was included within TMDL development [5, 6]. This supports the likelihood of a timely achievement of the TMDL. In contrast, a number of factors add uncertainty to the timely achievement of the TMDL under the current PCS. Of primary consideration is the level of development that has been permitted without PCS protections in critical areas of the watershed. At the time of this report, over 60,000



housing units were under construction, had been permitted, or were under review for permit in Sussex County [8]. Much of this growth is concentrated in the Environmentally Sensitive Area of the Inland Bays watershed. A draft analysis by DNREC determined that new construction raises pre-construction phosphorus loads by 30% [9]. Nitrogen loads are estimated to decrease by 15%, but this is far from the lowest reduction target of 40%. This suggests that additional amounts of nutrients will need to be reduced watershed-wide to meet TMDLs. It also increases the difficulty of meeting reduction goals for both phosphorus and nitrogen from this new development, because pollution control opportunities and cost efficiencies decrease post construction. Additionally, as permitted development occurs, it is expected that the nutrient processing capacity of the streams that drain these areas will decline [see 10, 11].

Other factors that add uncertainty to meeting the TMDL are the predictions of increased runoff, nitrogen loading<sup>2</sup>, and saltmarsh loss (and associated nutrient assimilation capacity) resulting from climate change (see [12, 13]); all of which were not considered during TMDL or PCS development. Finally, the primarily voluntary actions of the PCS combined with past difficulties in obtaining compliance with water quality regulations in the watershed, [14, 15] do not add confidence to the achievement of nutrient reductions. These factors suggest that a buffer system with the maximum efficiency to reduce pollutant loads be required as a part of the PCS.

#### *Condition of the Watershed Stream Network*

Streams function as the arteries and wetlands the kidneys of the watershed; together they supply and filter water moving towards estuaries. Thus the acreage and health of these systems affects estuarine water quality. Buffers are implemented to not only reduce and remove nitrogen and phosphorus travelling towards water bodies, but also to protect and improve the capacity of wetlands and waterways to themselves filter pollutants. In the Inland Bays watershed, wetlands and waterways have been severely altered and are limited in their capacity to reduce pollution. Sixty percent of the watershed's freshwater wetlands were eliminated since European settlement [16]. Further, a quarter of the watershed's tidal wetlands were eliminated between 1938 and 1980 [17]. The condition of the remaining Inland Bays wetlands was being assessed at

the time of this report. Preliminary information shows that over 75% of riverine (streamside) wetlands have highly degraded hydrologic and water quality functions [16]. These wetlands are impacted by inadequate buffers and pervasive hydrologic modifications. In particular, stream channelization (channel excavation) has increased the delivery of nutrients to streams and disconnected streams from their adjacent wetland filters. The condition of the watershed's streams themselves is also poor with 29% supporting their designated societal uses [7]. Nutrient and bacteria pollution, lax enforcement of existing regulations, ditching and stream channelization practices, and the lack of buffers has contributed to this condition. DNREC describes 78% of rivers, streams, and ditches in the watershed as inadequately buffered [18]. Buffer implementation should begin to restore the capacity of waterbodies to treat pollution and protect them from the effects of development.

#### *Effects of Development on Waterways*

Wetlands and waterways face increased stress as the watershed develops. The watershed is the fastest growing region of the State with developed lands increasing by 35% from 1992 to 2002 [7]. In the mid-Atlantic, the more development that occurs and the closer it is to a waterbody, the greater chance those aquatic resources will be degraded [19]. Elsewhere, permanent degradation of rivers and streams has been shown to occur as a watershed's impervious cover exceeds 25-60% (see Miltner et al. 2004 and references therein) [20]. Increases in impervious surfaces generally increases stream channel erosion and the speed at which pollutants are delivered downstream. This results in streams downcutting their channels and losing connection with their streamside wetland filters. It also reduces the capacity for riparian areas to filter nutrients from groundwater and the capacity for in-stream processing of nutrients [10, 21]. Research suggests that the nutrient processing capacity of waterways will likely decline as the permitted development in our watershed occurs [10, 11].

To date, development without the required buffers and adequate sediment and stormwater controls have stressed waterways (Figure 1). Buffers of tidal wetlands and waters have particularly been affected by lax enforcement of existing County regulations. Buffers maintained or installed prior to development can help to control runoff from an active construction site, and filter delayed discharges of high nitrogen groundwater from previously existing agricultural operations and more distant, ongoing farms [22].

<sup>2</sup> Climate change during this century is likely to have a profound effect on nutrient loading to estuaries. Predictions for increased precipitation in the mid-Atlantic suggest that both river flows and the fraction of land-applied nitrogen entering estuaries will increase. This could increase the number of "wet years" our estuary experiences when nutrient pollution and its affects are more severe (see citations in text above).





Figure 1. Typical examples of inadequate water quality buffers and sediment and erosion control from the Inland Bays watershed, 2006/2007. A. Chronically silted ditch on construction site with fertilized turf grass buffer. B. Sediment control failure and lack of buffer near White's Creek. C. Excessive turbidity from runoff in White's Creek and construction site with minimal buffer. Parts of the buffer here leaves little if any room for wetland migration with rising sea levels. D. Fertilized turfgrass buffer and exposed sediment near freshwater wetland. E. Lack of buffer on new development on Dirickson's Creek. F. Seamless transition from saltmarsh to golfcourse.



### *The Case for Riparian Buffers*

Mass balance studies that measure all watershed inputs and outputs provide the most accurate estimates of buffer effectiveness to reduce pollution. The Atlantic Coastal Plain is fortunate to have multiple nutrient mass balance studies of buffers. In small coastal plain watersheds with well-buffered waterways, riparian zones retained from 23 to 65 pounds of nitrogen per acre of buffer per year (67 – 89% of inputs) and 1.1 to 2.6 pounds of phosphorus per acre of buffer per year (24 – 81% of inputs) [23, 24]. Difference in effectiveness of individual buffers results from the great amount of natural variability among riparian areas [25]. On the whole, compelling evidence exists for the use of buffers to restore water quality, and the characteristics of buffers that best accomplish this are reviewed below.

### **Planning Buffers for the Whole Watershed: Why Different Waterbody Types Require Different Buffers**

Watersheds have different types of waterbodies, all with their own unique set of characteristics. Figure 2 illustrates these waterbodies and describes some of their water quality functions. There are the Bays themselves, their tidal tributaries, the freshwater streams of varying sizes, and the network of ditches that extends the natural drainage system. There are also wetlands of various types including tidal marshes, riparian (streamside) wetlands, flats wetlands such as the Great Cypress Swamp, and depressional wetlands such as Delmarva bays (Figure 3). Because these wetland and waterway types occur at different positions on the landscape, they receive water from different sources and thus function somewhat differently [26, 27]. For example, tidal wetlands move inland with rising sea levels while nontidal wetlands generally do not. People also interact with each waterbody type in different ways, and thus tend to appreciate their various functions more or less based on these interactions. For example, most homeowners seem to prefer a view across the waters of a tidal marsh, but usually do not manage their properties for a view across a drainage ditch. Waterway and wetland types are given

individual consideration to design the most efficient buffer system.

**Table 1. Wetland and waterway classification for a watershed buffer system.**

|  |
|--|
| <i>Tidal Wetlands and Waters</i>       |
| Gradual Upland/Wetland Boundary        |
| Steep Upland/Wetland Boundary          |
| <i>Nontidal Wetlands and Waterways</i> |
| Wetlands                               |
| Flats and Depressional Wetlands        |
| Riparian Wetlands                      |
| Headwaters                             |
| Larger Streams                         |
| Constructed Ditches                    |

The wetland and waterway classification developed for this report is presented as Table 1. It is one of many potential classification schemes. Tidal wetlands and waterways are separated from nontidal wetlands and waterways because tidal systems move with rising sea levels. Headwaters are separated from larger streams because they are the most important for water quality protection and can be so numerous that their buffers can have a relatively greater impact on how a parcel is developed. Ditches are separated from natural streams because filling or integrating ditches into a stormwater management system during development can result in more spatially efficient nutrient reductions relative to buffering ditches as they are. Riparian wetlands are separated from flats and depressional wetlands because they are more directly connected to flowing waterways.

This literature review focuses on buffers of waterways and their associated wetlands, generally called riparian areas. Less study has been given to water quality buffers of flats and depressional wetlands, and thus less review is presented. However, flats and depressions remain important to water quality protection, because they make up about three quarters of all freshwater wetland acreage [28]

*~ In small coastal plain watersheds with well-buffered waterways, riparian zones retained from 23 to 65 pounds of nitrogen per acre of buffer per year (67 – 89% of inputs) and 1.1 to 2.6 pounds of phosphorus per acre of buffer per year (24 – 81% of inputs) ~*



# Wetlands & Waterways of the Inland Bays Watershed

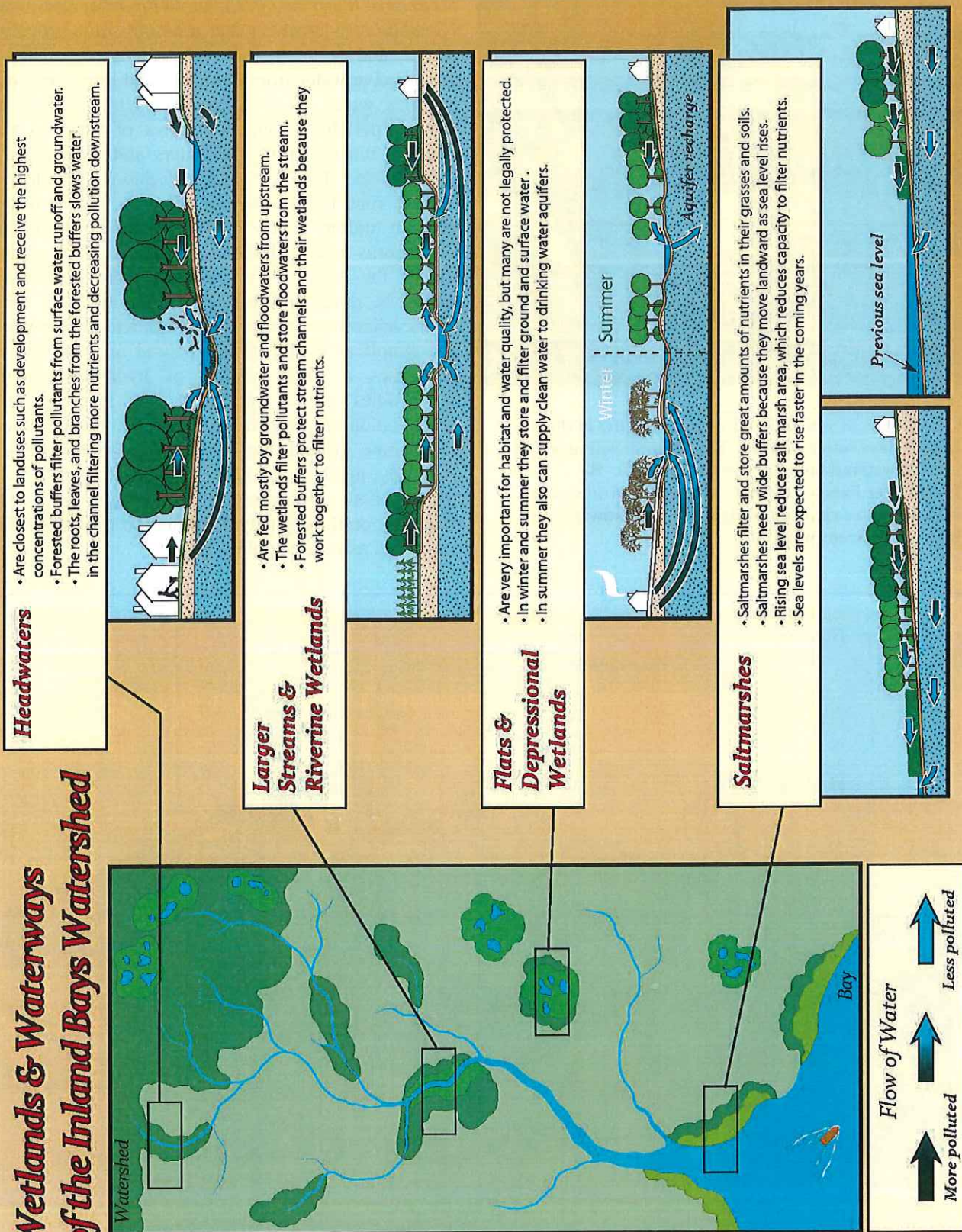
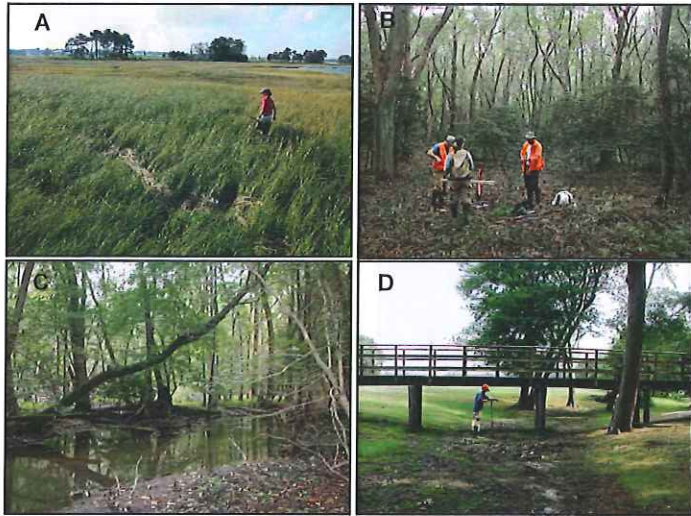


Figure 2. Wetland and waterway types of the Inland Bays watershed.

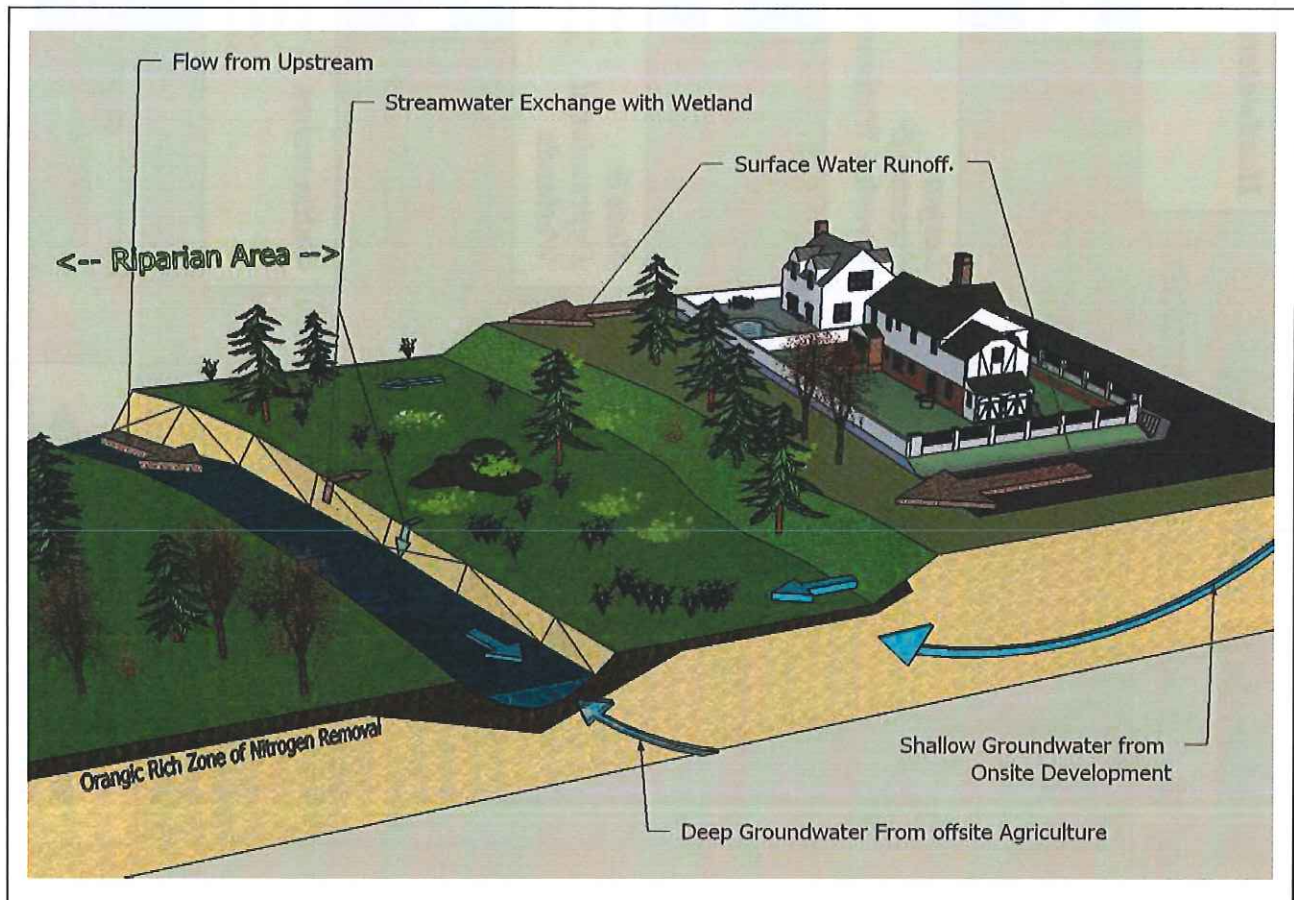




**Fig. 3. Examples of wetland and waterway types in the Inland Bays watershed. A. Tidal marsh with gradual upland-wetland boundary in background. B. Freshwater flats wetland. C. Larger natural stream with extensive riparian wetlands. D. Headwaters without adjacent wetlands.**

#### *Sources of Water and Pollution to Riparian Ecosystems*

Riparian areas receive water primarily from groundwater, runoff, and upstream flow [26] (Figure 4). Tidal areas also receive water from the Bays, and direct precipitation supplies water to all wetlands. While buffers act to remove pollution from all sources of water to varying degrees, nitrogen primarily enters and is removed from groundwater flow [29] and phosphorus primarily from surface runoff [30] (*but see Box 1*). Once through a riparian buffer, much of the remaining nitrogen and phosphorus enters ditch or stream channels that flow toward the Bays. Thus a comprehensive buffer system should be developed to control pollution from upstream flows, adjacent surface water runoff, and groundwater; not just runoff as is sometimes focused on. In fact, runoff comprises a small portion of hydrologic inputs to waterbodies of the watershed. As much as 80% of precipitation not evapotranspired, infiltrates into the earth to become groundwater on its way to the Bays [31]. Similarly, nearly three quarters of all nitrogen is delivered to Rehoboth Bay through groundwater [32], placing emphasis on the capacity of buffers to treat this source of water and associated pollution.



**Fig 4. Conceptual model of the primary sources of water and pollution to riparian areas. Arrows indicate flows.**



### **BOX 1. Phosphorus In Groundwater.**

Phosphorus in groundwater is a particular concern for the Inland Bays watershed. Phosphorus can leach into groundwater to be later absorbed by riparian buffers [1]. But this function of buffers has been overwhelmed in some areas by over-application of phosphorus rich poultry manure on agricultural fields. Certain soils in our watershed are naturally susceptible to phosphorus leaching and because they are phosphorus-saturated, will do less to control this pollutant even after converted to development [2]. Identification of these areas by soil type and phosphorus status could be used to prioritize areas of wider buffers or soil amendments that might make up for this deficiency. The laboratory of Tom Sims at the University of Delaware has been working to identify these soils and developing methods to better bind excess phosphorus to soils.

#### *Groundwater*

Groundwater flows are often classified as shallow and deep groundwater. Shallow groundwater comes from lands close to a waterbody, including designated buffers, and discharges within a few months to a few years. Shallow groundwater is the most plentiful for most of our waterways, and it tends to pass through zones of nitrogen removal in healthy riparian areas. Deep groundwater takes longer flow paths from lands more distant from waterbodies, and may take 20 to 50 years to discharge. Deep groundwater may discharge directly to the bottom of a waterbody, bypassing important areas of nutrient removal in certain riparian zones of well drained landscapes [33, 34]. Deep groundwater means that decades may pass before reduction in some pollutant loads finally begin to improve surface water quality. But it also means that buffers installed now can treat pollution from years when there was little nutrient management.

There is variation in how waterways receive groundwater and associated pollutants. Waterways can receive disproportionately more or less groundwater because of their orientation relative to the direction of groundwater flow [35]. Also, not all groundwater discharges evenly along riparian zones. Some groundwater follows preferential flow paths, where discharge concentrates into a riparian area. Preferential flow paths may form due to small differences in soil texture along a riparian zone or they may form due to larger features such as lateral ditches [36-39]. These relatively small areas of the total riparian zone can be responsible for disproportionate amounts of nitrogen discharge to a waterway (40% of nitrogen discharge in one study) [38]. Buffer systems

should avoid gaps and maintain a consistent minimum effective width for maximum water quality protection [40], partly to ensure areas of preferential flow paths are fully addressed.

#### *In-stream Processing of Nutrients*

The power of stream channels to treat pollutants is often overlooked. Waterways are not just drains but complex ecosystems with the capacity to retain pollution from waters flowing downstream [41-43]. Their capacity to do so varies with their condition [10, 44-46], with healthier streams retaining more pollutants. For example, channelized streams (or those that have had their channels excavated to increase drainage) have higher nitrogen and phosphorus concentrations [46], and much of the sediment loads to downstream waters originate from within the channels of such eroding waterways [47, 48]. This may be especially so in watersheds where development and stream channelization has increased the hydrologic energy of waterways. Streams with fewer hydrologic alterations provide more tortuous flowpaths and a greater hydrologic exchange with any adjacent wetlands which results in more opportunities for pollutant trapping and removal.

#### *Direct Precipitation*

All wetlands receive part of their water from precipitation that falls directly onto their surfaces. In the Inland Bays watershed, wet and dry atmospheric deposition of nitrogen and phosphorus make up a significant portion of nutrient inputs, especially during the summer months [49, 50]. Because flats and depressional wetlands tend to receive the greatest portion of their water from precipitation [26], they are particularly important for their role as interceptors and filters of this nutrient source. Furthermore, the fact that these types comprise the great majority of freshwater wetlands in the watershed (~75%) increases their importance in reducing pollution from direct precipitation. It is also notable that these wetland types are most likely to be considered non-jurisdictional under the federal Clean Water Act [51] and thereby legally unprotected in the State of Delaware at the writing of this report.

#### **Developing A Buffer System One Characteristic at a Time**

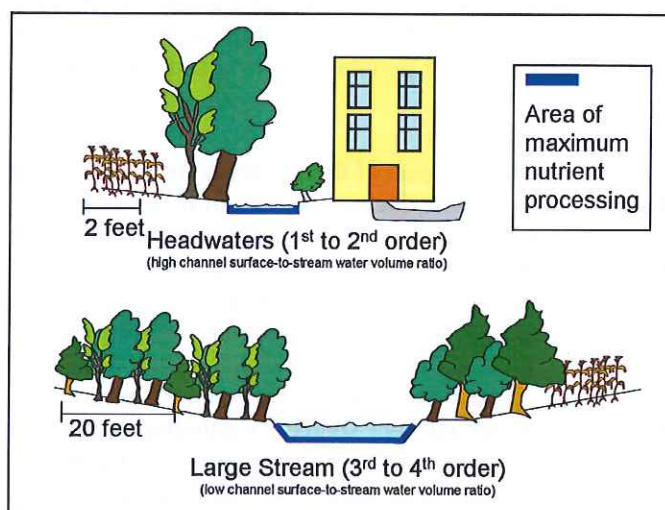
This section uses the available literature to develop recommendations for a buffer system with maximum efficiency to reduce pollutants. Each identified characteristic of a buffer system including extent, vegetation, width, waterbody type, and buffer restoration is treated by asking and answering questions.



## Buffer Extent

### *What Waterways are the Most Important to Buffer?*

To maximize the effectiveness of a watershed buffer system, all waterways that are to remain after development should be buffered. However, headwater streams are particularly recognized for their importance in reducing nitrogen loads downstream. Rates of nitrogen removal are higher in headwaters relative to larger waterways [42, 43, 52, 53]. Headwaters make up approximately 75% of total waterway length in watersheds [27, 54]. They tend to have the highest nitrate concentrations [55] because they are in the closest connection with the sources of pollution from the surrounding landuse [27]. And their small and shallow geometry allow water the greatest opportunity to interact with areas of the highest nutrient removal on the bottom and sides of the channel (Figure 6). Among waterways, the headwaters should be afforded the most protective buffers.



**Fig. 6. Headwaters are smaller, more numerous, more closely connected to the surrounding landuse, and provide proportionately greater areas of nutrient processing than larger streams. For stream order explanation see section directly below.**

### *How Can Headwaters be Differentiated from Larger Streams?*

Because headwaters are the most important for water quality protection, they will need to be differentiated from larger streams in order to be assigned the most protective buffers. Conversely, the great numbers of headwater ditches in the southern portion of the watershed (see below), may here require narrower buffers to accommodate development. A consistent method of differentiating headwaters from other waterways can facilitate requiring buffers with different characteristics including width.

One common method of differentiating waterways is to split them between those that normally flow perennially, and those that normally flow intermittently throughout the year. However, rapid determination of a waterways' flow regime as intermittent or perennial is difficult due to great variation in the flow patterns of the upstream drainage network and due to short and long-term changes in weather. Further, topographic maps indicate waterways categorized as perennial or intermittent based on observations that did not correspond well with the category definitions; and this can be a source of confusion. A more consistent and simple approach is to map the drainage network and assign waterways as either headwaters or larger streams based on their position in the drainage network. Unfortunately, many headwaters do not appear on coastal plain topographic maps and soil surveys that are commonly used for resource planning, and thus their protection cannot be ensured from plan review. Accurate, detailed and standardized maps of headwaters should be developed prior to regulation (see Baker et al. 2007) [56]. North Carolina is an example of a state that has undertaken this work, and one such tested method from their coastal plain is included as Appendix 1.

During the mapping process, natural streams should be differentiated from ditches. This can facilitate flexibility for land planners to fill those ditches that will not significantly impact on or off site drainage. Filling of unnecessary ditches will also help to restore stream network hydrology, reduce pollutant transport, and minimize buffer areas.

The Strahler stream order method [57] is suggested for designating headwaters. Using this approach, first order streams have no tributaries. Second order streams start at the confluence of two first order streams. The confluence of two second order streams is a third order stream, and so on. Often, first and second order streams are together designated as headwaters [58, 59].

### *In a Riparian Ecosystem, Where Should the Buffer Begin: From the Edge of the Wetland or the Edge of the Channel?*

Stream channels and their adjacent wetlands are inextricably linked in their natural capacity to filter pollution [60]. Even small streams in the watershed support wetlands. Because coastal plain stream slopes are gradual, channels regularly flood their banks after rains allowing the wetlands to slow and store water and to filter pollutants. Groundwater also discharges laterally into streamside wetlands where it is filtered and this can occur preferentially at the landward edge of the wetland [37]. To fully protect stream channels and their wetlands



buffers should begin from the upland/wetland boundary and not from the channel. Figure 7 illustrates this concept. Buffering from the upland/wetland boundary 1) eliminates a potential source area of excess nutrients that is closest to surface waters, 2) retains any existing forest buffering the wetland 3) provides full protection to wetlands themselves from common residential impacts such as filling, grading, and sediment runoff. Buffering from the channel may not even include the existing streamside wetlands in the buffer area. Former floodplains that have drained and are no longer wetlands but are within stream valleys should also be protected. Providing a buffer around these areas offers the opportunity for future restoration of the water quality functions of the former floodplain [61].

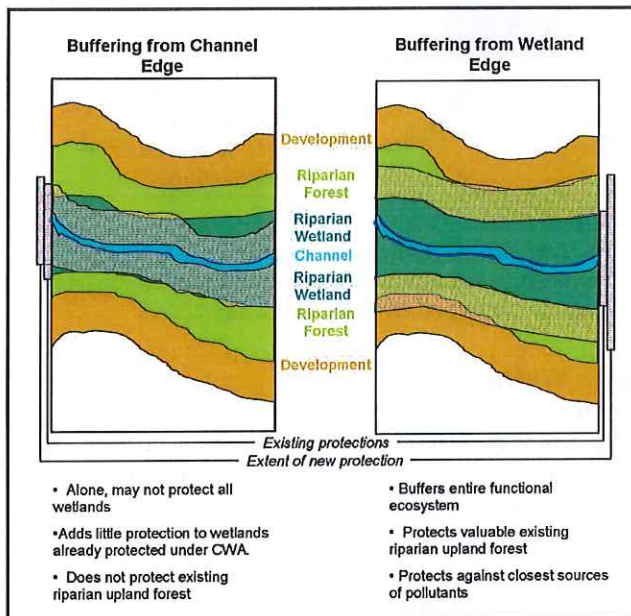


Fig 7. The effect of buffering from channel or wetland edge in riparian areas. CWA = federal Clean Water Act.

### Buffer Vegetation Type

The type of vegetation in a buffer influences the hydrology and nutrient processing capacity of riparian areas. Since most coastal plain streams have no rocks, the roots, logs, and branches of a forest provide the structure that influences how streams flow. Forests hold the sediments of streams in place and provide the coarse and dissolved organic material that helps remove nitrogen.

#### *What Type of Vegetation Reduces the Most Nutrients?*

Studies of this question have focused on the efficiency of native grass versus forested buffers (Figure 8). In general, forests reduce more nitrogen than other buffers [62, 63], but little coastal plain specific information is available. Data from a wide ranging review indicated that, on

average, forested buffers reduced 36% more nitrogen than grassed buffers<sup>3</sup>[29]. This difference may be smaller when corrected for differences in width. Another comprehensive study in the Piedmont found that headwaters with forested buffers had dramatically higher rates of in-stream nitrogen uptake than those without forests in their buffers[64].

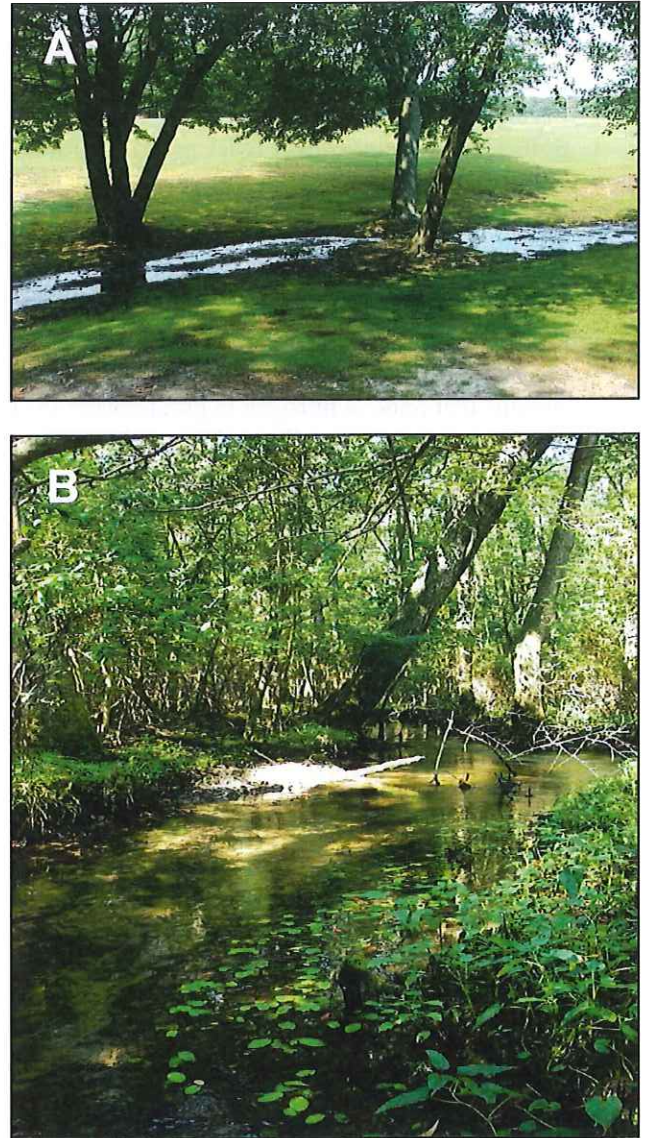


Fig 8. Turfgrass (A) versus forested (B) buffers. Note the differences in complexity, aboveground nutrient storage, and habitat quality.

<sup>3</sup> Forested buffers are the weighted average of forested and forested wetland buffers for 29 studies (mean reduction = 88.8%); grassed buffers were from 22 studies (mean reduction 53.3%).



### Why Do Forested Buffers Reduce more Nutrients than Turf or Grass Buffers?

1. Forests have greater long-term nutrient storage than grass buffers because they have more biomass. Coastal plain riparian forests uptake 11 to 37 pounds of nitrogen and 1.5 to 4.5 pounds of phosphorus per acre each year into their woody biomass [23, 65-67]. This form of nutrient removal and storage capacity is not present in turf or grass buffers.
2. Forests continue increasing their aboveground biomass until about 90 years of age [44] (Figure 9) Root and soil biomass likely continues to increase beyond 90 years.
3. Soil organic matter is over twice as high in forested buffers than grassed buffers, providing more potential for nitrogen removal [44].
4. The presence of an adequate carbon supply [(organic matter)] is the most commonly identified critical factor for nitrogen removal in a riparian area[68].
5. Forested buffers provide well developed zones of organic rich material directly below and adjacent to streams that remove nitrogen in groundwater [63]. These zones can be smaller and sparse in non-forested buffers (Figure 10).
6. The large roots of forest trees provide solid physical structure to stream channels, preventing erosion, slowing water, and increasing water flowpaths (e.g. [69]) which increases nitrogen removal.

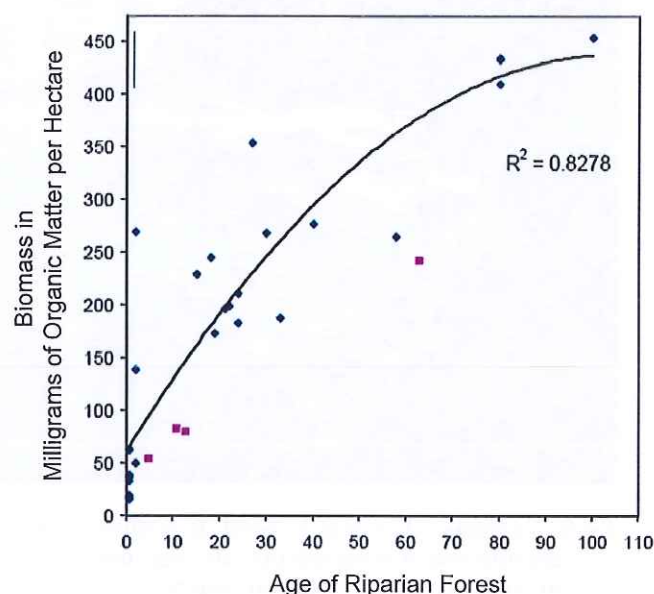


Fig. 9. Increase of headwaters riparian forest biomass with age in the North Carolina Coastal Plain. Blue diamonds are from Brinson et al. 2006 [44] and pink squares are from Giese et al. 2003 [70]. Adapted from Brinson et al. 2006.

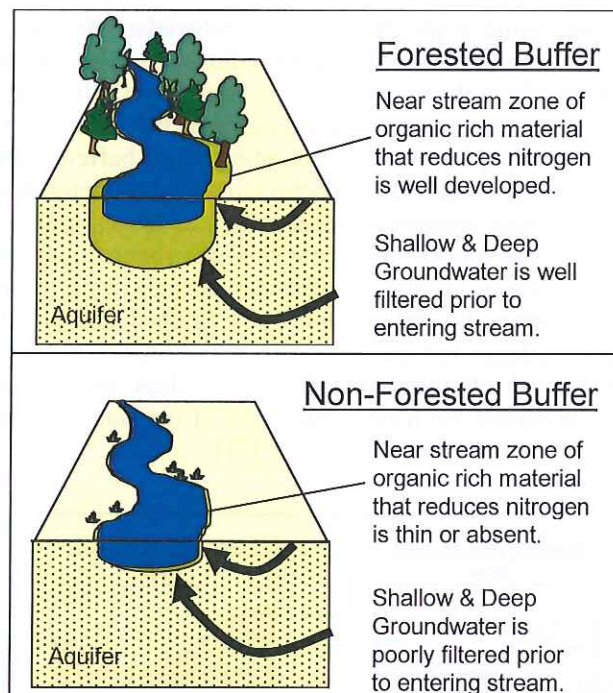


Fig. 10. Differences in the near stream zones nitrogen removal between forested and non-forested riparian buffers. Adapted from Spruill 2000 [63].

### Buffer Width

Next to extent, width is perhaps the most important ecologic and economic characteristic of a buffer system, because it affects both pollutant removal efficiency and where development can or cannot occur. Independent scientific reviews have recommended widths whereby buffers generally meet their potential for removing nitrogen and phosphorus. The recommended widths are consistently around 100 feet (Table 2). However, it is important to note that these and other reviews include studies from around the globe. To reduce the variation resulting from such different areas of the nation and world, studies from the Atlantic Coastal Plain were analyzed separately below.

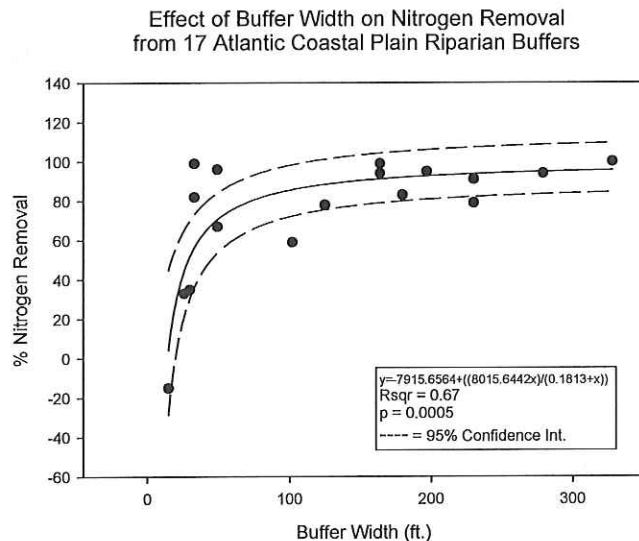
Table 2. Recommended buffer width for water quality protection from scientific reviews.

| Study                                 | Width (ft) | Comments                       |
|---------------------------------------|------------|--------------------------------|
| Environmental Law Institute 2003 [71] | 82         | Recommended minimum width      |
| Schueler & Holland 2000 [72]          | 100        | Typical mean width recommended |
| Christensen 2000 [73]                 | 100        |                                |
| Wenger & Fowler 2000 [74, 75]         | 100        | Recommended minimum            |



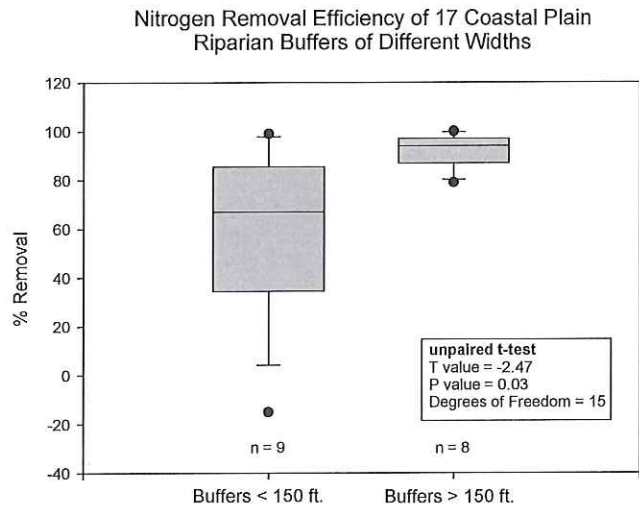
## Nitrogen

Seventeen coastal plain buffer studies were analyzed for the effect of width on nitrogen removal<sup>4</sup>. Most data points were taken from a wider analysis conducted by Mayer et al. 2007[29]. It could not be determined if wetlands were present adjacent to the waterways buffered for many of the studies. It is assumed that some buffers included streamside wetlands while some did not. A single rectangular hyperbola curve demonstrated the best fit to the plotted data. A strong relationship between buffer width and efficiency was found in this analysis that was not observed for Mayer et al.'s wider study ( $R^2 = 0.67$  and  $0.09$  respectively)(Figure 11). The data indicates a point between 80 and 90 feet, where only about a 2% increase in removal efficiency is gained with each additional foot of width. At 80 feet wide, buffers averaged nearly 80% nitrogen removal, with at least 67% removal occurring for most buffers (95% confidence interval lower bound). The data also suggests a threshold of 150 feet and above where buffers more consistently reach their maximum potential for nitrogen removal. Figure 12 shows the significantly greater and less variable nitrogen removal for buffers over 150 feet, here repeating Mayer et al.'s results.



**Fig. 11. Effect of buffer width on nitrogen removal from 17 Atlantic Coastal Plain riparian buffers. Appendix 2 includes a table of study references.**

<sup>4</sup> Buffers adjacent to manure or treatment effluent application were not included in this analysis and one 656 foot wide buffer was not included as its width was an outlier, over twice as the width of the next widest buffer.



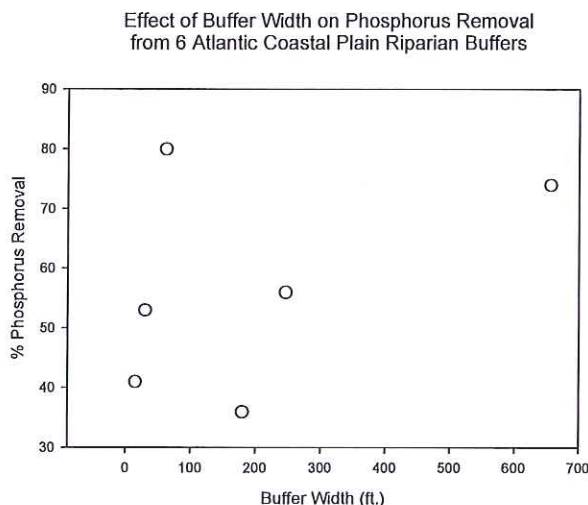
**Figure 12. Nitrogen removal efficiency of 17 coastal plain riparian buffers of different widths. Boxplots lines are the median, 25th percentile, 75th percentile, whiskers are the 10 and 90<sup>th</sup> percentiles, and dots are the outliers of the distributions for buffers less than and greater than 150 feet.**

## Phosphorus

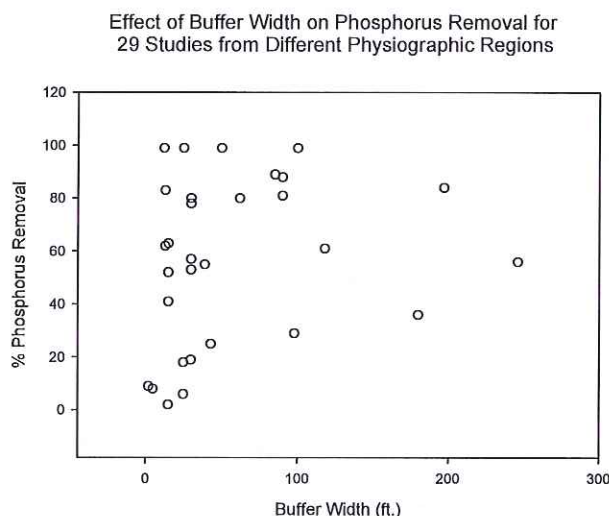
Only six studies comparing buffer width to phosphorus removal were found for the coastal plain. It could not be determined if wetlands were present adjacent to the waterways buffered for many of the studies. It is assumed that some buffers included streamside wetlands while some did not. The few studies precluded determining a relationship (Figure 13). Data from Desbonnet et al.'s [76] review of buffers from multiple regions plus data from two additional studies suggested that phosphorus removal increased with width in a similar but more variable fashion than nitrogen removal. However, this relationship was not found to be statistically significant, and the data are here presented without a trendline ( $y = 10.2 \cdot \ln(\text{buffer width}) + 21.4$ ,  $R^2 = 0.13$ ,  $p = 0.25$ ) (Figure 14).

The data does suggest a threshold where variation in phosphorus removal decreases near 80 feet and buffers more consistently remove high levels of phosphorus. At around 80 feet, removal averaged 66% with around 50% removal occurring for most buffers (lower 95% confidence interval of the above regression). It is likely that for this wide array of studies, width has a small effect on phosphorus retention relative to other factors.





**Figure 13. Effect of buffer width on phosphorus removal from 6 Atlantic Coastal Plain riparian buffers. Appendix 2 includes a table of study references.**



**Figure 14. The relationship between riparian buffer width and phosphorus removal for many study regions. Data from Desbonnet et al. 1994 [76] and two additional studies cited in Appendix 2.**

*What is the absolute minimum recommended width for a buffer allowed to vary in thickness along the length of a single waterway?*

A variable width buffer of a specified average width that is along a single water feature should be assigned an absolute minimum width at any one point that is able to maintain pollution removal. Below this minimum width, it is assumed that buffer function may become significantly reduced or overwhelmed by sediment inputs or invasive species. However, no known empirical studies exist on minimum sustainable widths. One recent review

commented that little experimental evidence is available for the efficiency of narrow buffers [77]. The Chesapeake Bay Program cited an absolute minimum buffer width of 35 feet to provide sustainable protection of aquatic resources [78]. Wenger recommended an absolute minimum width of 30 feet for trapping sediment [74].

#### *Variable versus Fixed Width Buffers*

Variable and fixed width buffer systems each have their own environmental and regulatory pros and cons. Buffers of a sufficient fixed width provide simplicity and consistency for regulatory purposes and have been shown to be more efficient at controlling pollution, but provide less flexibility for siting homes in a development. On the other hand, variable width buffers are likely to require more effort for accurate regulatory review, inspection and enforcement; and should do less to control pollution, but can provide more flexibility for home siting. However, variable width buffers, if implemented with regards to watershed and site-level differences in hydrogeology, can attempt to maximize pollution removal efficiency and maintain flexibility for development.

#### *Why are Variable Width Buffers Less Effective?*

Weller et al. modelled how the efficiency of buffers changed between variable and fixed width systems [40]. Variable width buffers remove lower levels of pollutants than fixed width buffers of equivalent average width. This is so because areas of narrow or absent buffers contribute relatively high levels of pollution. The extra pollutant discharge from below average width buffers is more than the extra pollutant retention from above average width buffers. So to reduce the same amount of pollutants a variable width buffer must be wider on average than a fixed width buffer. The difference in removal between fixed width and variable width buffers was greatest for narrow buffers. The amount by which variable width buffers contribute more pollution changed with the quality of the buffer, based on a factor such as vegetation type. Work in Wisconsin also suggested that uniform buffers are more important for phosphorus removal [79].

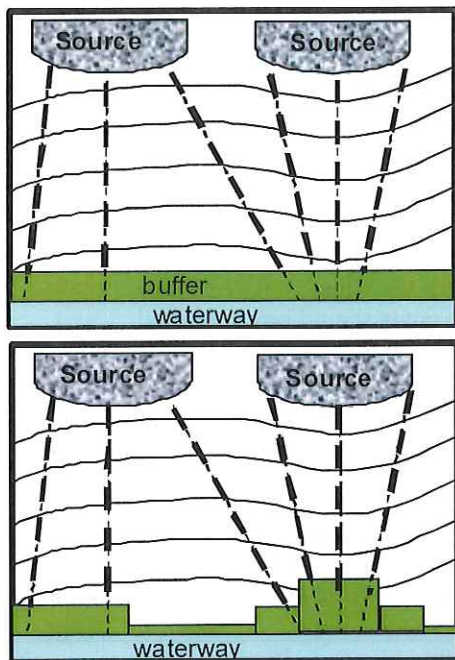
The importance of minimizing gaps in buffers and inefficient buffer widths has been repeated elsewhere. To the extent that the minimum effective buffer width is maintained, it is more effective to have continuous but narrow riparian buffers, than wider but discontinuous buffers [40, 61]. David Correll, also of the Smithsonian Environmental Research Center, remarked after a career studying riparian zones that, "Perhaps the most important guiding principles to emerge from the current scientific literature that should be considered when implementing riparian setback regulations are: (1) The importance of contiguity in riparian protection and (2) The great value



and importance of protecting the least disturbed riparian corridors in communities[80].”

*What can be done to Maximize the Effectiveness of Variable Width Buffers?*

At the watershed level, minimum buffer widths can be assigned based on the characteristics of different parts of the watershed (see The Two Regions of the Watershed and What they Mean for Riparian Buffer Width). At the site level, buffers can be planned using precision information [81]. This approach uses topographic, hydrologic, soils, and landuse information to maximize the effectiveness and efficiency of buffers on a site. Pollutants may enter waterways through compromised buffers or preferential flow paths. The precision approach can enhance buffers on a site by placing more buffer in these areas. In a simple example, buffers are widest along waterways where surface and subsurface drainage patterns route a large fraction of pollutants. Figure 15 compares the fixed width buffer approach with the variable width precision approach. Soils information, specific pollutant source location, and on site groundwater flow studies can be applied to increase the precision of buffer placement. In concert with an overall minimum buffer width and a policy of eliminating gaps this is an effective and flexible approach, but one that requires detailed study of certain site characteristics.



**Figure 15. A comparison of two approaches to buffer width: fixed at top and precision variable width at bottom. Relatively large sources of pollutants concentrate their discharge to waterways across topographic contours. Adapted from Dossekey et al. 2005[81].**

**The Two Regions of the Watershed and What they Mean for Riparian Buffer Width**

The geology, hydrology and resulting patterns of landuse differ between the northern and southern areas of the watershed. These areas have been previously defined as hydrogeomorphic regions by the USGS [33], and their regions are simplified and presented here for the purposes of a buffer strategy [33]<sup>5</sup> (Figure 16). The differences between these regions are summarized in Table 3. The northern region or the Well Drained Region has a gently rolling topography, soils that are well drained and low in organic matter, and few ditches. The southern region or the, Poorly Drained Region, is relatively flat, has higher water tables, less permeable soils with high organic matter content, and many ditches. From a buffering perspective, this would suggest that the capacity of buffers to treat groundwater would be higher in the Poorly Drained Region and perhaps could justify a smaller minimum buffer width. This is so because the low-permeability, highly organic soils provide longer residence times in the near surface area of buffers where nitrogen removal is high [82].

**Table 3. Relative characteristics of two simplified hydrogeomorphic regions of the Inland Bays Watershed.**

| Characteristic  | Well Drained Region | Poorly Drained Region |
|---|---------------------|-----------------------|
| Topography  | Very gently rolling | Flat                  |
| Riparian Slope  | Steeper             | More gradual          |
| Water table   | Lower               | High                  |
| Groundwater flow  | Rapid               | Slower                |
| Soil Permeability   | High                | Low                   |
| Soil Organic Matter   | Low                 | High                  |
| Drainage Ditch Density  | Low                 | Very High             |
| Wetlands Area   | Low                 | High                  |
| Subsurface Confining Areas                                    | Few                 | More                  |
| Potential for Groundwater Nitrogen Removal by Buffers[33, 82] | Medium              | High                  |

<sup>5</sup> Well Drained Uplands is mostly well-drained upland with some poorly drained upland and coastal wetland and beach region from the USGS categorization. Poorly Drained Lowlands is mostly surficial confined with some poorly drained lowland and coastal wetland and beach regions from the USGS.



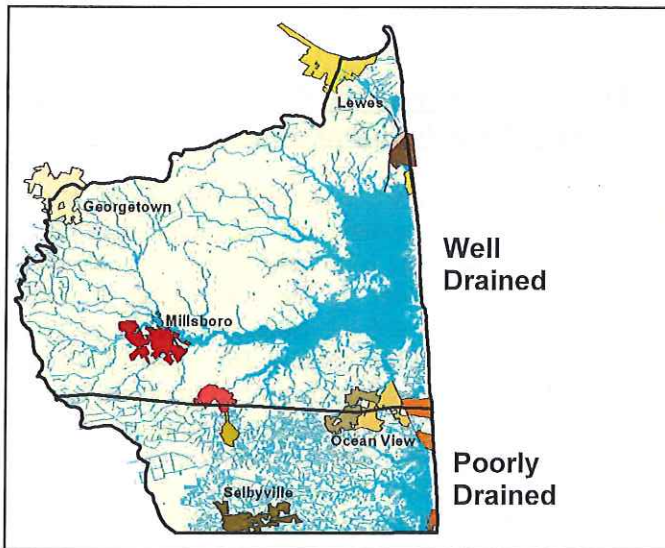


Figure 16. The two simplified hydrogeomorphic regions of the Inland Bays watershed. Water features are in blue. Note the differences in drainage density between the two regions.

### Tidal Wetlands & Waters

Tidal wetlands have a great capacity to remove nitrogen inputs [83] and can do so even when their width is narrow. As much as 75% of the nitrogen from the Rehoboth Bay watershed moves as groundwater that regularly discharges near and within tidal wetlands [32, 84]. This supports the buffering of all tidal wetlands. Tidal wetlands and waters require special concern for buffering because they migrate inland with sea level rise, reducing the width of their buffers over time. Once migrating marshes meet development, homeowners will protect their property by raising or armoring the upland-wetland interface, if this was not already done during site preparation. At this point, inland migration slows or generally stops but moderate to rapid erosion [85 and references therein] of the bayward edge continues, resulting in the wetlands eventually being "pinched out" of existence. This places the maintenance of tidal wetlands under extraordinary pressure from development because their existence in the absence of continual restorative efforts depends upon inland migration. Development already permitted around the Bays with absent or narrow buffers will contribute to an eventual large scale loss of wetland resources. Requiring buffers of widths that accommodate long-term wetland migration will protect remaining areas of these existing biofilters for the long-term. Buffers of tidal wetlands are also essential to protecting critical fish and bird nursery habitat, carbon storage and sequestration capacity, and other functions that support the health of the Inland Bays.

### *How Wide Should Buffers of Tidal Areas Be?*

Buffers of tidal areas should maximize nutrient removal and allow their inland migration. Given typical resource management planning horizons of 50 to 100 years, wetland migration rates will primarily determine the width of buffers on tidal areas. Rates of migration are primarily controlled by the slope of the upland-wetland interface, with more gradual slopes resulting in greater rates. Inland Bays specific rates of migration are presented as Table 4 [85].

Table 4. Average landward migration rates of tidal wetlands in feet per year by adjacent upland slope from 1944-1989. Gradual Slope =  $<0.08$  rise/run, Steep Slope =  $>0.09$  rise/run. Valley Axis refers to tidal creeks. [85 page 131].

| Slope of Wetland-Upland Interface | Indian River Bay | Rehoboth Bay |
|-----------------------------------|------------------|--------------|
| Gradual                           | 5.25             | 6.07         |
| Steep                             | 1.44             | 0.82         |
| Valley Axis                       | 16.40            | 4.56         |

The rates were used to calculate upland buffer widths that can be reasonably assumed to protect wetlands for different planning horizons (Table 5). After the number of years indicated, the average wetland is assumed to have fully migrated over the buffer. Over the time horizons, upland buffers are assumed to lose some effectiveness as their width decreases. No empirical data could be found to quantify these decreases in effectiveness. The data used to develop the presented widths are likely conservative, such that the increase in tidal amplitudes of the Bays since the period of analysis and predicted increases in rates sea level rise were not accounted for. These factors suggest that actual rates of migration may now be greater and could continue to increase, and thus selection of wider buffer widths relative to planning horizon goals should be considered.

Table 5. Average number of years upland buffers of different widths and slopes will provide protection to tidal wetlands or waters. Gradual Slope =  $<0.08$  rise/run, Steep Slope =  $>0.09$  rise/run.

| Upland Buffer Width | Indian River Bay |             | Rehoboth Bay  |             |
|---------------------|------------------|-------------|---------------|-------------|
|                     | Gradual Slope    | Steep Slope | Gradual Slope | Steep Slope |
| 50'                 | 10               | 35          | 8             | 61          |
| 75'                 | 14               | 52          | 12            | 91          |
| 100'                | 19               | 69          | 17            | 122         |
| 200'                | 38               | 139         | 33            | 244         |
| 300'                | 57               | 208         | 49            | 366         |
| 400'                | 76               | 278         | 66            | 488         |
| 500'                | 95               | 347         | 82            | 610         |



It is recommended that buffers of freshwater flats wetlands adjacent to tidal wetlands should be assigned buffer widths based on the estimated rate of migration of the tidal wetlands. Additionally, because the influence of tides rapidly moves upstream as sea level rises, a length of freshwater stream that is adjacently upstream to a tidal stream should be afforded buffer widths equal to those of buffers of tidal waters. This should apply to a length of these freshwater streams that is equal to the length that tidal influence will encroach over a determined planning horizon. Appendix 3 explains the methodology used to develop tidal buffer width recommendations in more detail.

#### *How Can Viewscapes Across Tidal Areas be Provided in Buffers?*

The demand for residential viewscapes across tidal areas suggests that the recommended requirement of forested buffers be refined. Views would likely not be possible across the wide forested buffers recommended above. Only requiring forested vegetation nearest to the upland wetland/waterway boundary would allow for viewscapes. To maximize the efficiency of the buffer, the forested zone should be as wide as possible while still allowing acceptable views. The 80 foot buffer width for nontidal waterways and riparian wetlands is recommended as minimum forested width for wide buffers of tidal areas. Management could enhance selected view corridors while allowing denser forest in other sections. Evidence suggests that such management would have little effect on at least subsurface nitrate processing [86]. In wide buffers, non-permanent landuse and structures could be located further landward from the buffered feature. A management plan could require tree planting in the non-forested part of the buffer relative to the rate of estimated landward migration of the wetland.



**Figure 17.** Example of maintained forested buffer that provides a viewcape onto White's Creek and its marshes (photo taken in early spring).

#### **Freshwater Flats and Depressional Wetlands**

No research could be found that specifically recommended a minimum buffer width to protect the water quality functions of freshwater flats and depressional wetlands. However, it has been documented that the direct and indirect impacts of development and deforestation near a wetland can cause irreversible changes to its hydrology and species composition [87, 88]. Development also leads to increased nutrient loading of wetlands [89]. Together these impacts may result in changes to the nutrient processing capacity of wetlands. Wetlands can "dry out" and their capacity for nitrogen removal can decrease, or they can become wetter, reducing their capacity to store hydrologic inputs [87, 90]. Requiring forested buffers will likely provide greater protection from these impacts than non-forested buffers and remains consistent with the recommendations for other buffer types. More study is needed to better define effective water quality buffer widths for these wetland types. It is more or less arbitrarily recommended that 50-foot and 100-foot buffers be required for these wetland types.

#### **Restoration and Management**

Restoration of riparian networks has become a focus water quality improvement efforts. Passive reforestation of buffers within developments is one form of riparian restoration. Opportunities also exist for the accelerated reforestation of buffers at development. Requirements or incentives could be developed that encourage planting of native forest species especially in areas where a native forest is not adjacent to the buffer. Planting buffers provides opportunities to increase stewardship within these areas and accelerates the restoration of water quality functions. A few coastal plain studies have shown increased pollutant removal by buffers shortly after restoration. One buffer was increased from 30 to 98 feet resulting in nitrate removal efficiencies from shallow groundwater increasing from an average 44% to 94% [91]. A mass balance study of another restored riparian wetland showed that within the first 8 years following restoration the buffer was highly effective at reducing nitrogen and phosphorus loads [36]. On average, restored buffers appear to have a substantial effect on nitrate removal within 5 – 10 years [82].

Requiring buffers at the development poses an temporary opportunity to implement physical restoration activities within degraded waterways. After development, opportunities to access sites with heavy equipment decline. Further incentives and cost-share agreements should be formulated to take advantage of this opportunity



by encouraging developers to cooperatively plan and implement restoration with public and private restoration practitioners. Restoration techniques including controlled drainage, check dams, addition of logs, channel reformation, and controlled beaver population introduction can complement the water quality functions of buffers.

### **Recommendations**

The following recommendations for the characteristics of a buffer system are based on the above review of the scientific literature. This first set applies to the entire buffer system and is critical to maximizing the pollution removal potential of buffers and ensuring their implementation.

1. All wetlands and waterways have high potential to filter significant amounts of nutrients and should be buffered, where feasible, for all new subdivisions and redevelopments.
2. Headwaters and those existing natural waterways and wetlands that are in the best ecological condition should receive the most protective buffers.
3. Governments should encourage alternative site designs to ensure implementation of the buffer systems.
4. A variance procedure should be developed to resolve rare instances where buffer requirements may preclude development of a property, especially for small subdivisions.
5. Buffers should begin at the upland edge of streamside wetlands where they are present.
6. Forested riparian buffers provide greater potential for long-term improvement and protection of water quality than non-forested buffers and should be the required vegetation type for all buffers<sup>6</sup>.
7. Filling of minor drainage ditches or their incorporation into stormwater management during development should be encouraged where adequate drainage can be maintained especially in the southern portion of the watershed.
8. Where forested buffers are required but do not exist, restoration of native vegetation (typically native hardwood or mixed-pine hardwood forest) should occur.
9. Only water dependent structures and necessary public utilities should be allowed in the buffer zone. Stormwater control features in the buffer should be limited to necessary conveyances and outfalls.
10. New incentives and cost-share agreements should be explored and existing programs promoted to encourage developers to cooperatively plan and

implement restoration of degraded wetlands and waterways with restoration practitioners.

The second set of recommendations is for two alternative buffer systems with different levels of protection based on vegetation type and width (Table 6). Alternatives were developed to offer flexibility for developing the Pollution Control Strategy and can be used to incorporate incentives. For example, the first level of protection could be required by regulation, while the higher level of protection could be pursued voluntarily in conjunction with incentives such as faster development permit review. The adequate protection alternative provides around 80% and 66% removal for nitrogen and phosphorus respectively, protects tidal wetlands for approximately 50 – 70 years, and provides 50 foot buffers to flats and depressional wetlands. The optimum protection alternative increases nitrogen and phosphorus removal by about 8%, and provides greater certainty that waterway buffers maximize their pollution removal efficiency. It also protects tidal wetlands for approximately 88 - 132 years, provides 100 foot buffers for flats and depressional wetlands, and provides increased protection of other important wetland and waterway functions. The optimum protection alternative is most consistent with the goals of the Inland Bays CCMP.

### **Development Analysis**

#### *Abstract*

A watershed-level GIS analysis explored the dimensions of the recommended buffer systems on 11 randomly selected developments listed by the State of Delaware's Preliminary Landuse Service between February 2004 and January 2007. The percentage of developable acreage as buffer varied widely and averaged 13.8% and 33.2% for the adequate and optimum protection alternatives. Estimates are likely high due to the scale of the analysis. Developments that are small, that are in the Poorly Drained Region, and/or that have tidal wetlands by gradually sloping uplands will have larger buffer areas. The total buffer acreage was evenly distributed between buffers on ditches, freshwater wetlands, and tidal areas. Ditches made up almost all of the freshwater waterway length. Requiring narrower buffers ( $\geq 35$  feet) on shallow ditches (~2 – 3 feet deep) can provide the flexibility needed by developers to site homes and more adequately buffer natural wetlands and waterways. Buffers on most developments can be accommodated within current County open space requirements. Ordinances and incentives that facilitate development site designs to accommodate buffers are likely critical for implementing these recommendations in the Inland Bays watershed.

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<sup>6</sup> Only the areas of buffer within a set distance closest to a tidal feature should be required to be forested (see a).



**Table 6. Alternative buffers systems for the Inland Bays watershed with different levels of resource protection. Years next to tidal wetland and waters widths indicate average number of years buffer will provide protection. Notes below indicate estimates of nutrient removal associated with widths.**

| Buffer System Characteristic           | Adequate Protection Alternative | Optimum Protection Alternative |
|--|---------------------------------|--------------------------------|
| Buffer Width Variation                 | Variable Width                  | Fixed Width                    |
| Vegetation Type                        | Dominance of Native Forest†     | All Native Forest†             |
| <u>Buffer Width by Type</u>            |                                 |                                |
| <i>Tidal Wetlands &amp; Waters</i>     |                                 |                                |
| Gradual Upland/Wetland Boundary        | 300 feet (53 yrs)               | 500 feet (88 yrs)              |
| Steep Upland/Wetland Boundary          | 80 feet (71 yrs)                | 150 feet (132 yrs)             |
| <i>Nontidal Wetlands and Waterways</i> |                                 |                                |
| Flats and Depressional Wetlands        | 50 feet                         | 100 feet                       |
| Riparian Wetlands                      | 80 feet††                       | 150 feet†††                    |
| Headwaters Streams & Ditches           | 80 feet††                       | 150 feet†††                    |
| Larger Streams & Ditches               | 80 feet††                       | 150 feet†††                    |

† See Tidal Wetlands & Waters section for elaboration on a recommended vegetation type for these buffers.

†† Estimated 82% nitrogen removal on average with at least 67% removal for most buffers. 66% phosphorus removal on average with more variability.

††† Estimated 90% nitrogen removal on average with at least 78% removal for most buffers. 73% phosphorus removal on average with less variability

## Methods

A detailed GIS workflow with data sources is attached as Appendix 4 to supplement the general methodology presented here. A shapefile of developments that were submitted to the State's Preliminary Land Use Service (PLUS) from February 2004 to January 2007 were clipped to the Inland Bays Watershed using ArcView 3.2 GIS software. Three or four small developments (under the median acreage of the distribution) and 2 large developments (over the 75th percentile of acreage) were randomly selected from the northern and southern regions of the watershed. For each development, the Delaware State Wetlands Mapping Project layer and a detailed hydrography layer were used to determine the dimensions of wetlands and waterways onsite and offsite whose buffers might intersect the development. Due to the scale of the analysis, the hydrography layer was not updated to include unmapped headwaters and ditches. Ditches were separated from natural waterways. Length of ditches totally within wetlands were not recorded but length of ditches on wetland boundaries were recorded. Ditches were considered to be minor when they had small drainage areas. Minor ditches were evaluated to determine if they were fillable or otherwise able to be disconnected from the drainage network without causing drainage problems upstream. The slope of uplands adjacent to tidal wetlands was estimated as gradual or steep using both hypsography data layers derived from the most recent USGS topographic maps and best professional judgement. LIDAR derived elevation data available for

the study area would provide much more accurate estimates but could not be used for this study.

Both protection alternatives were applied to the developments. Areas isolated by buffers such that development was unlikely were recorded. Large isolated areas were assumed buildable with access roads permitted through the buffer. The percent of the developable acreage each buffer alternative would take up was calculated. The contributions to total buffer acreage from buffers of different wetland and waterway types were calculated. The amount of buffer acreage to be restored to forest was determined using the 2002 State landuse data layers. For tidal buffers, only the first 80 or 150 feet from the water or wetland boundary was considered to be required to be restored for the adequate and optimum alternatives respectively. These widths were selected to correspond to efficient widths chosen for non-tidal waterways of the two protection alternatives. Statistics were compiled by development size and hydrogeomorphic region.

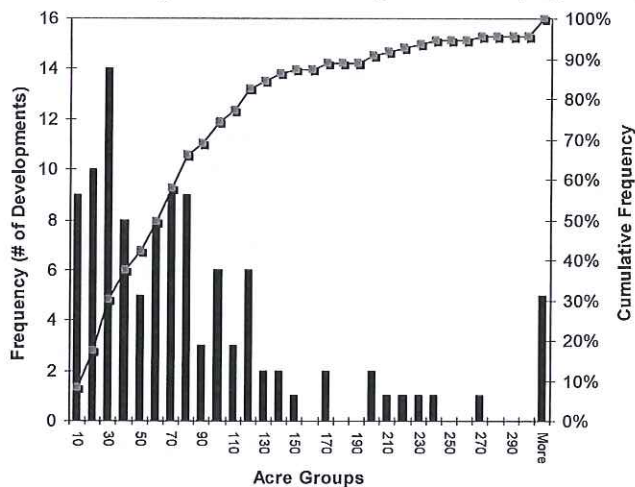
## Results

**GIS Data Layer Accuracy.** The hydrography and wetlands data layers demonstrated errors that likely resulted in inflated estimates of buffer acreage on developments. These errors resulted from incorrect mapping of waterways near property boundaries, the over-mapping of freshwater wetlands (inherent to the SWMP data layer), and the assumption that no wetlands would be



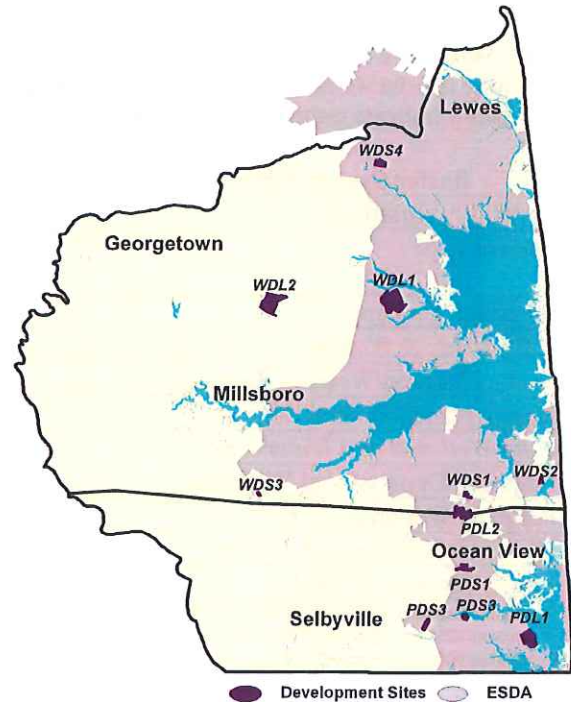
filled. Furthermore, the extent of tidal wetlands by gradually sloping uplands was likely overestimated.

**Development Distribution.** One hundred and ten developments in the watershed were recorded by the PLUS for the roughly two years of available data. The distribution of development size is depicted as a histogram in Figure 18. The median development size was 61 acres. The 25<sup>th</sup> and 75<sup>th</sup> percentiles were 25 and 106 acres respectively. Nine of the eleven developments (82%) randomly selected for study were located in the Environmentally Sensitive Development Area (Figure 19).



**Figure 18. Histogram of development size with cumulative frequency for developments proposed in the Inland Bays watershed from February 2004 to January 2007.**

**Development Characteristics.** Dimensions of the 11 developments, their waterways and wetlands, and their buffers by protection alternative are presented individually as color maps and tables on page 23 to page 33. Appendix 5 contains complete summary tables for the analysis. Site characteristics are summarized in Table 7. The percentage of a site as wetlands had a median value of 12% and ranged from 0% to 67%. Non-tidal wetlands dominated the wetland acreage, and only three sites had tidal wetlands. The percent developable acreage prior to buffering had a median value of 88% and ranged from 33 to 100% of a site. Total waterway length was highly variable and ranged from 0 to 3,362 feet with a mean of 1,615 feet. Only one site had a natural stream so almost all waterway length was of ditches. About half of the ditches (51%) were considered minor ditches. About half of these minor ditches (45%) were considered fillable or otherwise able to be disconnected from the drainage network so that they did not require buffers. A number of developments required buffers of features on adjacent properties.



**Figure 19. Location of PLUS application development sites analyzed showing the Environmentally Sensitive Development Area (ESDA).**

Sites in the Poorly Drained Region had more ditches and more nontidal wetlands than sites in the Well Drained Region (means = 2,220 feet vs. 805 feet and 10.1 acres vs. 3.3 acres, respectively) (Table 8). As a result, the percent developable acreage of sites in the Poorly Drained Region (68%) was less than in the Well Drained Region (89%). Ditch density was surprisingly similar between regions (means = 65.3 and 70.0 respectively)<sup>7</sup>, but much higher in smaller (98.3) than larger developments (14.8). (Appendix 5 & Table 9).

**Table 7. Site characteristics for eleven study developments.**

| Site Characteristics  | Min | Max    | Mean   | Median |
|-----------------------|-----|--------|--------|--------|
| Site Acreage          | 8.7 | 314.0  | 94.0   | 50.2   |
| Total Wetland Acreage | 0.0 | 99.7   | 14.9   | 4.0    |
| Nontidal Wetlands     | 0.0 | 16.4   | 6.4    | 3.2    |
| Tidal Wetlands        | 0.0 | 88.9   | 8.5    | 0.0    |
| Developable Acreage   | 8.7 | 308.7  | 79.0   | 37.1   |
| Waterway length (ft)  | 0.0 | 3362.0 | 1615.0 | 1653.0 |
| Stream Length         | 0.0 | 150.0  | 30.0   | 0.0    |
| Ditch Length          | 0.0 | 3362.0 | 1448.7 | 1562.0 |
| Minor Ditch Length    | 0.0 | 2996.0 | 979.1  | 681.0  |
| Fillable Ditch Length | 0.0 | 1993.0 | 615.8  | 799.0  |

<sup>7</sup> Calculating this including wetlands, where many ditches occur, showed a much greater ditch density in the Poorly Drained Region as expected.



# Windhurst Manor

Small Residential Development in the Well Drained Region

WDS1



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 23.7   |
| Total Wetland Acreage | 2.8    |
| Nontidal Wetlands     | 2.8    |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 20.9   |
| Waterway length (ft)  | 1915.5 |
| Stream Length         | 0.0    |
| Ditch Length          | 1915.5 |
| Minor Ditch Length    | 0.0    |
| Fillable Ditch Length | 0.0    |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 4.7      | 7.1     |
| Ac. on Ditches                   | 2.9      | 5.9     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 3.4      | 4.1     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.0      | 0.0     |
| Ac. Overlapping Buffers          | 1.6      | 2.9     |
| Developable Acreage With Buffer  | 16.2     | 13.8    |
| % Developable Acreage as Buffer  | 22.5     | 34.0    |
| Acreage of Buffer to be Restored | 0.0      | 0.0     |



- Development Outline
- Tidal Waters
- Stream
- - - Filled Ditch
- - - Ditch

- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer

- Tidal Buffer
- Areas isolated by buffer



# Bethany Woods

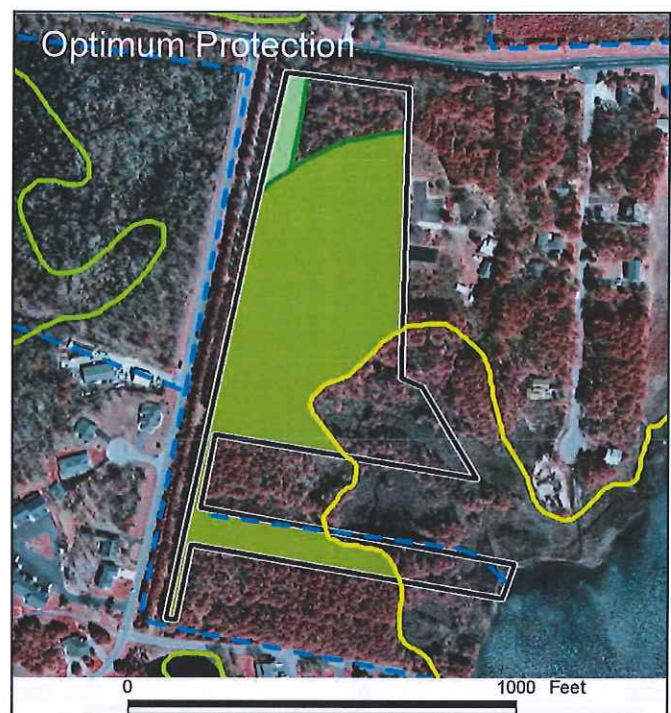
Small Residential Development in the Well Drained Region

WDS2



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 11.6   |
| Total Wetland Acreage | 2.5    |
| Nontidal Wetlands     | 0.0    |
| Tidal Wetlands        | 2.5    |
| Developable Acreage   | 9.1    |
| Waterway length (ft)  | 2371.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 1562.0 |
| Minor Ditch Length    | 809.0  |
| Fillable Ditch Length | 809.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 5.5      | 8.1     |
| Ac. on Ditches                   | 0.1      | 1.9     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 0.0      | 0.0     |
| Ac. on Tidal Wetlands            | 5.2      | 7.7     |
| Ac. Confined by Buffer           | 0.2      | 0.0     |
| Ac. Overlapping Buffers          | 0.1      | 1.5     |
| Developable Acreage With Buffer  | 3.4      | 1.0     |
| % Developable Acreage as Buffer  | 60.6     | 89.0    |
| Acreage of Buffer to be Restored | 0.0      | 0.0     |





# Savannah Square

Small Commercial Development in the Well Drained Region

WDS3



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 8.7    |
| Total Wetland Acreage | 0.0    |
| Nontidal Wetlands     | 0.0    |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 8.7    |
| Waterway length (ft)  | 1358.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 1358.0 |
| Minor Ditch Length    | 1040.0 |
| Fillable Ditch Length | 1040.0 |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 0.6      | 1.4     |
| Ac. on Ditches                   | 0.6      | 1.4     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 0.0      | 0.0     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.0      | 0.0     |
| Ac. Overlapping Buffers          | 0.0      | 0.0     |
| Developable Acreage With Buffer  | 8.1      | 7.3     |
| % Developable Acreage as Buffer  | 6.7      | 16.1    |
| Acreage of Buffer to be Restored | 0.6      | 1.4     |



- Development Outline
- Tidal Waters
- Freshwater Stream
- - - Filled Ditch
- - - Ditch

- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer

- Tidal Buffer
- Areas isolated by buffer



# Land of Givens

## Small Residential Development in the Well Drained Region

WDS4



| Site Characteristics  |      |
|-----------------------|------|
| Site Acreage          | 50.2 |
| Total Wetland Acreage | 12.9 |
| Nontidal Wetlands     | 12.9 |
| Tidal Wetlands        | 0.0  |
| Developable Acreage   | 37.1 |
| Waterway length (ft)  | 0.0  |
| Stream Length         | 0.0  |
| Ditch Length          | 0.0  |
| Minor Ditch Length    | 0.0  |
| Fillable Ditch Length | 0.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 5.1      | 12.3    |
| Ac. on Ditches                   | 0.0      | 0.0     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 5.1      | 10.0    |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.0      | 2.3     |
| Ac. Overlapping Buffers          | 0.0      | 0.0     |
| Developable Acreage With Buffer  | 32.0     | 24.8    |
| % Developable Acreage as Buffer  | 13.8     | 33.2    |
| Acreage of Buffer to be Restored | 1.8      | 4.4     |

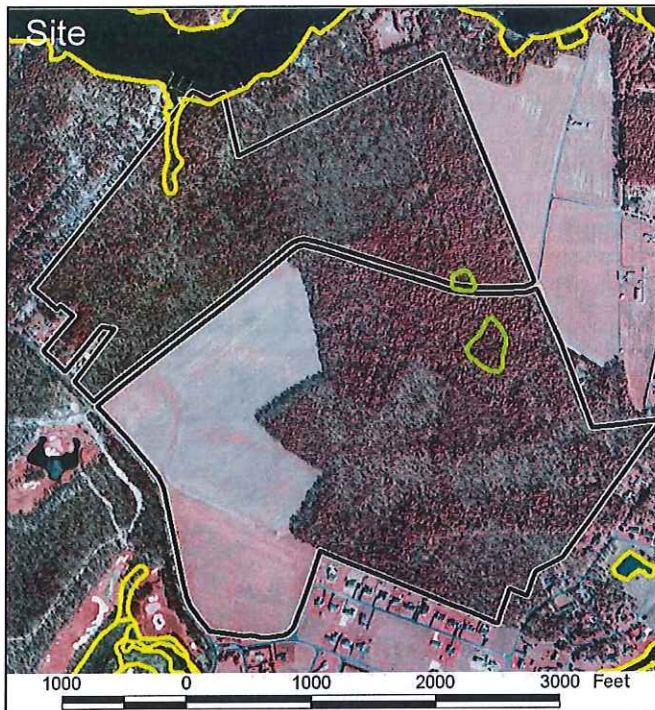




# Bridlewood

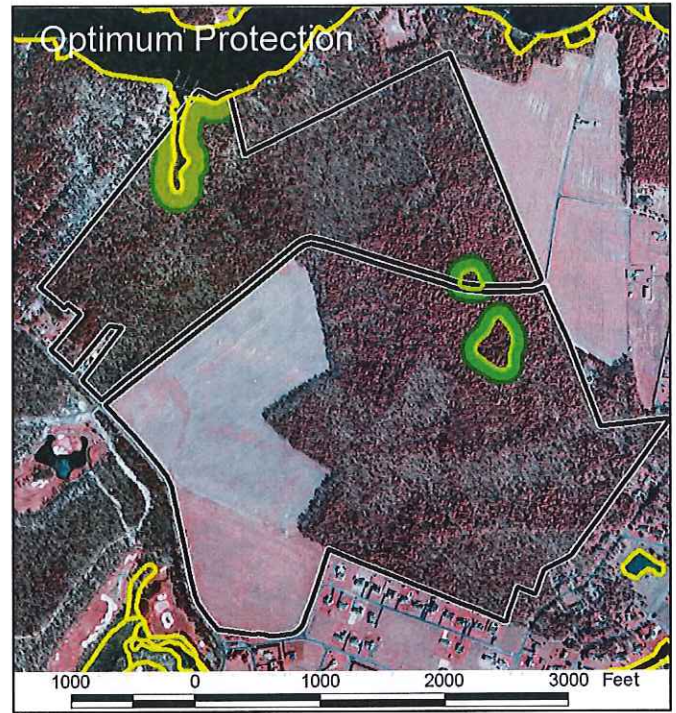
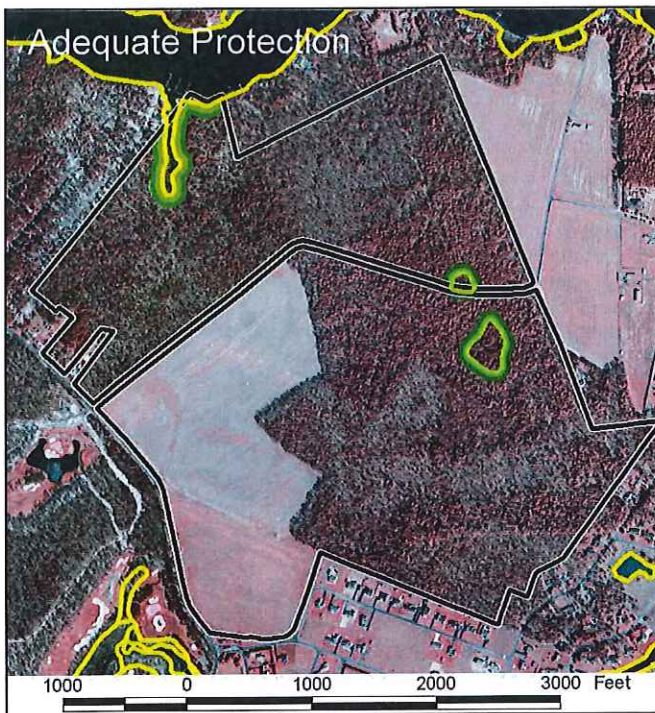
## Large Residential Development in the Well Drained Region

WDL1



| Site Characteristics  |       |
|-----------------------|-------|
| Site Acreage          | 314.0 |
| Total Wetland Acreage | 4.0   |
| Nontidal Wetlands     | 2.5   |
| Tidal Wetlands        | 1.5   |
| Developable Acreage   | 308.7 |
| Waterway length (ft)  | 0.0   |
| Stream Length         | 0.0   |
| Ditch Length          | 0.0   |
| Minor Ditch Length    | 0.0   |
| Fillable Ditch Length | 0.0   |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 5.7      | 11.5    |
| Ac. on Ditches                   | 0.0      | 0.0     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 2.1      | 5.0     |
| Ac. on Tidal Wetlands            | 3.6      | 6.5     |
| Ac. Confined by Buffer           | 0.0      | 0.0     |
| Ac. Overlapping Buffers          | 0.0      | 0.0     |
| Developable Acreage With Buffer  | 303.1    | 297.2   |
| % Developable Acreage as Buffer  | 1.8      | 3.7     |
| Acreage of Buffer to be Restored | 0.0      | 0.0     |



- Development Outline
- Tidal Waters
- Stream
- Filled Ditch
- Ditch
- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer
- Tidal Buffer
- Areas isolated by buffer



# Avebury

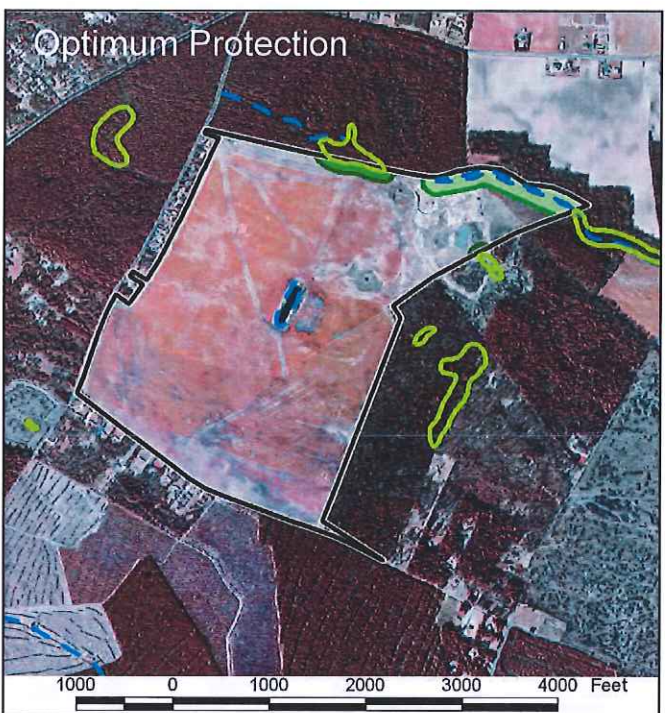
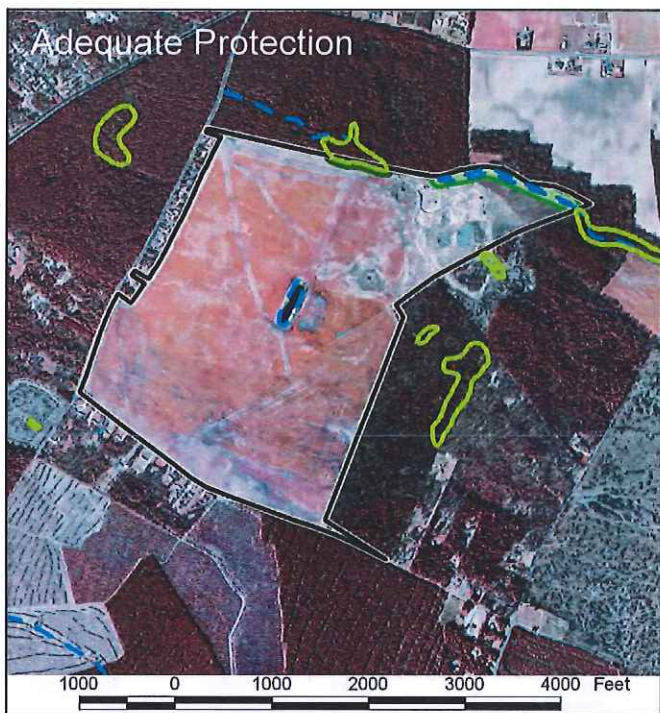
## Large Residential Development in the Well Drained Region

WDL2



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 32.9   |
| Total Wetland Acreage | 16.4   |
| Nontidal Wetlands     | 16.4   |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 16.5   |
| Waterway length (ft)  | 2851.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 2851.0 |
| Minor Ditch Length    | 2291.0 |
| Fillable Ditch Length | 990.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 8.5      | 12.1    |
| Ac. on Ditches                   | 5.4      | 8.3     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 3.3      | 4.7     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.4      | 0.0     |
| Ac. Overlapping Buffers          | 0.6      | 0.9     |
| Developable Acreage With Buffer  | 8.0      | 4.4     |
| % Developable Acreage as Buffer  | 51.5     | 73.3    |
| Acreage of Buffer to be Restored | 6.9      | 7.6     |



- Development Outline
- Tidal Waters
- Freshwater Stream
- - - Filled Ditch
- - - Ditch
- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer
- Tidal Buffer
- ▨ Areas isolated by buffer



# The Woodlands

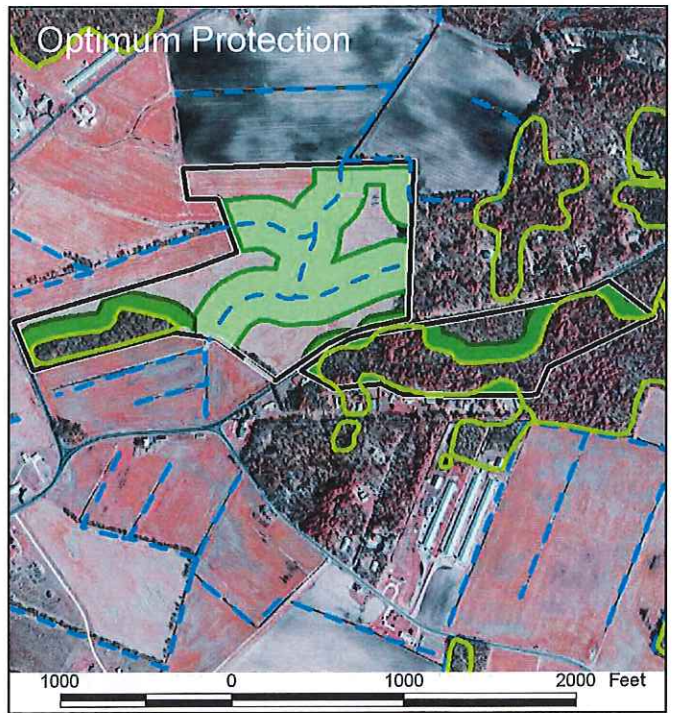
## Small Residential Development in the Poorly Drained Region

PDS1



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 52.0   |
| Total Wetland Acreage | 12.5   |
| Nontidal Wetlands     | 12.5   |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 39.5   |
| Waterway length (ft)  | 3362.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 3362.0 |
| Minor Ditch Length    | 2782.0 |
| Fillable Ditch Length | 799.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 14.2     | 24.9    |
| Ac. on Ditches                   | 9.7      | 17.3    |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 4.4      | 7.8     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.0      | 0.0     |
| Ac. Overlapping Buffers          | 0.0      | 0.2     |
| Developable Acreage With Buffer  | 25.3     | 14.6    |
| % Developable Acreage as Buffer  | 35.9     | 63.0    |
| Acreage of Buffer to be Restored | 11.4     | 20.6    |





# Fenwick Medical Complex

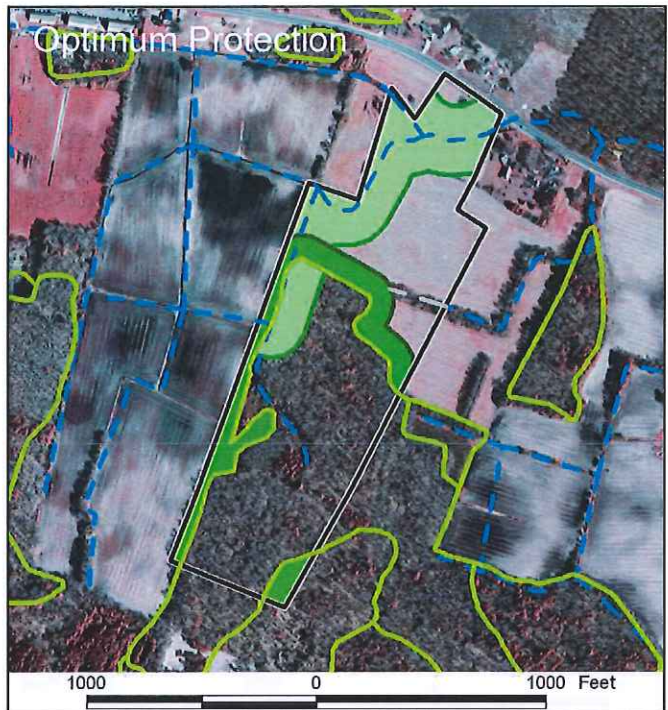
## Small Commercial Development in the Poorly Drained Region

PDS2



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 32.9   |
| Total Wetland Acreage | 16.4   |
| Nontidal Wetlands     | 16.4   |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 16.5   |
| Waterway length (ft)  | 2851.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 2851.0 |
| Minor Ditch Length    | 2291.0 |
| Fillable Ditch Length | 990.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 8.5      | 12.1    |
| Ac. on Ditches                   | 5.4      | 8.3     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 3.3      | 4.7     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.4      | 0.0     |
| Ac. Overlapping Buffers          | 0.6      | 0.9     |
| Developable Acreage With Buffer  | 8.0      | 4.4     |
| % Developable Acreage as Buffer  | 51.5     | 73.3    |
| Acreage of Buffer to be Restored | 6.9      | 7.6     |



- Development Outline
- Tidal Waters
- Freshwater Stream
- Filled Ditch
- Ditch
- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer
- Tidal Buffer
- Areas isolated by buffer



# Water's Run

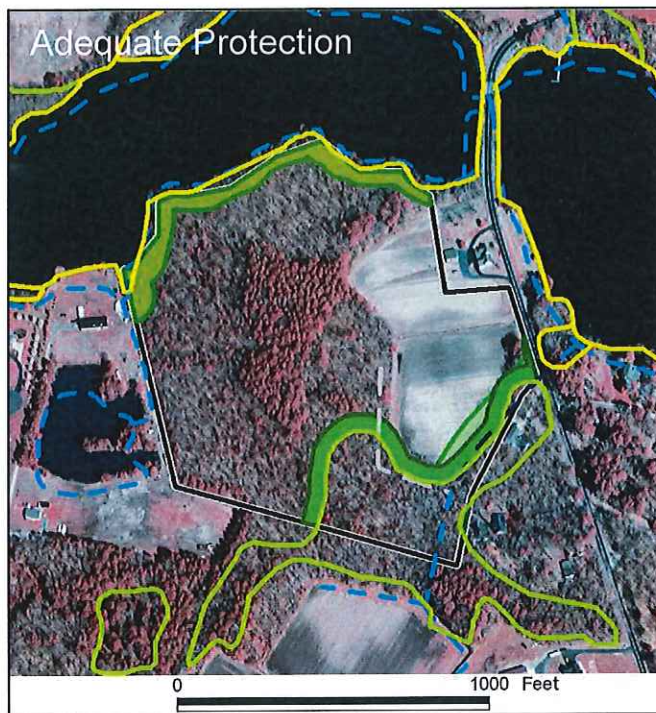
## Small Residential Development in the Poorly Drained Region

PDS3



| Site Characteristics  |       |
|-----------------------|-------|
| Site Acreage          | 27.2  |
| Total Wetland Acreage | 3.3   |
| Nontidal Wetlands     | 3.2   |
| Tidal Wetlands        | 0.0   |
| Developable Acreage   | 23.9  |
| Waterway length (ft)  | 389.0 |
| Stream Length         | 150.0 |
| Ditch Length          | 238.0 |
| Minor Ditch Length    | 171.0 |
| Fillable Ditch Length | 171.0 |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 3.2      | 6.9     |
| Ac. on Ditches                   | 0.0      | 0.0     |
| Ac. on Streams                   | 0.8      | 1.7     |
| Ac. on Freshwater Wetlands       | 1.4      | 3.0     |
| Ac. on Tidal Wetlands            | 1.5      | 3.6     |
| Ac. Confined by Buffer           | 0.0      | 0.0     |
| Ac. Overlapping Buffers          | 0.6      | 1.5     |
| Developable Acreage With Buffer  | 20.7     | 17.0    |
| % Developable Acreage as Buffer  | 13.2     | 28.9    |
| Acreage of Buffer to be Restored | 0.4      | 1.4     |



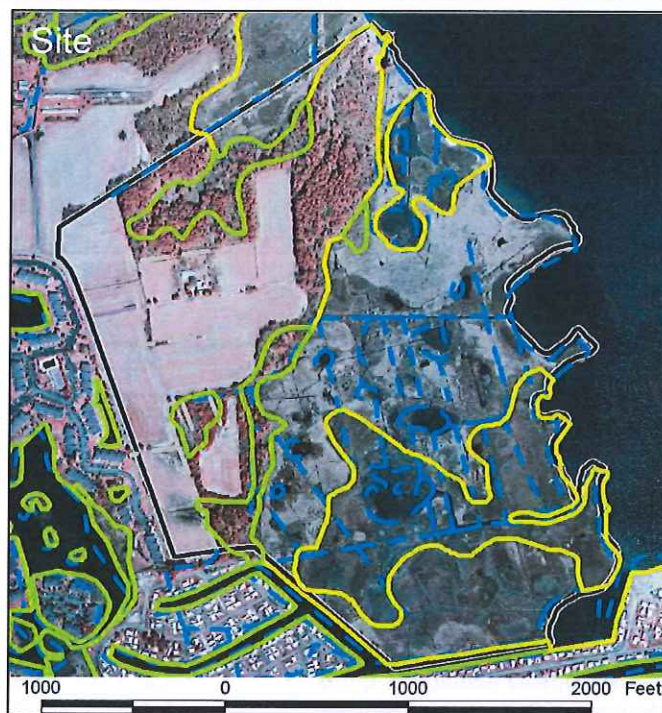
- Development Outline
- Tidal Waters
- Freshwater Stream
- - - Filled Ditch
- - - Ditch
- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer
- Tidal Buffer
- ▨ Areas isolated by buffer



# Bayville Point

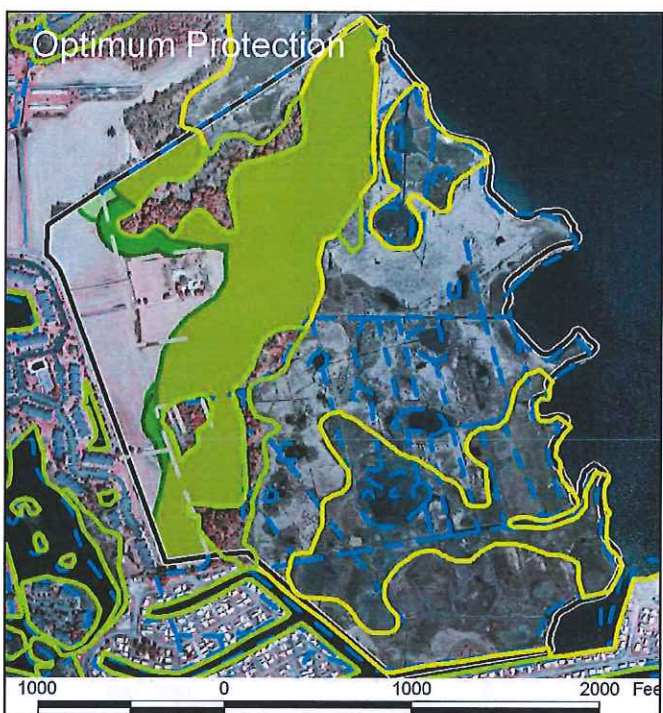
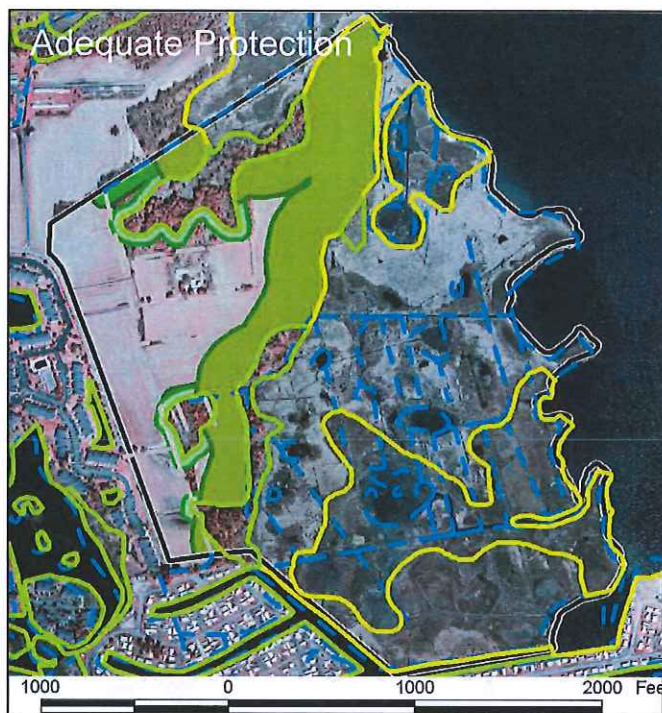
## Large Residential Development in the Poorly Drained Region

PDL1



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 148.0  |
| Total Wetland Acreage | 99.7   |
| Nontidal Wetlands     | 10.8   |
| Tidal Wetlands        | 88.9   |
| Developable Acreage   | 48.3   |
| Waterway length (ft)  | 1653.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 1653.0 |
| Minor Ditch Length    | 1653.0 |
| Fillable Ditch Length | 972.0  |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 24.4     | 33.7    |
| Ac. on Ditches                   | 2.7      | 6.1     |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 6.8      | 14.2    |
| Ac. on Tidal Wetlands            | 20.9     | 31.1    |
| Ac. Confined by Buffer           | 0.1      | 0.0     |
| Ac. Overlapping Buffers          | 6.0      | 17.7    |
| Developable Acreage With Buffer  | 23.9     | 14.6    |
| % Developable Acreage as Buffer  | 50.5     | 69.8    |
| Acreage of Buffer to be Restored | 1.5      | 6.5     |





# Barrington Park

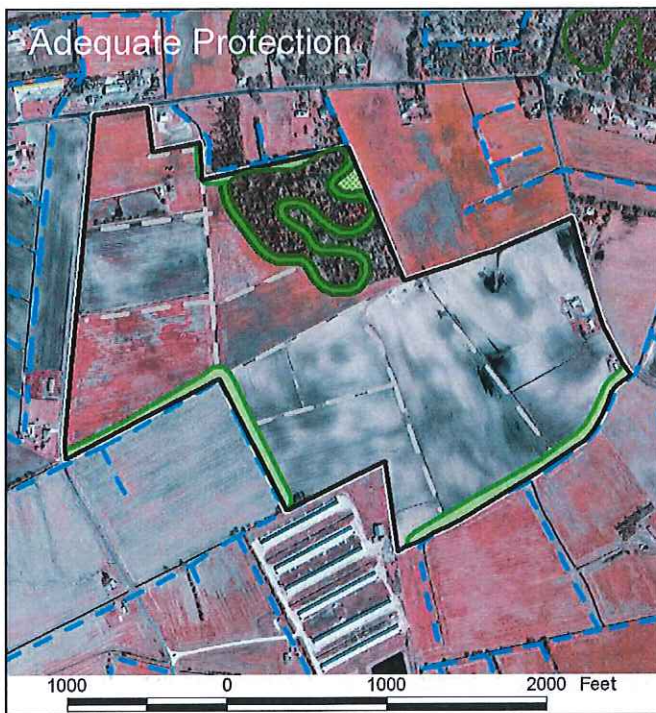
## Large Residential Development in the Poorly Drained Region

PDL2



| Site Characteristics  |        |
|-----------------------|--------|
| Site Acreage          | 128.0  |
| Total Wetland Acreage | 7.7    |
| Nontidal Wetlands     | 7.7    |
| Tidal Wetlands        | 0.0    |
| Developable Acreage   | 120.3  |
| Waterway length (ft)  | 2996.0 |
| Stream Length         | 0.0    |
| Ditch Length          | 2996.0 |
| Minor Ditch Length    | 2996.0 |
| Fillable Ditch Length | 1993.0 |

| Buffer Characteristics           |          |         |
|----------------------------------|----------|---------|
| Protection Alternative           | Adequate | Optimum |
| Acreage of Buffer                | 10.5     | 20.5    |
| Ac. on Ditches                   | 6.3      | 13.6    |
| Ac. on Streams                   | 0.0      | 0.0     |
| Ac. on Freshwater Wetlands       | 4.3      | 7.8     |
| Ac. on Tidal Wetlands            | 0.0      | 0.0     |
| Ac. Confined by Buffer           | 0.4      | 0.0     |
| Ac. Overlapping Buffers          | 0.5      | 0.9     |
| Developable Acreage With Buffer  | 109.8    | 99.8    |
| % Developable Acreage as Buffer  | 8.7      | 17.0    |
| Acreage of Buffer to be Restored | 6.5      | 14.9    |



- Development Outline
- Tidal Waters
- Freshwater Stream
- Filled Ditch
- Ditch
- Freshwater Wetlands
- Tidal Wetlands
- Non-tidal Waterway Buffer
- Freshwater Wetland Buffer
- Tidal Buffer
- ▨ Areas isolated by buffer



**Table 8. Site characteristics by watershed hydrogeomorphic region. Five sites are in the Poorly Drained and six are in the Well Drained Region.**

| Site Characteristics  | Poorly Drained |        |        |        | Well Drained |        |        |        |
|-----------------------|----------------|--------|--------|--------|--------------|--------|--------|--------|
|                       | Min            | Max    | Mean   | Median | Min          | Max    | Mean   | Median |
| Site Acreage          | 27.2           | 148.0  | 77.6   | 52.0   | 8.7          | 314.0  | 107.7  | 37.0   |
| Total Wetland Acreage | 3.3            | 99.7   | 27.9   | 12.5   | 0.0          | 12.9   | 4.0    | 2.7    |
| Nontidal Wetlands     | 3.2            | 16.4   | 10.1   | 10.8   | 0.0          | 12.9   | 3.3    | 2.1    |
| Tidal Wetlands        | 0.0            | 88.9   | 17.8   | 0.0    | 0.0          | 2.5    | 0.7    | 0.0    |
| Developable Acreage   | 16.5           | 120.3  | 49.7   | 39.5   | 8.7          | 308.7  | 103.4  | 29.0   |
| Waterway length (ft)  | 389.0          | 3362.0 | 2250.2 | 2851.0 | 0.0          | 2371.0 | 1085.6 | 1113.5 |
| Stream Length         | 0.0            | 150.0  | 50.0   | 0.0    | 0.0          | 0.0    | 0.0    | 0.0    |
| Ditch Length          | 238.0          | 3362.0 | 2220.0 | 2851.0 | 0.0          | 1915.5 | 805.9  | 679.0  |
| Minor Ditch Length    | 171.0          | 2996.0 | 1784.2 | 2291.0 | 0.0          | 1040.0 | 308.2  | 0.0    |
| Fillable Ditch Length | 171.0          | 1993.0 | 985.0  | 972.0  | 0.0          | 1040.0 | 308.2  | 0.0    |

**Buffer Characteristics.** The percentage of developable acreage as buffer varied widely for both protection alternatives (Table 10). The median percentage of developable acreage as buffer for the adequate protection alternative was 13.8% and this ranged from 1.8% to 60.6%. For the optimum protection alternative the median was 33.2% with a range of 3.7% to 89%. The total buffer acreage was evenly distributed between buffers on ditches, freshwater wetlands, and tidal areas. Sites of the Poorly Drained Region had more developable area as buffer (32% for the adequate alternative) than did sites of the Well Drained Region (18%) (Table 11). Small developments had about twice as much of their developable acreage as buffer than did larger sites (Table 12). The two sites with tidal wetlands adjacent to gradually sloping uplands had two of the three greatest percentages of developable area as buffer. Acreage of buffer requiring restoration to forest was generally low with a mean acreage of 2.6 for the adequate protection alternative and 5.2 for the optimum protection alternative (Table 10).

**Table 9. Site characteristics by development size. Seven sites are small (< 61 acres) and four sites are large (>61 acres).**

| Site Characteristics  | Small |        |        |        | Large |        |        |        |
|-----------------------|-------|--------|--------|--------|-------|--------|--------|--------|
|                       | Min   | Max    | Mean   | Median | Min   | Max    | Mean   | Median |
| Site Acreage          | 8.7   | 52.0   | 29.5   | 27.2   | 128.0 | 314.0  | 207.0  | 193.0  |
| Total Wetland Acreage | 0.0   | 16.4   | 7.2    | 3.3    | 1.8   | 99.7   | 28.3   | 5.8    |
| Nontidal Wetlands     | 0.0   | 16.4   | 6.8    | 3.2    | 1.8   | 10.8   | 5.7    | 5.1    |
| Tidal Wetlands        | 0.0   | 2.5    | 0.4    | 0.0    | 0.0   | 88.9   | 22.6   | 0.8    |
| Developable Acreage   | 8.7   | 39.5   | 22.2   | 20.9   | 48.3  | 308.7  | 178.4  | 178.3  |
| Waterway length (ft)  | 0.0   | 3362.0 | 1749.5 | 1915.5 | 0.0   | 2996.0 | 1379.5 | 1261.0 |
| Stream Length         | 0.0   | 150.0  | 21.4   | 0.0    | 0.0   | 0.0    | 0.0    | 0.0    |
| Ditch Length          | 0.0   | 3362.0 | 1612.4 | 1562.0 | 0.0   | 2996.0 | 1162.3 | 826.5  |
| Minor Ditch Length    | 0.0   | 2782.0 | 1013.3 | 809.0  | 0.0   | 2996.0 | 919.3  | 340.5  |
| Fillable Ditch Length | 0.0   | 1040.0 | 544.1  | 799.0  | 0.0   | 1993.0 | 741.3  | 486.0  |

### Discussion.

This analysis clearly shows that the amount of buffer required to maximize the protection of water resources is highly variable among developments. This variation is driven by the underlying differences in the type, amount, and distribution of wetlands and waterways on a development. Smaller developments, developments in the Poorly Drained Region, and developments with tidal

wetlands adjacent to gradually sloping uplands will have more buffer area. Larger developments and developments in the Well Drained Region will have less buffer area. For adequate and consistent resource protection, buffer acreage on a development must vary in response to the number and distribution of water features present, and thus a buffer regulation will not compel even responsibility for buffering among developments, which are inherently variable in their water features. On average, buffers of both protection alternatives fell within the range of Sussex County open space requirements for development (~25 – 40%). For the adequate alternative, lumping buffer and nontidal wetland acreage amounted to 32% of a development eligible for inclusion as open space; still within the range of County requirements. Tidal wetlands are not eligible for inclusion as open space, and only some developments include freshwater wetlands as open space. At writing, the County was considering removal of freshwater wetlands from inclusion in open space calculations (*personal communication* Lawrence Lank, Sussex County Planning and Zoning).

**Table 10. Buffer characteristics by protection alternatives.**

| Buffer Characteristics           | SUFFICIENT |       |      |        | OPTIMUM |       |      |        |
|----------------------------------|------------|-------|------|--------|---------|-------|------|--------|
|                                  | Min        | Max   | Mean | Median | Min     | Max   | Mean | Median |
| Acreage of Buffer                | 0.6        | 24.4  | 8.0  | 5.7    | 1.4     | 33.7  | 13.5 | 11.5   |
| Ac. on Ditches                   | 0.0        | 9.7   | 2.5  | 0.6    | 0.0     | 17.3  | 5.0  | 1.9    |
| Ac. on Natural Waterways         | 0.0        | 4.7   | 0.5  | 0.0    | 0.0     | 7.6   | 0.8  | 0.0    |
| Ac. on Freshwater Wetlands       | 0.0        | 6.8   | 2.9  | 3.3    | 0.0     | 14.2  | 5.3  | 4.7    |
| Ac. on Tidal Wetlands            | 0.0        | 20.9  | 2.8  | 0.0    | 0.0     | 31.1  | 4.4  | 0.0    |
| Ac. Confined by Buffer           | 0.0        | 0.4   | 0.1  | 0.0    | 0.0     | 2.3   | 0.2  | 0.0    |
| Ac. Overlapping Buffers          | 0.0        | 6.0   | 0.9  | 0.1    | 0.0     | 17.7  | 2.3  | 0.9    |
| Developable Acreage With Buffer  | 3.4        | 303.1 | 71.0 | 23.9   | 1.0     | 297.2 | 65.5 | 14.6   |
| % Developable Acreage as Buffer  | 1.8        | 60.6  | 24.3 | 13.8   | 3.7     | 89.0  | 39.3 | 33.2   |
| Acreage of Buffer to be Restored | 0.0        | 11.4  | 2.6  | 0.6    | 0.0     | 20.6  | 5.2  | 1.4    |

For certain developments, requiring buffers will result in a greatly reduced area on which to build. This will be most pronounced in the Poorly Drained Region where tidal wetlands are present. Bayville Point (PDL1) is a good example of this case (page 32). Here buffers take up 50.5% and 69.8% of the developable area for the two alternatives. The majority of the buffer acreage is of tidal wetlands. Development on this location will result in particularly large resource impacts because it lies in the path of rapidly migrating wetlands. At application to PLUS, Bayville Point was a proposed residential planned community of 242 units. To maintain this number of units with buffers that provide optimum protection, greater than 17 units per acre would be required.

Small developments had about twice as much of their developable acreage as buffer than did larger developments. The Woodlands (PDS1) (page 29) is a good example of a small development in the Poorly Drained Region where buffers of both adequate and optimum protection would alter site design..



Table 11. Buffer characteristics by protection alternative and hydrogeomorphic region for eleven randomly selected sites.

| Buffer Characteristics           | ADEQUATE       |       |      |              |     |       | OPTIMUM        |      |      |              |      |      |
|----------------------------------|----------------|-------|------|--------------|-----|-------|----------------|------|------|--------------|------|------|
|                                  | Poorly Drained |       |      | Well Drained |     |       | Poorly Drained |      |      | Well Drained |      |      |
|                                  | Min            | Max   | Mean | Median       | Min | Max   | Min            | Max  | Mean | Min          | Max  | Mean |
| Acreage of Buffer                | 3.2            | 24.4  | 12.2 | 10.5         | 0.6 | 5.9   | 4.6            | 5.3  | 6.9  | 33.7         | 19.6 | 20.5 |
| Ac. on Ditches                   | 0.0            | 9.7   | 4.8  | 5.4          | 0.0 | 2.9   | 0.6            | 0.1  | 0.0  | 17.3         | 9.1  | 8.3  |
| Ac. on Natural Waterways         | 0.0            | 0.8   | 0.2  | 0.0          | 0.0 | 4.7   | 0.8            | 0.0  | 0.0  | 1.7          | 0.3  | 0.0  |
| Ac. on Freshwater Wetlands       | 1.4            | 6.8   | 4.0  | 4.3          | 0.0 | 5.1   | 1.9            | 1.5  | 3.0  | 14.2         | 7.5  | 7.8  |
| Ac. on Tidal Wetlands            | 0.0            | 20.9  | 4.5  | 0.0          | 0.0 | 5.2   | 1.5            | 0.0  | 0.0  | 31.1         | 6.9  | 0.0  |
| Ac. Confined by Buffer           | 0.0            | 0.4   | 0.2  | 0.1          | 0.0 | 0.3   | 0.1            | 0.0  | 0.0  | 0.0          | 0.0  | 0.0  |
| Ac. Overlapping Buffers          | 0.0            | 6.0   | 1.5  | 0.6          | 0.0 | 1.6   | 0.3            | 0.0  | 0.2  | 17.7         | 4.2  | 0.9  |
| Developable Acreage With Buffer  | 8.0            | 109.8 | 37.5 | 23.9         | 3.4 | 303.1 | 98.8           | 24.1 | 4.4  | 99.8         | 30.1 | 14.6 |
| % Developable Acreage as Buffer  | 8.7            | 51.5  | 32.0 | 35.9         | 1.8 | 60.6  | 18.0           | 10.2 | 17.0 | 73.3         | 50.4 | 63.0 |
| Acreage of Buffer to be Restored | 0.4            | 11.4  | 5.3  | 6.5          | 0.0 | 1.8   | 0.4            | 0.0  | 1.4  | 20.6         | 10.2 | 7.6  |

Table 12. Buffer characteristics by protection alternative and development size for eleven randomly selected sites. Large developments are <61 acres, small are >61 acres.

| Buffer Characteristics           | ADEQUATE |       |       |        |     |      | OPTIMUM |       |       |       |      |      |
|----------------------------------|----------|-------|-------|--------|-----|------|---------|-------|-------|-------|------|------|
|                                  | Large    |       |       | Small  |     |      | Large   |       |       | Small |      |      |
|                                  | Min      | Max   | Mean  | Median | Min | Max  | Min     | Max   | Mean  | Min   | Max  | Mean |
| Acreage of Buffer                | 5.7      | 24.4  | 11.6  | 8.2    | 0.6 | 14.2 | 9.8     | 33.7  | 18.9  | 1.4   | 24.9 | 10.4 |
| Ac. on Ditches                   | 0.0      | 6.3   | 2.2   | 1.3    | 0.0 | 9.7  | 0.0     | 13.6  | 4.9   | 0.0   | 17.3 | 5.0  |
| Ac. on Natural Waterways         | 0.0      | 4.7   | 1.2   | 0.0    | 0.0 | 0.8  | 0.0     | 7.6   | 1.9   | 0.0   | 1.7  | 0.2  |
| Ac. on Freshwater Wetlands       | 0.9      | 6.8   | 3.5   | 3.2    | 0.0 | 5.1  | 2.2     | 14.2  | 7.3   | 6.4   | 10.0 | 4.2  |
| Ac. on Tidal Wetlands            | 0.0      | 20.9  | 6.1   | 1.8    | 0.0 | 5.2  | 0.0     | 31.1  | 9.4   | 3.3   | 7.7  | 1.6  |
| Ac. Confined by Buffer           | 0.0      | 0.4   | 0.2   | 0.2    | 0.0 | 0.4  | 0.0     | 0.0   | 0.0   | 0.0   | 2.3  | 0.3  |
| Ac. Overlapping Buffers          | 0.0      | 6.0   | 1.6   | 0.3    | 0.0 | 1.6  | 0.0     | 17.7  | 4.7   | 0.4   | 2.9  | 1.0  |
| Developable Acreage With Buffer  | 23.9     | 303.1 | 166.8 | 170.1  | 3.4 | 32.0 | 14.6    | 297.2 | 159.5 | 163.1 | 24.8 | 11.8 |
| % Developable Acreage as Buffer  | 1.8      | 50.5  | 15.9  | 5.6    | 6.7 | 60.6 | 3.7     | 69.8  | 23.7  | 10.6  | 89.0 | 48.2 |
| Acreage of Buffer to be Restored | 0.0      | 6.5   | 2.0   | 0.8    | 0.0 | 11.4 | 0.0     | 14.9  | 5.4   | 3.3   | 20.6 | 5.1  |

Nearly one quarter of the property was wetlands and the site was criss-crossed by ditches, most of which appeared unable to be disconnected from the drainage network. The percent developable acreage was 35.9% and 63.0% for the two protection alternatives. About two-thirds of the buffer acreage was of the ditches. The Woodlands was a proposed community of 88 units. To maintain this number of units with buffers that provide adequate protection, greater than 2.5 units per acre would be required. This density still falls within what is currently permitted by the County.

Buffers of ditches made up a large portion of total buffer acreage, even after half of minor ditches were removed from the drainage network. Ditches receive inputs of both surface water and groundwater [92], and are important conduits for nitrogen, phosphorus, and sediments [93]. However, many ditches are shallow ( $\sim \leq 2 - 3$  feet deep) and are fed primarily by localized inputs of surface water [94]. These shallow ditches may receive less benefit from buffers than deeper ditches ( $> 2 - 3$  feet deep) [94]. Shallow ditches also provide lower levels of other wetland functions relative to natural wetlands and waterways. Reducing the minimum buffer width on shallow ditches could provide the flexibility needed by developers to site homes and more adequately buffer wetlands and more functionally important waterways.

Using The Woodlands (PDS1 page 29) as an example, the developable acreage as buffer was reduced from 35.9% to 26% by requiring 40 foot buffers on shallow ditches<sup>8</sup>. This strategy will substantially reduce the average % developable area as buffer for both protection alternatives.

Buffers on shallow ditches should not fall below 35 feet (*see Width above*), and should remain forested. Forested buffers of ditches result in lower nutrient inputs and an increased capacity of ditches to slow or reduce pollutants [95]. In light of the fact that ditches remain the dominant waterways even after site development, it is recommended that 1) governments encourage cooperation within and between developments to reduce ditch networks through fill and conversion to stormwater features while continuing to manage for adequate drainage and 2) incentives be developed which take advantage of the opportunity that development provides to address the drainage network by encouraging practices that further improve nutrient reduction in ditches. These practices

include channel regrading to simulate flood plains, small scale controlled drainage, and in-line wetlands [96-98].

Both protection alternatives resulted in low acreages and costs for required buffer restoration. Recommended restoration practices for buffers are detailed in the August 2006 version of the PCS [7]. The cost to install Conservation Reserve Enhancement Program (CREP) forested buffers range from \$125 -- \$725/acre. Since buffers installed in developments often use better quality plant material than typical CREP projects, a cost of \$1,000/acre is applied here. This results in an average of \$2,600 to \$5,200 in restoration costs per development.

This study suggests that most developments in the Well Drained Region can accommodate buffers of the optimum protection alternative as required open space. Example developments in this regard include Bridlewood (WDL1 page 27) and Savannah Square (WDS3 page 25). Some small developments and developments in the Poorly Drained Region will have to substantially adapt site designs to accommodate buffers. Adaptations could include smaller lot sizes, smaller street widths, alternative parking options, and perhaps increased densities. Cooperation of Sussex County to develop ordinances that facilitate flexible site designs will be critical to developments accommodating buffers. Where buffer extent must be reduced, shallow ditches should be addressed first, followed by flats and depressional wetlands.

### **Additional Recommendations**

Review of the buffer system analysis has led to following additional recommendations.

1. Given the level and type of development already permitted along Bay shorelines, given that this development has been permitted without pollution control strategy requirements and without adequate buffers, and given that sea level rise and tidal wetland migration is predicted to increase, perhaps drastically [99-101]<sup>9</sup>, it is recommended that the optimum protection alternative be afforded to tidal waters and wetlands.

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<sup>8</sup> For adequate protection alternative. Assumed, based on study data layers, that 2,119 feet or 83% of these ditches on site were shallow.

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<sup>9</sup> Recent information suggests that sea-level rise has a high probability of increasing rapidly over the next 100 years such that sea-level could be 45 to 145 cm higher by 2100. These increases in the rates of sea level rise will increase rates of wetland migration inland. Furthermore, increased stresses on tidal wetlands are placing greater importance on their capacity to migrate inland to maintain themselves (*see citations in text above*).



2. Buffers of any wetlands and waterways that occur on adjacent undeveloped properties and that have more than half of their buffer width on the developing property should be required on the developing property.
3. Shallow ditches can be afforded smaller buffer widths, not to fall below 35 feet, so that buffers of natural wetlands and waterway features can be better accommodated.
4. Governments should encourage cooperation within and among developments to reduce ditch networks and implement additional nutrient reduction techniques in remaining ditches.
5. Ordinances and incentives that facilitate development site designs to accommodate buffers are likely critical for implementing a watershed level buffer system.

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**Appendix 1: Excerpt from Rheinhardt et al. 2005 detailing an approach to mapping unmapped natural headwaters. From Rheinhardt, R.D., et al., Applying Ecological Assessments to Planning Stream Restorations in Coastal Plain North Carolina. 2005, North Carolina Department of Environment and Natural Resources: Raleigh, NC. p. 39.**

Several approaches for extending the stream network were tested. First, we manually digitized additional headwater streams from county soil survey maps (USDA Soil Conservation Service, now Natural Resources Conservation Service), which often show headwater streams not included on USGS quads. (Digital soil survey hydrographic data are not presently available for most counties in NC.) In a test using one of the six assessed watersheds (Cow Swamp), we determined that manually digitizing additional streams would be too time consuming.

In the second method tested, we used digital elevation models (DEMs) constructed using high-resolution LIDAR data available from the NC Floodplain Mapping Program (a cooperative program involving local governments, agencies of the State of North Carolina and the Federal Emergency Management Agency (FEMA) (<http://www.ncfloodmaps.com>)). LIDAR DEMs were processed using ArcGIS 9 and a geospatial hydrologic modeling extension (HEC-GeoHMS) developed by the U.S. Army Corps of Engineers (<http://www.hec.usace.army.mil/software/hec-hms/hechms-geohms.html>). The resulting stream network was ground-truthed with another watershed in the study area (Green Mill Run). Despite manipulation of model parameters (primarily the flow-initiation threshold), we were unable to reasonably replicate the stream network. At low values of the flow-initiation threshold, many streams were generated by the model that did not exist. Raising the threshold would reduce the number of non-existent streams added, but would also increase the number of true streams not identified. A suitable intermediate threshold could not be found that would prevent the addition of non-existent streams without removing streams known to exist. The flat topography of the coastal plain is probably the main reason this method failed to reliably identify the true stream network.

The third method tested, and eventually adopted, was to predict additional streams from existing topographic maps. Most unmapped streams observed by us in previous surveys had occurred in topographic linear depressions (visible on topographic maps as a crenulation, or "draw"). From this observation, and previously collected slope data for headwater streams (Rheinhardt et al. 1998, Brinson et al. in preparation), we developed

criteria for manually extending streams headward and removing ditches, based on topography. For a linear depression to indicate the presence of an intermittent or perennial stream it had to have: (1) two or more topographic contours showing a v-shaped deflection of  $<90^\circ$  from the general trend of the contour line (i.e., lines tangent to the inflection point of the deflected portion of the contour line had to intersect at an angle of  $<90^\circ$ ), (2) a slope of greater than 0.5%, and (3) a downstream connection to a mapped stream not more than two stream orders higher than the added stream (i.e., 1<sup>st</sup> order added streams could connect to a 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> order stream, but not to a 4<sup>th</sup> or higher order stream and 2<sup>nd</sup> order added streams could not connect to 5<sup>th</sup> or higher order streams). This connection rule was developed to avoid adding streams where groundwater tables, controlled (lowered) by the higher order stream, would have been too deep to contribute to flows of an added tributary. However, a few additional streams may have been missed using this criterion. Figure 1 shows an example of streams added using the topographic rules outlined above. Figure 2 shows the resulting digital stream network for the Cow Swamp watershed.

## Appendix 2. References for the Effect of Width on Nitrogen and Phosphorus Removal in Coastal Plain Riparian Buffers.

| Vegetation Type  | Flow Wype  | N Species | Width (ft) | % N Removal | Study                          |
|------------------|------------|-----------|------------|-------------|--------------------------------|
| grass            | surface    | total N   | 15         | -15         | Magette et al. 1989 [1]        |
| grass and forest | subsurface | nitrate   | 26         | 33          | King 2005 [2]                  |
| grass            | surface    | total N   | 30         | 35          | Magette et al. 1989 [1]        |
| grass            | subsurface | nitrate   | 33         | 99          | Schoonover & Williard 2003 [3] |
| forest           | subsurface | nitrate   | 33         | 82          | Schoonover & Williard 2003 [3] |
| forest           | subsurface | nitrate   | 49         | 96          | Hubbard & Sheridan 1989 [4]    |
| grass and forest | subsurface | nitrate   | 49         | 67          | King 2005 [2]                  |
| forestwetland    | subsurface | nitrate   | 102        | 59          | Hanson 1994 [5]                |
| forestwetland    | subsurface | nitrate   | 125        | 78          | Vellidis et al. 2003 [6]       |
| forest           | subsurface | nitrate   | 164        | 94          | Lowrance 1992 [7]              |
| forest           | subsurface | nitrate   | 164        | 99          | Jacobs & Gilliam 1985 [8]      |
| forest           | subsurface | nitrate   | 180        | 83          | Lowrance et al. 1984 [9]       |
| forest           | subsurface | nitrate   | 197        | 95          | Jordan et al. 1993 [10]        |
| grassforest      | subsurface | nitrate   | 230        | 91          | Hubbard & Lowrance 1997 [11]   |
| forest           | surface    | nitrate   | 230        | 79          | Peterjohn & Correll 1984 [12]  |
| forest           | subsurface | nitrate   | 279        | 94          | Peterjohn & Correll 1984 [12]  |
| forest           | subsurface | nitrate   | 328        | 100         | Spruill 2004 [13]              |

| Buffer Width (ft.) | % P Removal | Study Reference  | Notes  |
|--------------------|-------------|--|--|
| 15                 | 41          | Magette et al. 1987 [14]   |  |
| 30                 | 53          | Magette et al. 1987 [14]   |  |
| 62                 | 80          | Peterjohn & Correll, 1984 [12]   |  |
| 180                | 36          | Lowrance et al. 1984 [9]<br>Desbonnet et al. 1994 [15]<br>Mayer et al. 2007 [16] | Values compiled from multiple sources.<br>Used median removal value. |
| 246                | 56          | Lowrance & Sheridan 2005 [17]  |  |
| 656                | 74          | Casey & Klaine 2001 [18]   |  |

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**Appendix 3.**  
**Planning Buffers for Tidal Wetlands**  
**Christopher Bason, Scientific & Technical Coordinator, Center for the Inland Bays**  
**(Updated October 05, 2007)**

This paper uses existing local data to describe rates of tidal wetland migration into upland areas potentially regulated as wetland buffers. It is based on the concept that tidal wetlands move inland by processes of erosion at their bayward edges and by migrating over uplands at their landward edges.

1. Shoreline erosion in Rehoboth Bay during 1938-1981 ranged from 0.66 to 5.25 feet per year and was highly variable [1 and references therein].
2. The landward migration of tidal wetlands is surprisingly rapid and is controlled primarily by the slope of the adjacent upland, with wetlands migrating faster over gradually sloping uplands (Table 1.) [1].
3. Tidal wetlands also migrate in the upstream direction of stream or creek valley axes at even faster rates. But here, newly established tidal wetlands are generally confined to the narrow stream valley (Table 1.) [1].

**Table 1. Rates of landward migration of tidal wetlands by adjacent upland slope from 1944-1989.**  
Gradual Slope =  $<0.08$  rise/run, Steep Slope =  $>0.09$  rise/run (pg. 131 [1]).

| Slope       | Indian River Bay | Rehoboth Bay |
|-------------|------------------|--------------|
| Gradual     | 5.25 ft/yr       | 6.07 ft/yr   |
| Steep       | 1.44 ft/yr       | 0.82 ft/yr   |
| Valley Axis | 16.40 ft/yr      | 4.56 ft/yr   |

3. The above historical rates of migration are likely conservative compared to today's rates of migration because:
  - a. The Indian River Inlet has increased greatly in cross section and thus transmits a greater volume of water per tidal cycle thus increasing tidal amplitude, or the range of high and low tides[2]. The highest tides begin the conversion of adjacent uplands to tidal wetlands.
  - b. Storm frequencies nearly doubled over the last century, creating more frequent and sometimes more powerful tidal surges inland [3].
  - c. Certain tidal wetlands may be submerging under increased rates of sea-level rise, allowing surges to attenuate less on their path over marshes towards uplands [4, 5].
4. Using these conservative rates of migration, the minimum period of time (in years) upland buffers of different widths may be reasonably assumed to protect wetlands or shorelines are calculated (Table 2).
5. The rates of migration of tidal wetlands up stream or creek valleys are also presented to allow for anticipation of future extent of tidal wetlands (Table 3).



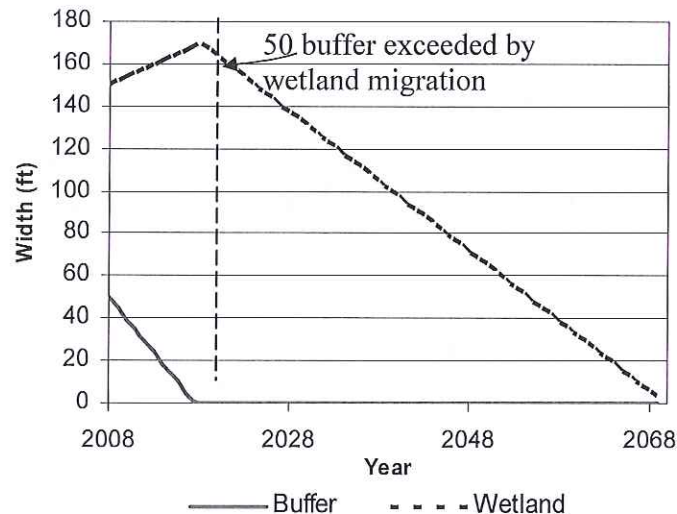
**Table 2. Years upland buffers of different widths will provide any protection to tidal wetlands or waters**

| Upland Buffer Width | Indian River Bay |             | Rehoboth Bay  |             |
|---------------------|------------------|-------------|---------------|-------------|
|                     | Gradual Slope    | Steep Slope | Gradual Slope | Steep Slope |
| 50'                 | 10               | 35          | 8             | 61          |
| 75'                 | 14               | 52          | 12            | 91          |
| 100'                | 19               | 69          | 17            | 122         |
| 200'                | 38               | 139         | 33            | 244         |
| 300'                | 57               | 208         | 49            | 366         |
| 400'                | 76               | 278         | 66            | 488         |
| 500'                | 95               | 347         | 82            | 610         |

**Table 3. Length a tidal marsh moves upstream for different planning horizons. Mean marsh migration up tidal creeks (10.48 ft/yr) is the average of 4 locations in Indian River and Rehoboth Bays from 1944-1989.**

| Upstream Movement of Tidal Wetlands (ft) | Years |
|--|-------|
| 105                                      | 10    |
| 262                                      | 25    |
| 524                                      | 50    |
| 786                                      | 75    |
| 1048                                     | 100   |

5. Once these time periods have past, wetlands will have migrated through buffers into built or production lands and loss of these lands will begin. Two general scenarios will then occur: 1) the upland will be bulk-headed or diked or 2) the built or production land will be abandoned. The first scenario will prevent the tidal wetlands from migrating inland and will result in their loss at a rate equal to its bayshoreline erosion rate (see above) (Figure 1). The second scenario will allow the wetlands to maintain themselves but is unlikely as most private lands adjacent to the Bays are, or will soon be, developed with substantial economic investments



**Figure 1.** Conceptual change in width of upland buffers and tidal wetlands due to landward migration and erosion of tidal wetlands under for tidal wetlands with gradually sloping adjacent uplands and somewhat above average bayshoreline erosion.

6. Large-scale loss of tidal wetlands under this scenario will eliminate large acreages of existing biofilters and will release of huge amounts of stored nutrients into the Inland Bays. Loss of fish and bird nursery habitat, carbon storage and sequestration capacity, and other functions would likely change the entire nature of the Inland Bays.
7. Currently, many Inland Bays marshes appear unable to maintain their elevation with sea-level rise [1, 6-8] and may submerge in the near future, likely causing rates of inland migration to increase. Emerging stressors such as sudden wetland dieback may exacerbate this process.

### Recommendation

To adequately protect the nutrient filtration and storage capacity of tidal wetlands under predictions of rising sea-level, upland buffers sufficient to allow inland wetland migration near a 100 year time horizon should be mandated. Special consideration should be afforded to the conservative estimates of wetland migration presented here, new estimations of the rates of future sea-level rise[9, 10], and the sensitivity of tidal wetlands to this process. Regulations should be developed based on the slope of adjacent uplands. Attention should be given to rates of migration up stream or creek valleys so that appropriate buffer widths may be allowed for in advance of migration.

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4. Kearney, M.S., Professor of Geography, *Personal Communication*. 2006.
5. Kearney, M.S., et al., *Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware Bays*. *Eos, Transactions, American Geophysical Union*, 2002. **83**(16): p. 173, 177-178.
6. NOAA, *Tides & Currents*. 2006. **2006**(October). <http://tidesandcurrents.noaa.gov/>
7. Najjar, R.G., et al., *The potential impacts of climate change on the mid-Atlantic coastal region*. *Climate Research*, 2000. **14**: p. 219-233.
8. Yi, H.-I., *Stratigraphy, microfacies analysis, and paleoenvironment evolution of the wetlands of Delaware Bay estuarine coast and Atlantic coast of Delaware*, in *Department of Geology*. 1992, University of Delaware: Newark, DE. p. 254.
9. IPCC, *Climate Change 2007: The Physical Science Basis. Summary for Policymakers*. 2007, Intergovernmental Panel on Climate Change: Geneva. p. 18.
10. Rahmstorf, S., *A Semi-Empirical Approach to Projecting Future Sea-Level Rise*. *Science*, 2007. **315**(5810): p. 368-370.

#### Appendix 4. GIS Analysis Workflow

1. Roughly determine onsite and offsite waterway and wetland features whose buffers would affect development
2. Determine what features would be provided buffers. Buffers of any wetlands and waterways that occur on adjacent undeveloped properties and that have more than half of their buffer width on the developing property should be required on the developing property.
3. Using topographic valley contours, the presence of riverine wetlands, historic and current aerial imagery, and best professional judgement, classify waterways as ditches or natural waterways. Natural waterways tend to occur within distinctly sloping topographic valleys and may have been excavated to improve drainage (channelized). Channelization may eliminate wetland conditions adjacent to streams. Topographic valleys are more conservative distinguishing features. Ditches are an extension of the natural drainage network. Ditches are often excavated through flats wetlands or uplands with high water tables. Ditches generally do not support topographic valley contours. However, topographic maps often depict contour lines on the top of ditch banks. Special attention must be given to the Poorly Drained Region of the watershed when distinguishing ditches from natural streams. This region was almost entirely wetlands prior to European colonization and has undergone landscape level drainage and profound water table lowering. Here natural drainage was likely dominated by forested sloughs that slowly delivered water through tortuous paths across the wetland landscape. Some of these sloughs remain and are characterized by very slight “valley” slopes that generally are not distinguishable from topographic maps. It’s the opinion of the author that LIDAR derived digital elevation maps would provide great insight into these drainage features.
4. Using best professional judgement, classify ditches as minor or major. Minor ditches are generally terminal or connector ditches, have very small watersheds, and if the entire upstream ditch network was incapacitated no apparent issues of concern for development would occur.
5. Classify minor ditches as fillable (or otherwise able to be disconnected from the drainage network) or not. Minor ditches are fillable if no upstream drainage impacts to existing landuse would result from their incapacitation.
6. Union wetland features whose buffers will affect development. *This may be unnecessary but sometimes the contiguity function of the buffer command on arcview does not work.*
7. Clip wetlands to developing property on PLUS layer.
8. Erase clipped wetlands layer from developing property to create developable area shapefile.
9. Buffer non-fillable ditches.
10. Buffer natural waterways.
11. Buffer freshwater wetlands.
12. Buffer tidal features.
13. Further determine if buffers of offsite features would be required on development.
14. Determine what if any areas will not be buildable due to buffer arrangement. If areas were very small and access to them was not conducive based on the layout of buffers on the site then they were considered isolated. This means that the buffer would not be altered to allow access to these pieces of the development and they would functionally be part of the buffer. If they were situated such that access through the buffer would be reasonable based on other site features such as existing roads and layout then they were not considered isolated. For example road access across natural waterways in their



natural condition was generally assumed to not occur. Road access across ditches or natural waterways where the stream was channelized and wetlands were filled was assumed to occur in all cases.

15. Create a shapefile for areas not buildable due to buffer arrangement.
16. Batch Clip all shapefiles to the development area.
17. Merge all the clipped shapefiles.
18. Calculate the acreage of the total buffer and by feature type using the merged shapefile's table.
19. Determine the amount of nonforested buffer to restore by clipping buffer to areas that are both not forested and not likely to remain in their current developed state.
20. If tidal wetlands with gradually sloping adjacent uplands are present, buffer tidal areas with 150' buffers for the optimum recommendation and 80' for the sufficient recommendation. These are the portions of the tidal buffer to be restored to forest, call them tidalrestoreclip.
21. Merge the clipped nontidal waterways, wetlands and the tidal buffer restoration shapefiles.
22. Union the features of this merged shapefile.
23. Determine the amount of nonforested buffer to restore by clipping this buffer to areas that are both not forested and not likely to remain in their current developed state.
24. Calculate area of buffer to be restored.

Table 1. GIS layers used in this study. All layers should be available from the Delaware Datamil, the State of Delaware, Sussex County, or the Center for the Inland Bays.

| Layer Name  | Filename               | Description   |
|---|------------------------|---|
| State Wetlands Mapping Project (SWMP) Layer                               | Swmp.shp               | Wetlands mapped using 1992 aerial photography and other information. DNREC. |
| Sussex County Water Lines 1999  | Suswtr99.shp           | Hydrography. DNREC.   |
| Preliminary Landuse Service Project Areas (February 2004 to January 2007) | Project_areas.shp      | Developments proposed to the State. State of Delaware.                      |
| 2002 Delaware Landuse   | 2002_delaware_lulc.shp | State of Delaware digitized landuse. Delaware Datamil.                      |
| Sussex County Tax Parcels   | Parcels.shp            | Updated May 2007. Sussex County online.                                     |
| State of Delaware Agricultural Easements                                  | State_ag_easements.shp | Agricultural lands preserved in perpetuity. State of Delaware.              |
| Inland Bays Simplified Hydrogeomorphic Regions                            | Inlndbyshgmrgsmpl.shp  | CIB created watershed regions simplified from USGS studies. CIB.            |
| Inland Bays Watershed   | Outline.shp            | Watershed outline per the DNREC whole basin initiative. DNREC.              |
| USGS topographic quadrangle maps  | Susseast.tiff          | Mosaic of quadrangles for the eastern half of the county. DNREC.            |
| Hypsography   | Example: hypso48.shp   | Line file of topographic contours extracted from USGS                       |

|                               |            |  |
|-------------------------------|------------|--|
|                               |            | quadrangles. Available from Delaware Geological Survey online. |
| 2002 Aerial photography       | Sussex.sid | Delaware Datamil.  |
| Historical Aerial photography |            | Delaware Datamil.  |



## Jamie Whitehouse

---

**From:** Robin Griffith  
**Sent:** Monday, January 10, 2022 3:27 PM  
**To:** Michael H. Vincent; John Rieley; Cynthia Green; Doug Hudson; Mark Schaeffer  
**Cc:** Todd F. Lawson; Jamie Whitehouse; Tracy Torbert  
**Subject:** FW: Buffer Hearing Testimony for Public Record from Center for the Inland Bays (1/2)  
**Attachments:** CIB MARKUP TO Sussex County - Drainage and Resource Buffer - PZ Recommendations 010622.pdf; CIB Justification for Markups to County Buffer Ordinance to Council 011122.pdf; Recommendations-for-an-Inland-Bays-Watershed-Buffer-System-Final.pdf

Forwarding ...

---

**From:** Chris Bason <chrisbason@inlandbays.org>  
**Sent:** Monday, January 10, 2022 3:06 PM  
**To:** Robin Griffith <rgriffith@sussexcountysde.gov>; Todd F. Lawson <tlawson@sussexcountysde.gov>  
**Subject:** Buffer Hearing Testimony for Public Record from Center for the Inland Bays (1/2)

Hi Robin and Todd,

This is part 1 of 2 part email. Please find attached a number of items to be submitted to the record for the hearing on buffers tomorrow morning:

1. Requested amendments as a marked up version of the proposed ordinance.
2. Justification for the requested amendments.
3. The Center's Recommendations for Water Quality Buffers.

The second email will contain:

4. A pdf copy of the presentation i will deliver in person tomorrow at the hearing.

Because the presentation includes slide animations, I plan on presenting as a powerpoint that I will bring on a thumb drive tomorrow. Thank you for preparing these items for the record and please let me know if there is anything I can do to prepare otherwise.

--

*Chris Bason*

Executive Director

Delaware Center for the Inland Bays



**Get on Board with the Bays!**







DELAWARE CENTER FOR THE  
**INLAND BAYS**  
Research. Educate. Restore.

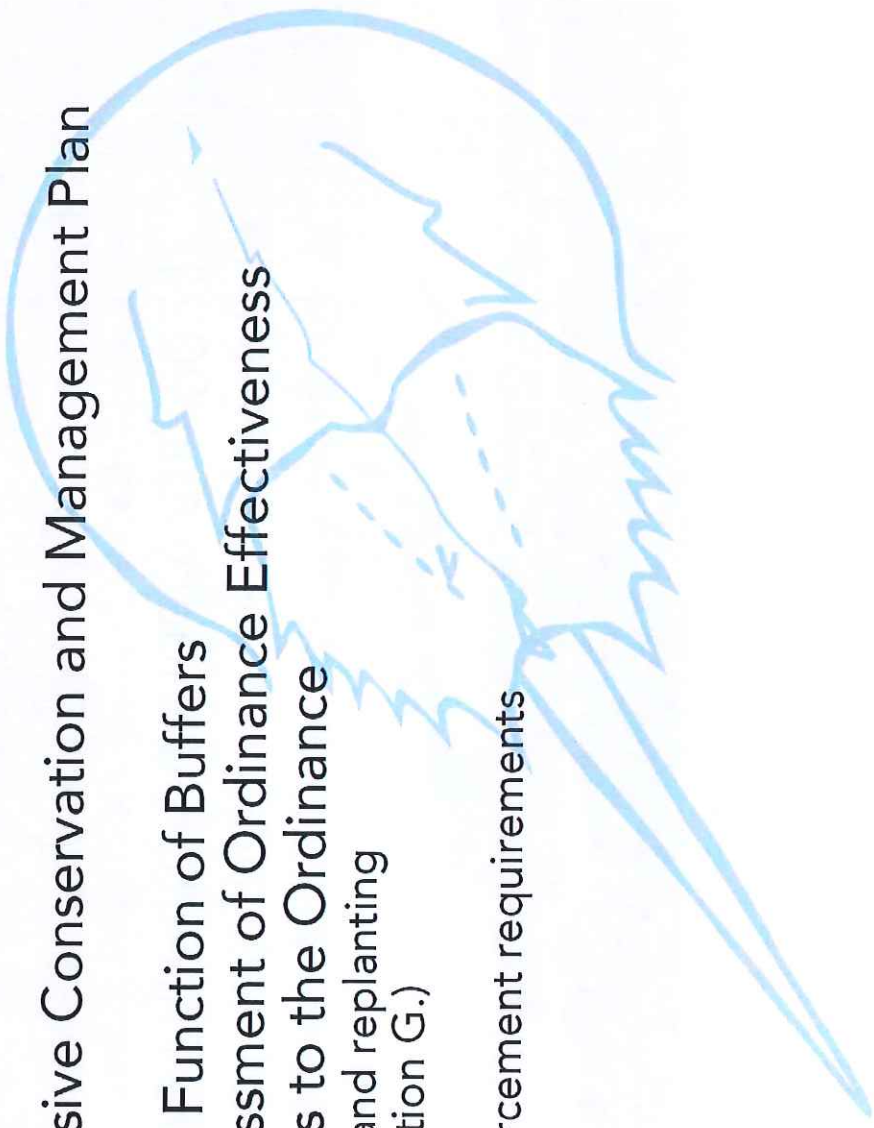
# Hearing Testimony Presentation

SUSSEX COUNTY ORDINANCE REGARDING CERTAIN DRAINAGE FEATURES,  
WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO

Chris Bason, Executive Director, January 11, 2021

# Contents

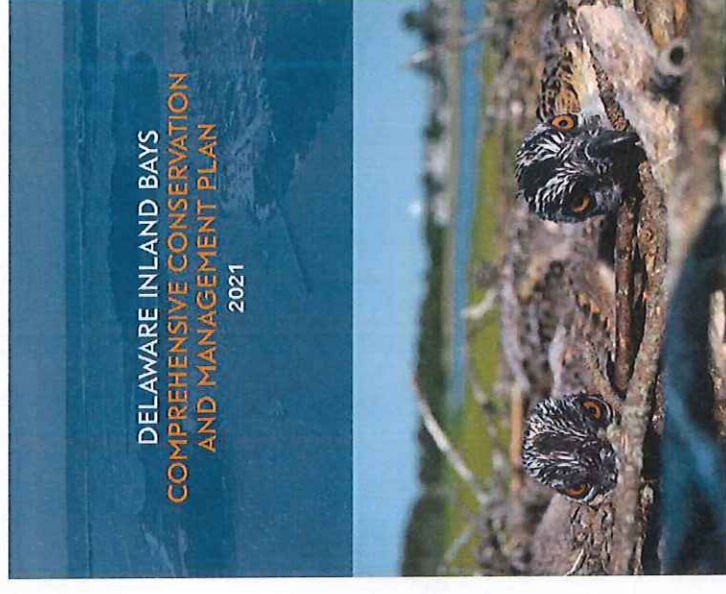
- Inland Bays Comprehensive Conservation and Management Plan
- Status of Resources
- Review of Purposes and Function of Buffers
- Achievements and Assessment of Ordinance Effectiveness
- Requested Amendments to the Ordinance
  - Requirement for forests and replanting
  - Removal of Options (Section G.)
  - Minor amendments
  - Addition of specific enforcement requirements

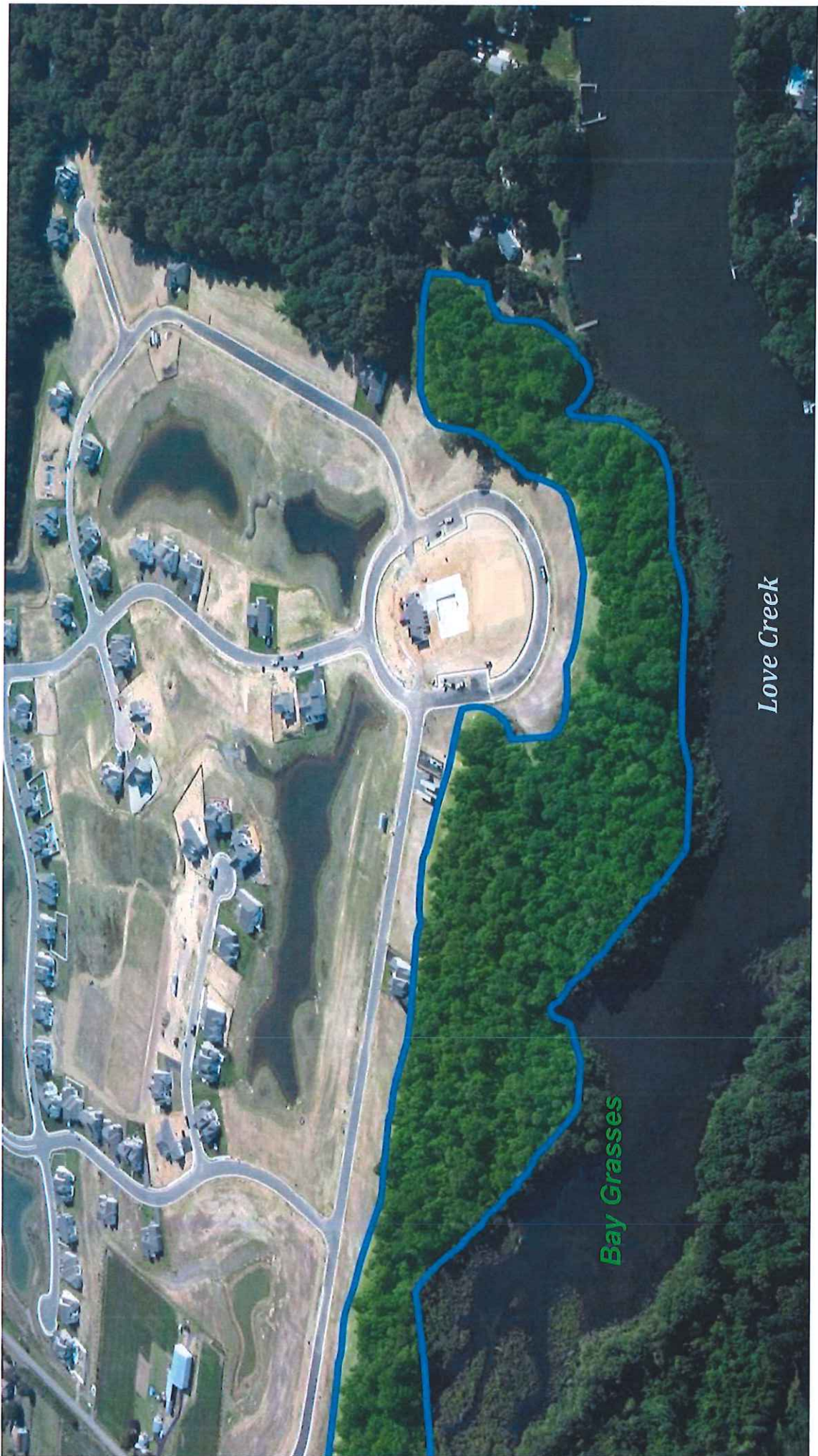




## Buffers are an important action of the 2021 Inland Bays CCMP

- 67 actions focused on
  - reducing nutrient pollution to achieve water quality
  - protecting and restoring natural habitats
  - public education and engagement
  - mitigating & adapting to flooding and climate change
- County 1 of 7 Plan Signatories
- 60% of 500 public surveyed identified runoff from developments as the biggest threat.
- Increasing protection of buffers is in 1995 CCMP, 2012 Addendum, and 2021 Revision.
- CM 2-5: Revise the Sussex County Code related to buffers for improved water quality.





Love Creek

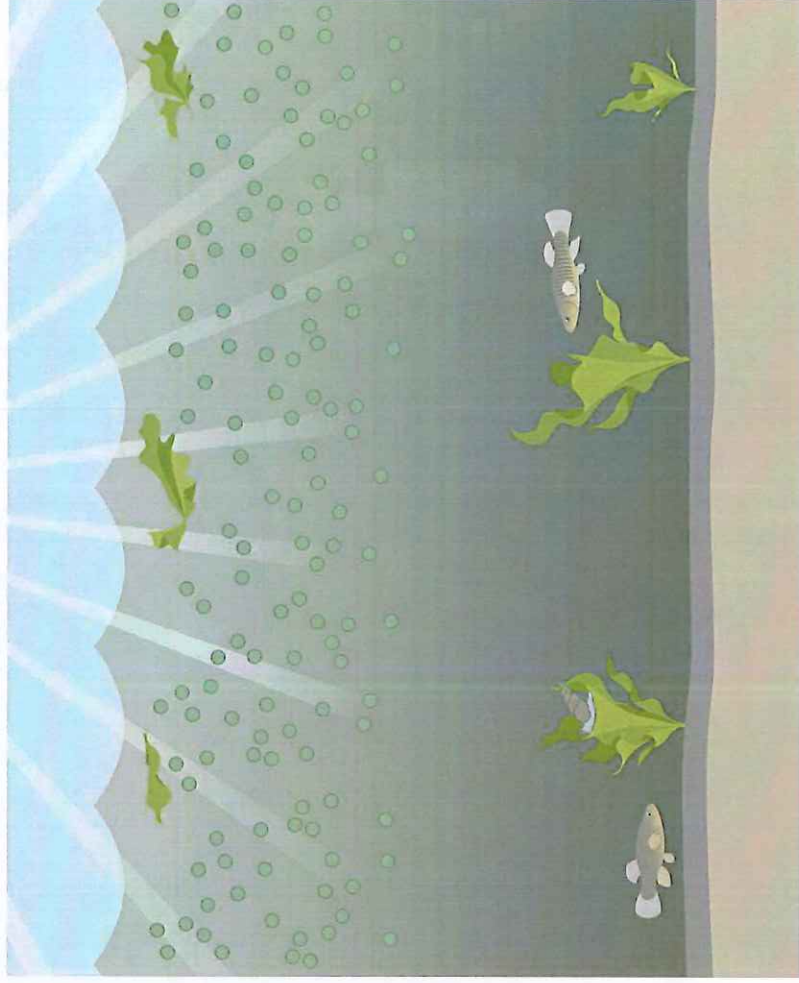
Bay Grasses



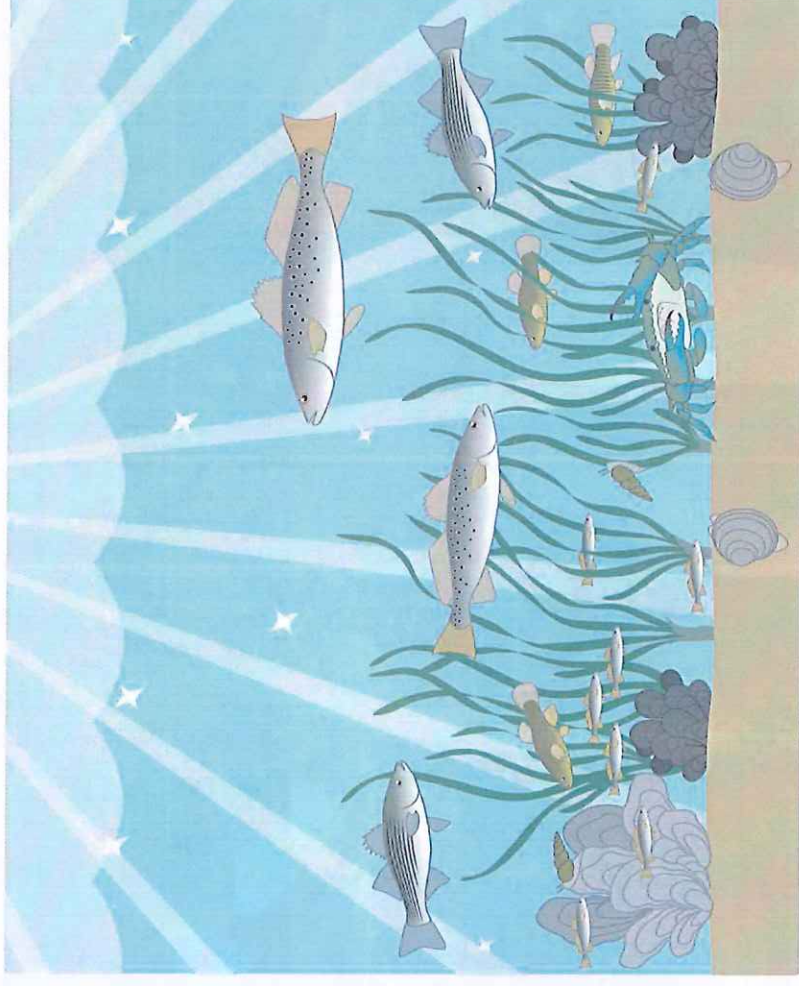




Excess Nutrients: Current Condition

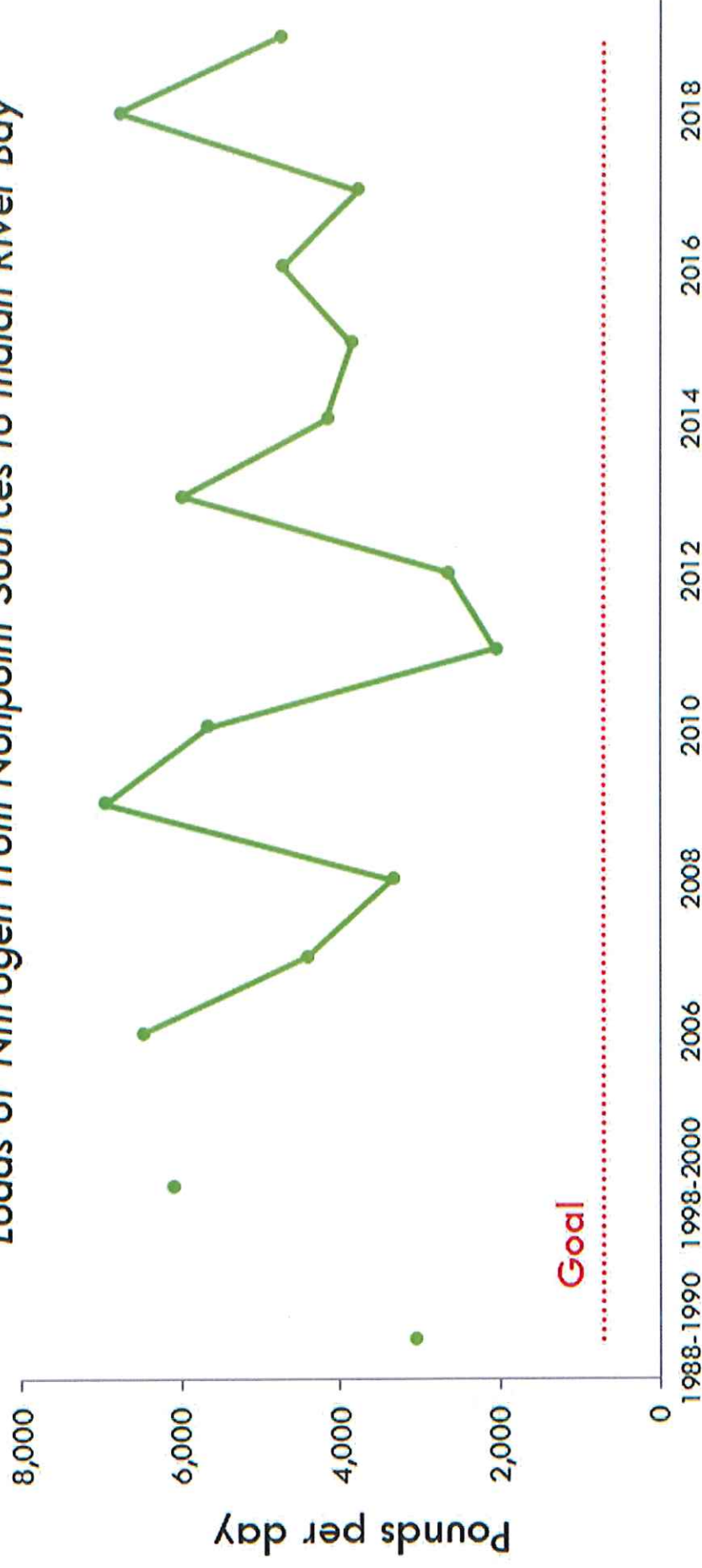


Healthy Bay: Restoration Target

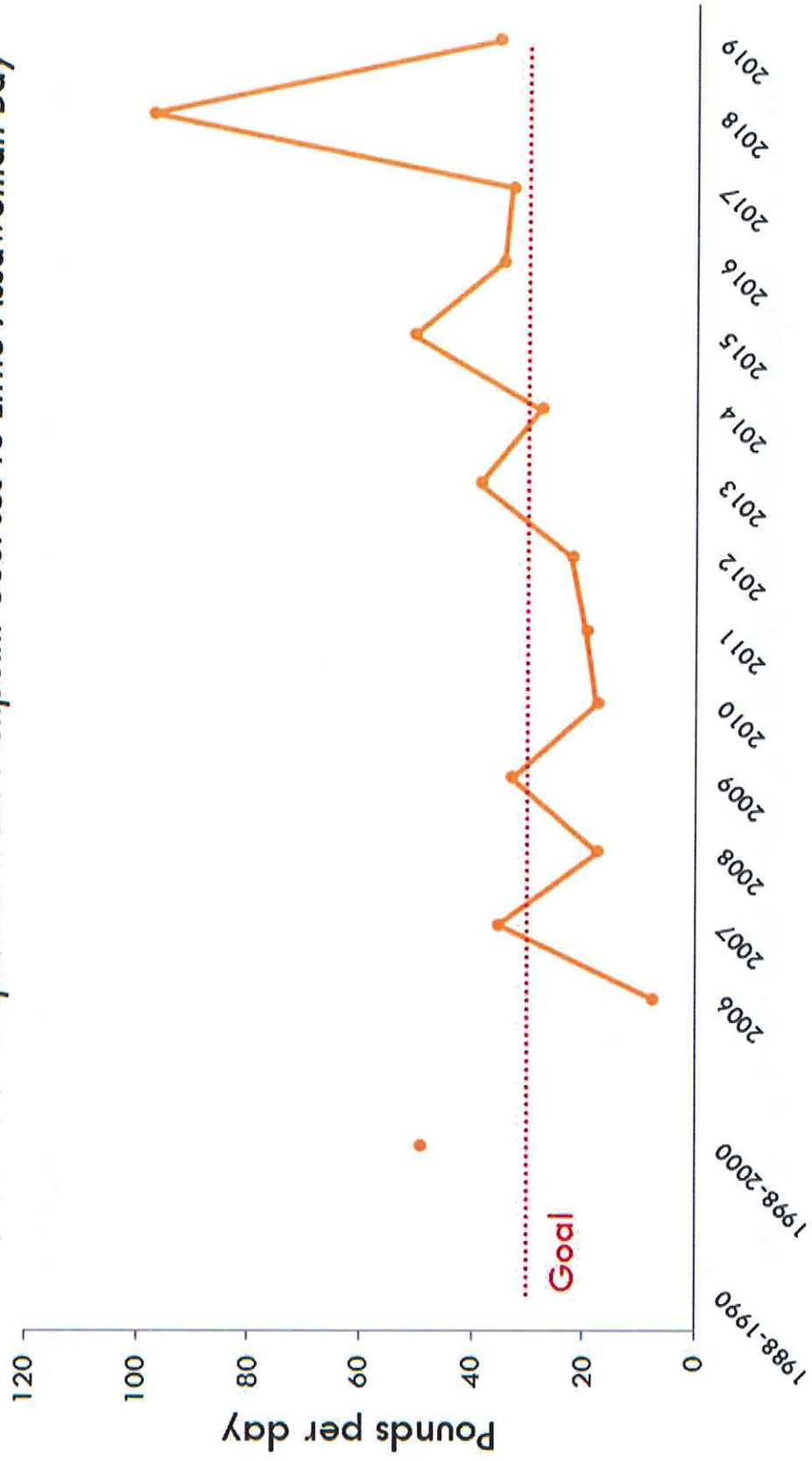




Loads of Nitrogen from Nonpoint Sources to Indian River Bay



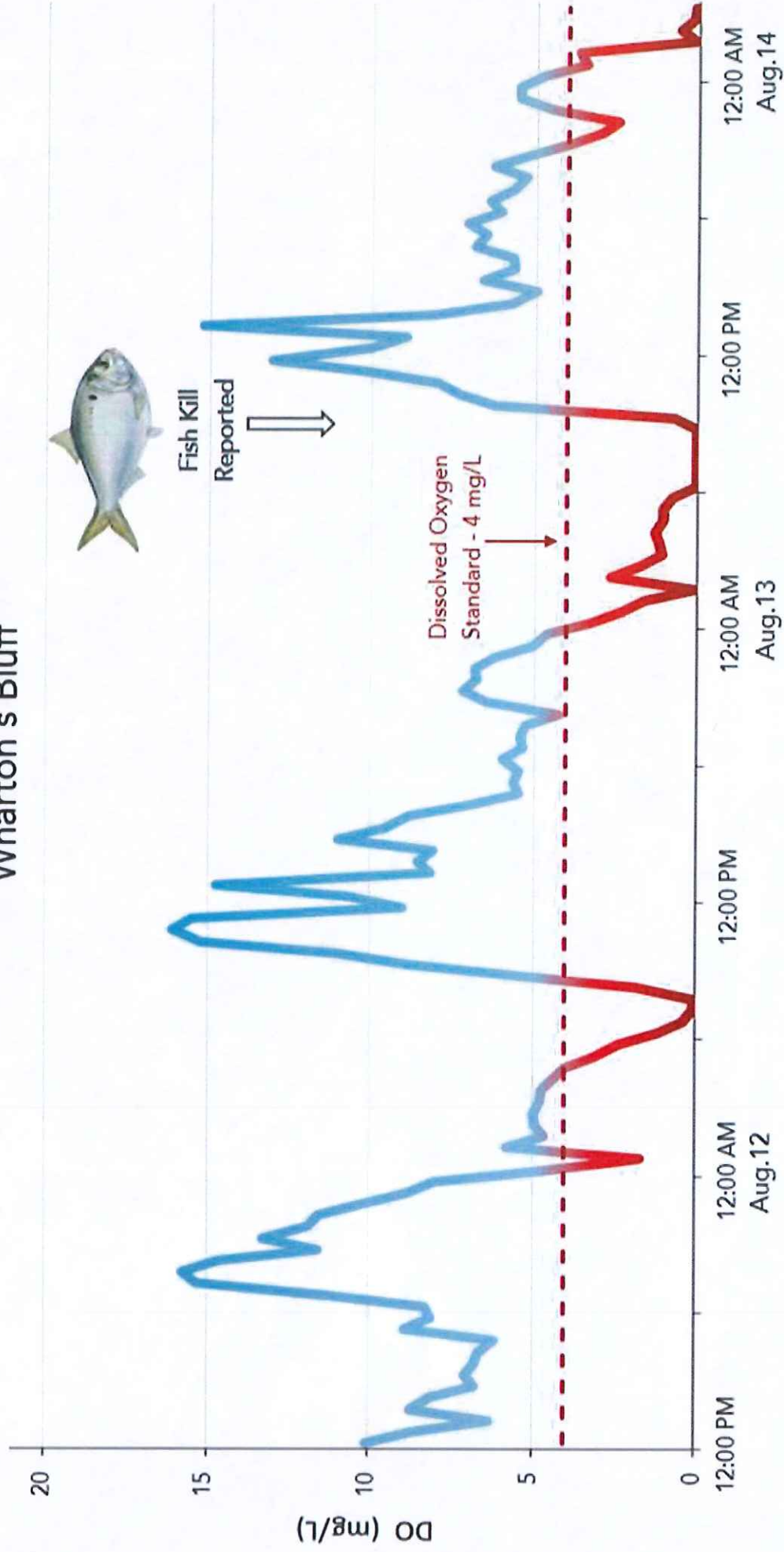
Loads of Phosphorus from Nonpoint Sources to Little Assawoman Bay







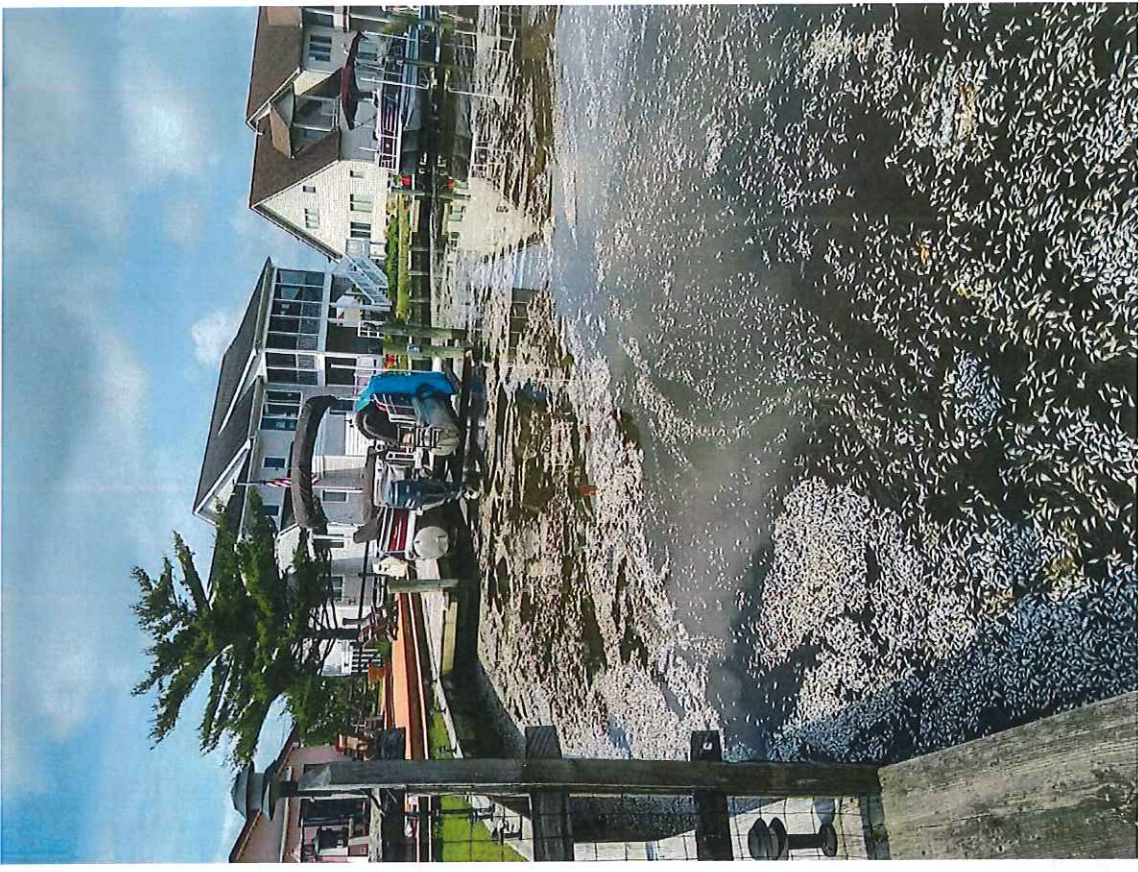
# Dissolved Oxygen Concentration Wharton's Bluff





## 2021 set record for number of Inland Bays fish kills

- 15 recorded
- In canals creeks and open waters
- ~2 million fish mostly menhaden
- Low dissolved oxygen





## Watershed Trends Show Mixed Results That Differ for Nitrogen and Phosphorus

USGS updates trends in total nitrogen and phosphorus on the basis of data from the nontidal monitoring network. Trends (fig. 1) are normalized for watershed area and the magnitude of stream flow, to make it easier to compare sites and distinguish trends resulting from human actions.

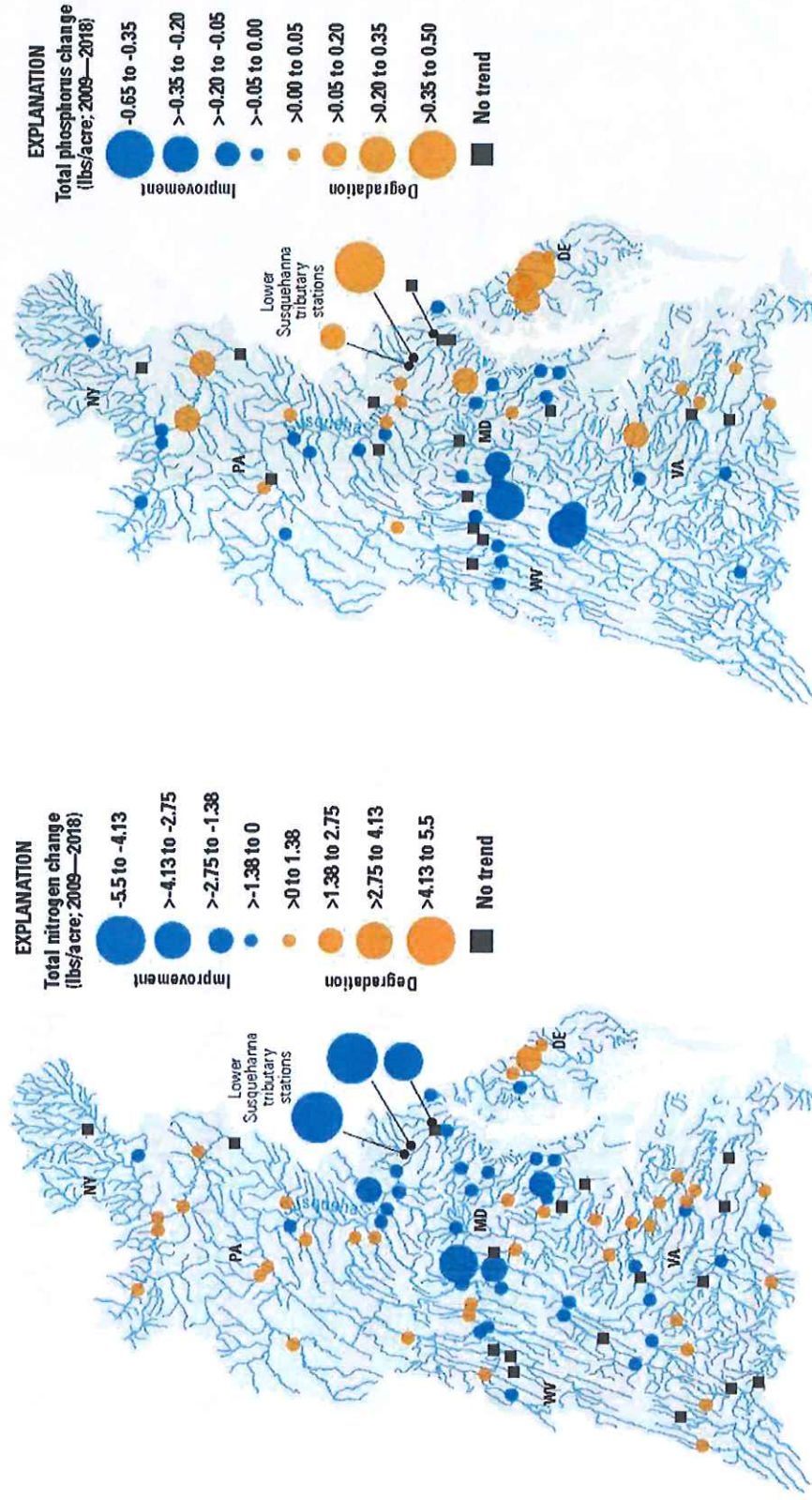
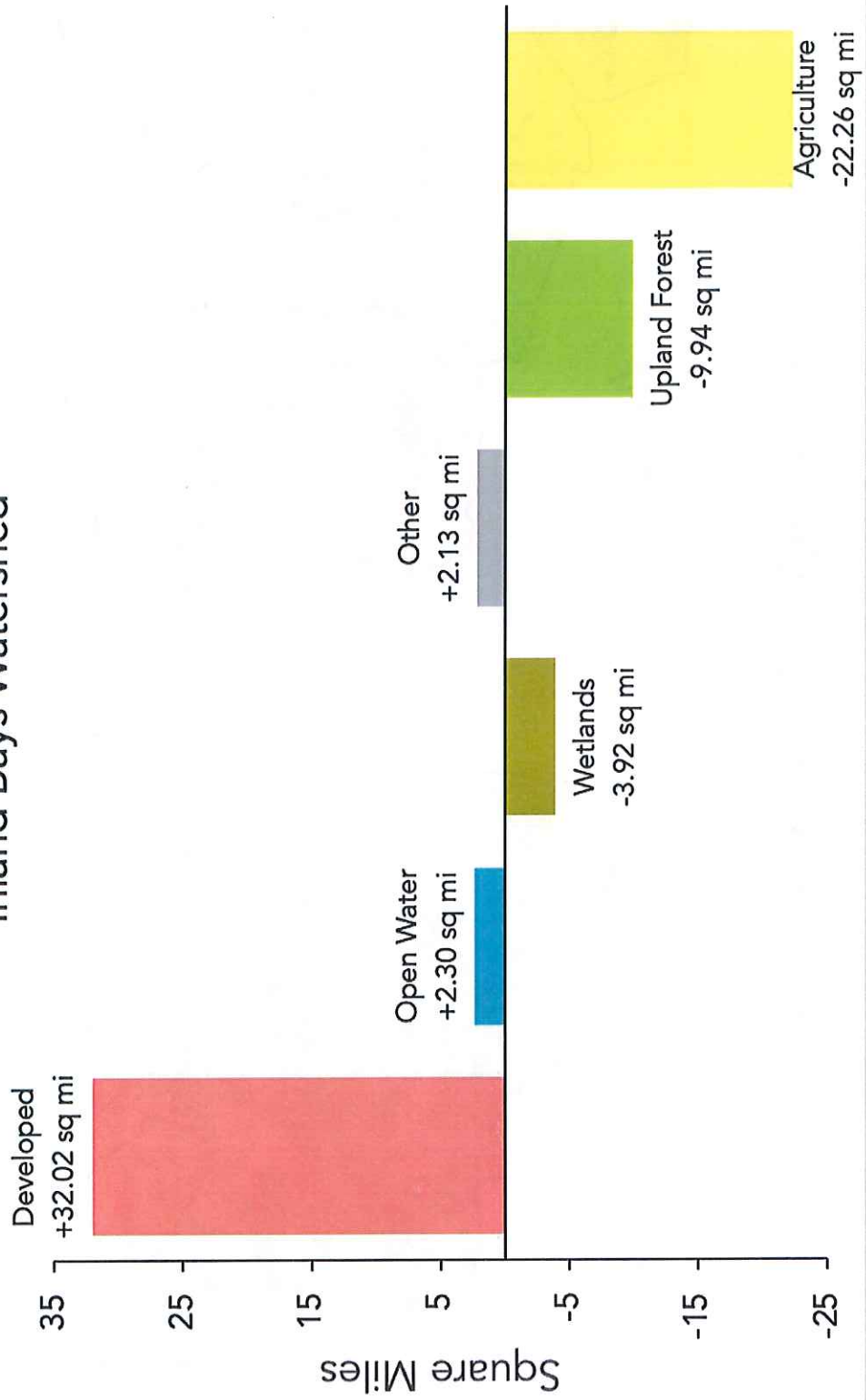


Figure 1. Total nitrogen and total phosphorus trends at nontidal monitoring stations in the Chesapeake Bay watershed. Data from Moyer and Langland (2020). (lbs, pounds; NY, New York; MD, Maryland; PA, Pennsylvania; VA, Virginia; WV, West Virginia; DE, Delaware)



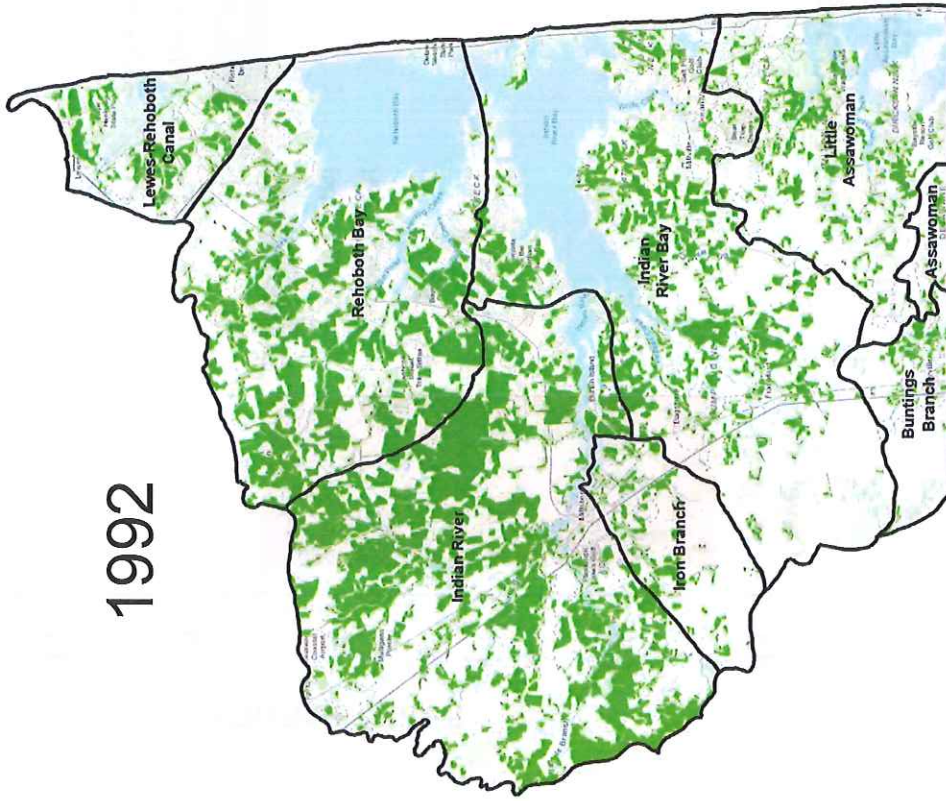
# Land Cover Changes 1992-2017

## Inland Bays Watershed

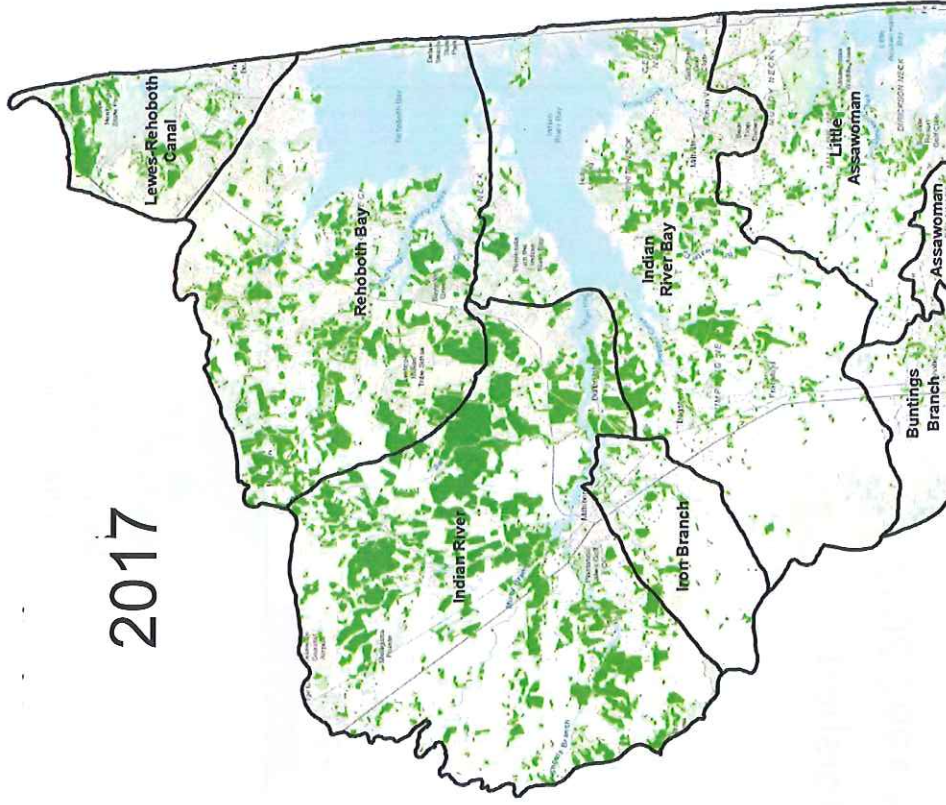


# Changes in Upland Forest Cover Over Time

1992



2017





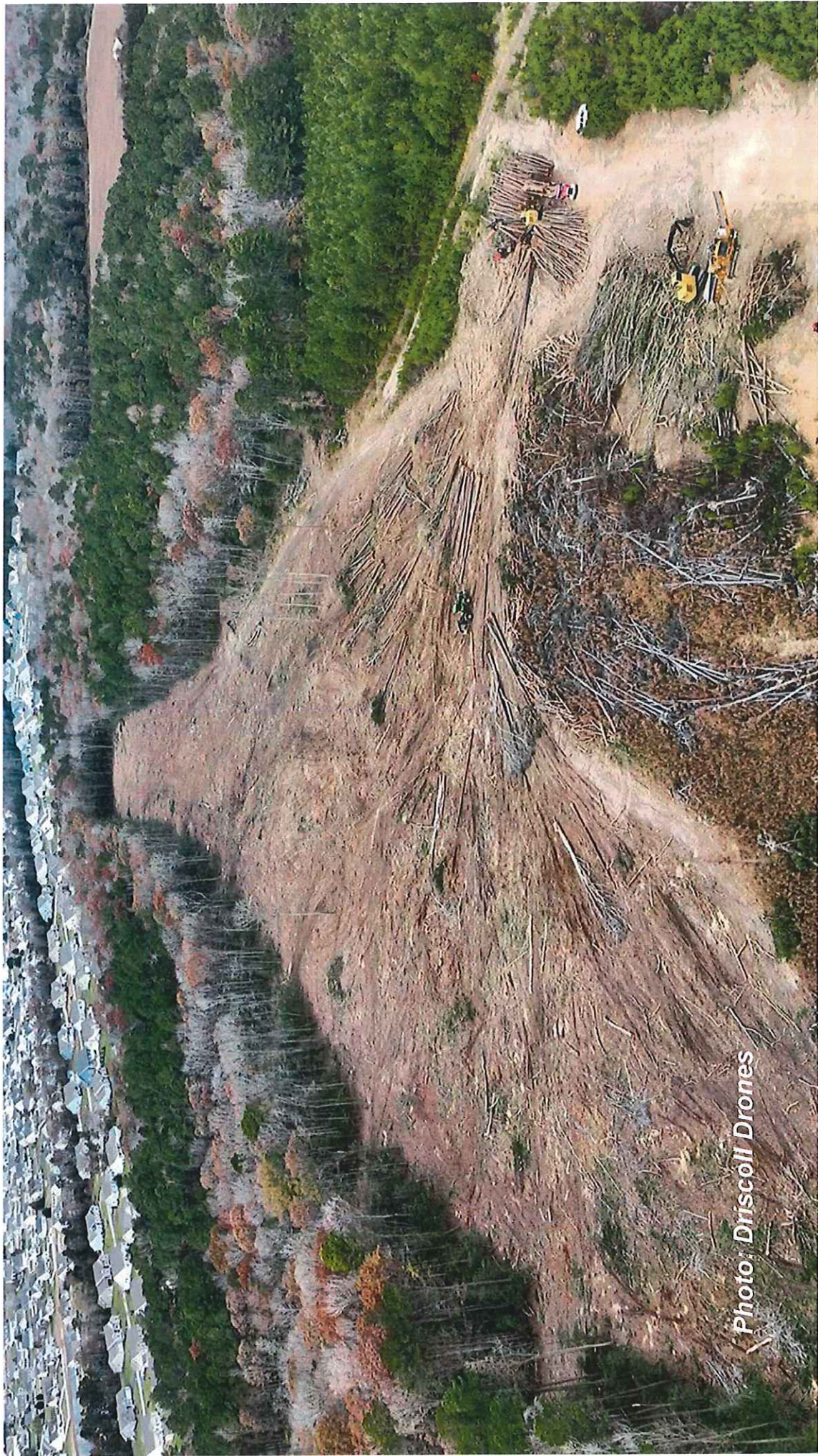
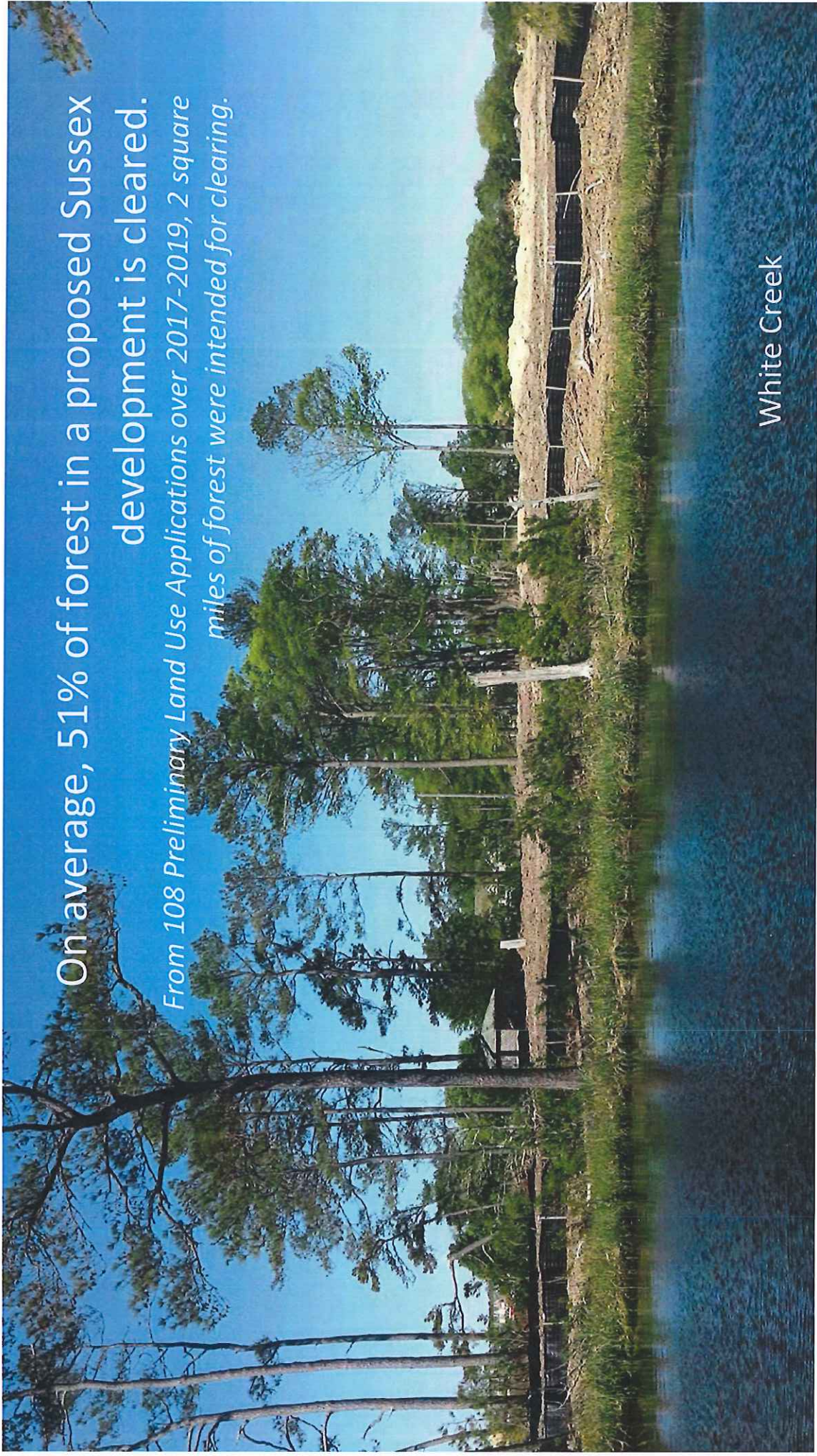


Photo: Driscoll Drones



On average, 51% of forest in a proposed Sussex  
development is cleared.  
*From 108 Preliminary Land Use Applications over 2017-2019, 2 square  
miles of forest were intended for clearing.*



White Creek



# Building happening in flood prone areas

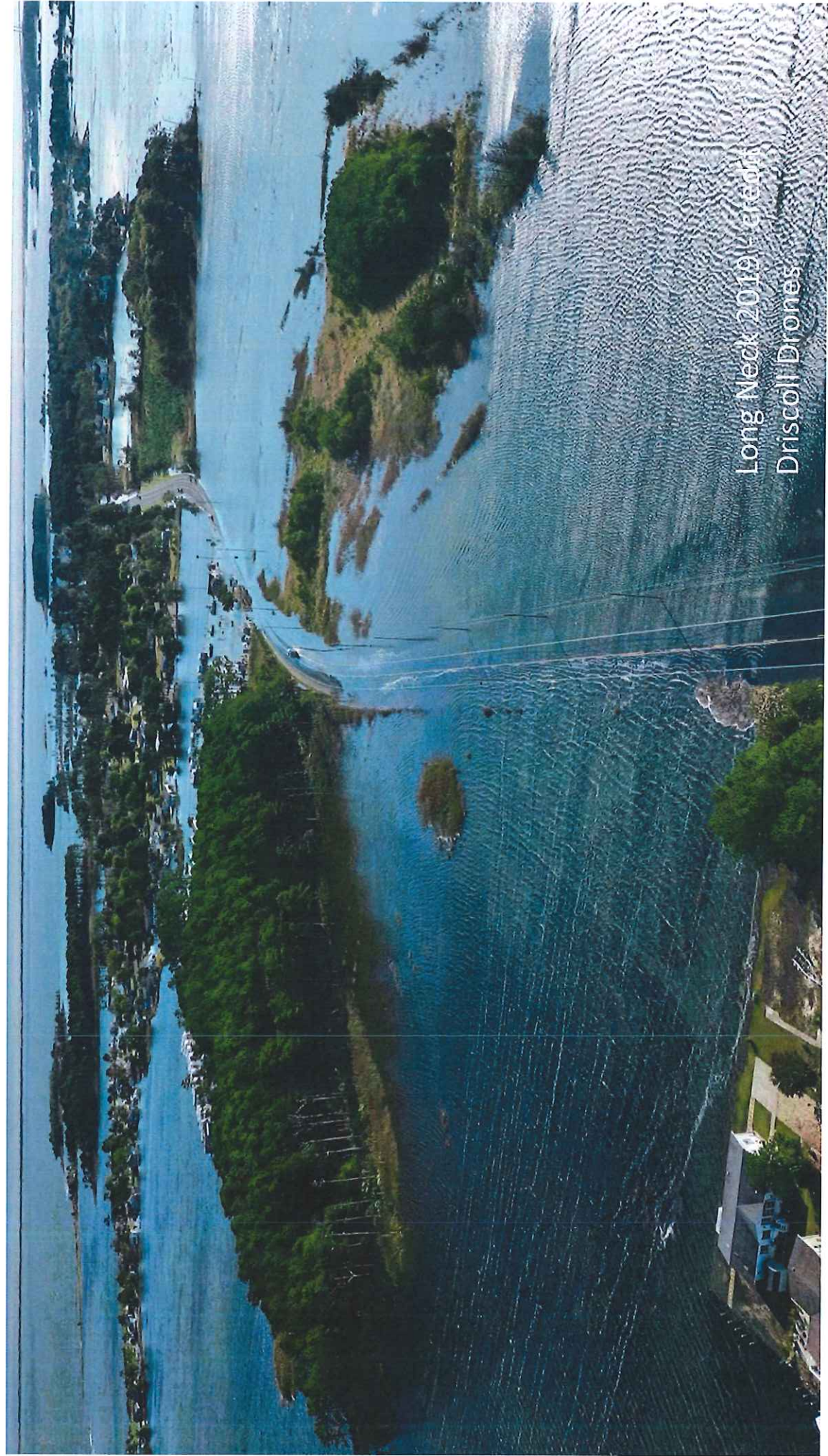
From 2010 to 2017 Sussex Co. had 3rd-highest number of homes built in 10-year flood risk zone of any ocean coastal county in US.

Flood risk zone defined as area projected to be exposed to at least a 10-year flood threat in yr 2050 under sea level rise projections corresponding to moderate green house gas emission cuts.

From *Ocean at the Door: New Homes and the Rising Sea 2019 Edition*. Climate Central.



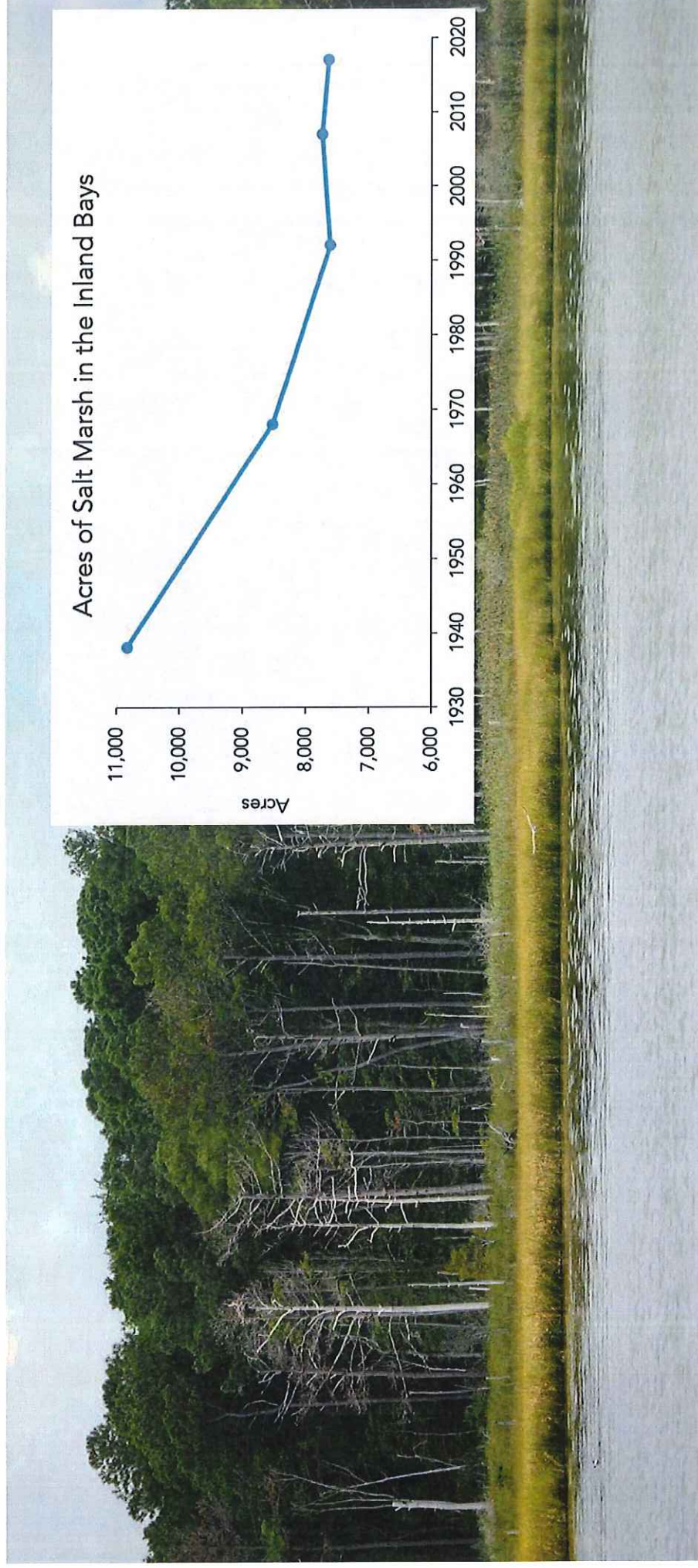




Long Neck 2019 - credit  
Driscoll Drones



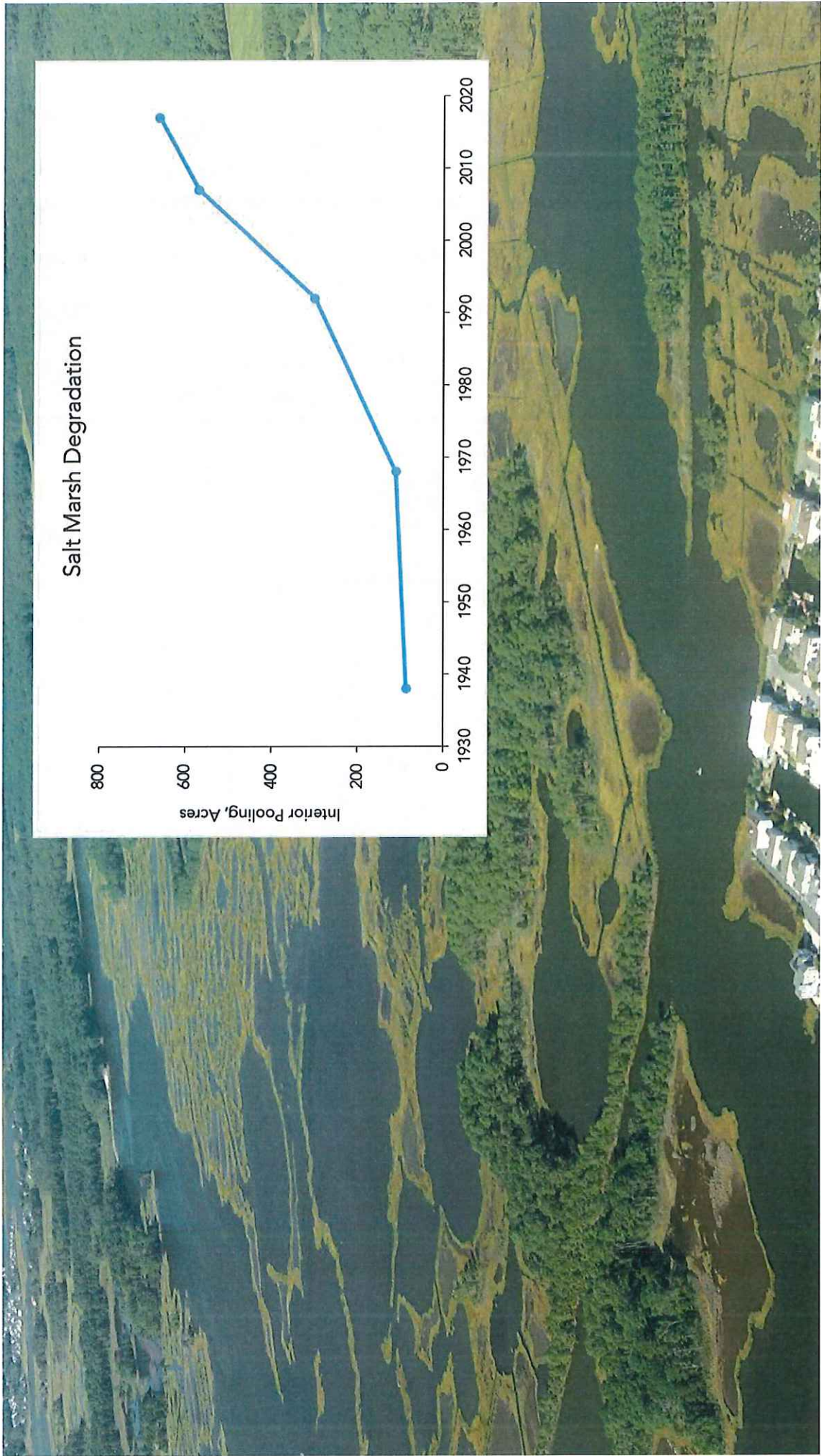
# Salt Marsh Acreage and Condition Trends















## Rates of tidal wetland migration

*derived from metric mapping analysis 1926-1989*

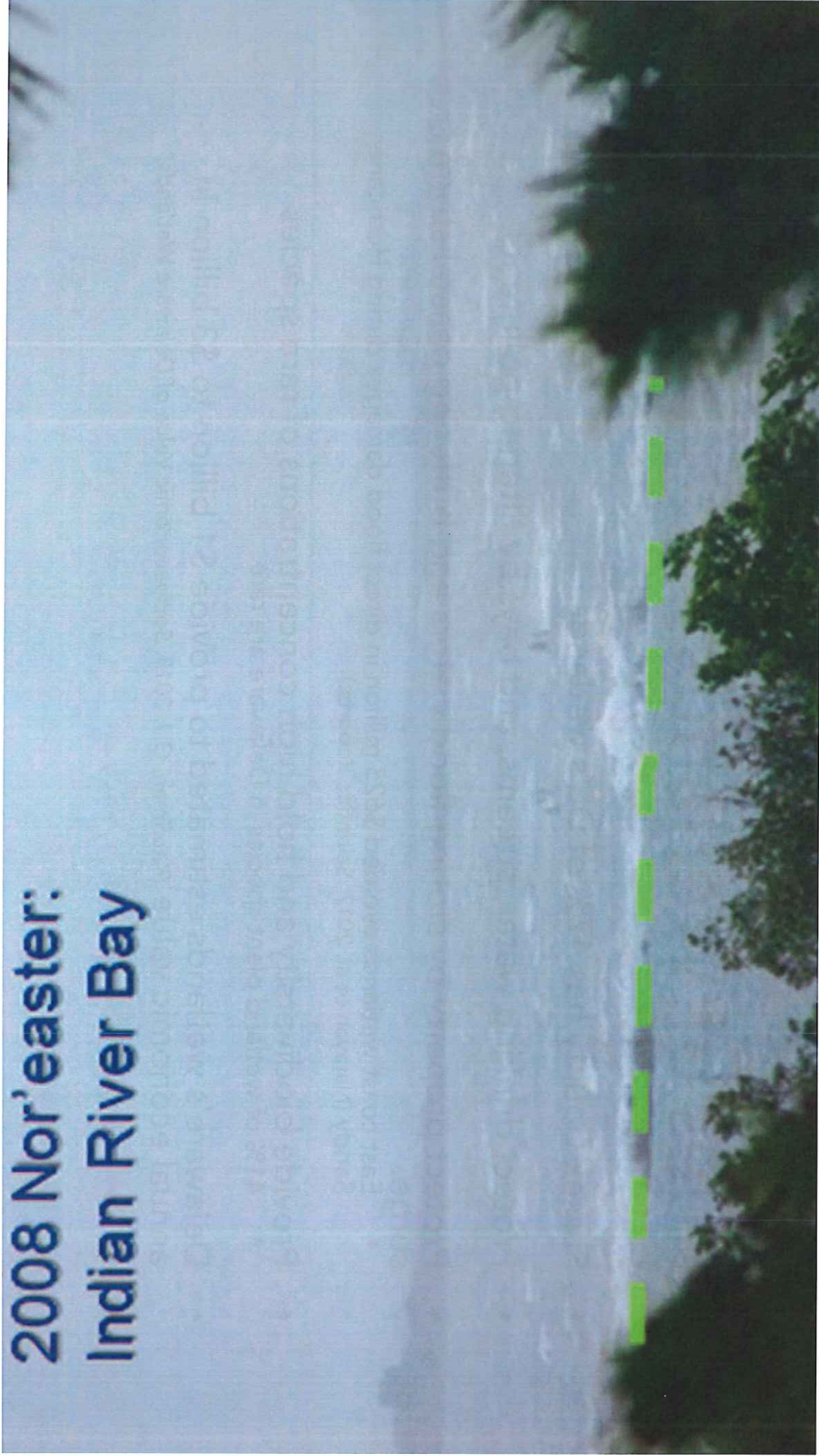
| Slope of Adjacent Upland | Indian River Bay | Rehoboth Bay |
|--------------------------|------------------|--------------|
| Gradual (<0.08 rise/run) | 5.25 ft/yr       | 6.07 ft/yr   |
| Steep (>0.09 rise/run)   | 1.44 ft/yr       | 0.82 ft/yr   |



# Values of Wetlands

- Sussex County has 47% of DE's wetlands.
- Protect drinking water, streams, and bays by filtering pollutants.
- Protect property by storing flood waters and buffering coastal storm surge.
  - East coast wetlands avoided \$625 million in direct flood damages during Hurricane Sandy (Narayan et al. 2017. Scientific Reports.)
- Provide biodiversity and hold high concentrations of rare species
  - 41% of wetland plant species in Delaware are rare.
- Delaware's wetlands estimated to provide \$1 billion to \$3 billion in annual economic value (Kauffman, G.J. 2018. Socioeconomic Value of Delaware Wetlands)

# 2008 Nor'easter: Indian River Bay





# Achievements of Ordinance

- Includes consensus points of buffer work group regarding features, widths, activities, and site design flexibility (buffer averaging only)
- Specifies purposes of buffer
- Requires Management Plan
- Excludes lot lines from the buffer
- Addresses invasive species
- Includes access to features through easement

# Review of Ordinance Purposes

- Protect the Resources and their associated functions.
- Improve/protect water quality via sediment filtration, reduce impact of nutrient loading on Resources, moderate water temperature, and enhance infiltration and stabilization of channel banks.
- Provide wildlife habitat via nesting, breeding, and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge.
- Enhance and/or maintain the floodplain storage functionality via reduction of flood conveyance velocities as well as dissipation of stormwater discharge energy.



# Buffer Widths

- The wider the buffer the more functional, to a point
- Minimum effective widths vary by buffer purpose and buffer type
- Very wide buffers needed for marsh migration and wildlife protection
- Narrow parts of the buffer can reduce effectiveness
- Streamside buffers often recommended at 100 feet minimum

## STREAMSIDE FOREST BUFFER WIDTH NEEDED TO PROTECT STREAM WATER QUALITY, HABITAT, AND ORGANISMS: A LITERATURE REVIEW<sup>1</sup>

Bernard W. Sweeney and J. Denis Newbold<sup>2</sup>

**ABSTRACT:** This literature review addresses how wide a streamside forest buffer needs to be to protect water quality, habitat, and biota for small streams ( $\leq 100 \text{ km}^2$  or  $\sim 5\text{th}$  order watershed) with a focus on eight functions: (1) *nitrate removal* varied inversely with subsurface water flux and for sites with water flux  $>50 \text{ Lm}^2\text{day}$  ( $\sim 10\%$  avg base flow to Chesapeake Bay) median removal efficiency was 55% (26–64%) for buffers  $<10 \text{ m}$  wide and 89% (27–99%) for buffers  $>10 \text{ m}$  wide; (2) *sediment trapping* was  $\sim 45\%$  and  $\sim 85\%$  for a 10- and 30-m buffer, respectively, based on streamside field or experimentally loaded sites; (3) *stream channel width* was significantly wider when bordered by  $\sim 25\text{-m}$  buffer (relative to no forest) with no additional widening for buffers  $\geq 25 \text{ m}$ ; (4) *channel meandering and bank erosion* were lower in forest but more studies are needed to determine the effect of buffer width; (5) *temperature* remained within  $2^\circ\text{C}$  of levels in a fully forested watershed (UNIV) but been poorly studied in forest buffers wider than  $250 \text{ m}$ ; (6) *large woody debris* ( $>30 \text{ m}$ ) can provide habitat for fish and invertebrates and contribute to stream channel complexity; (7, 8) *streamside forest habitat* remain near a natural or semi-natural state when buffered by  $\geq 30 \text{ m}$  forest. Overall, buffers  $\geq 30 \text{ m}$  wide are needed to protect the physical, chemical, and biological integrity of small streams.

**KEY TERMS:** riparian ecology; nonpoint source pollution; temperature; nutrients; best management practices; sediment; rivers/streams; macroinvertebrates; fish; streamside forest; buffer; nitrate; streambank stability; woody debris.)

Sweeney, Bernard W. and J. Denis Newbold. 2014. Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review. *Journal of the American Water Resources Association* (JAWRA) 50(3): 560–584. DOI: 10.1111/jawr.12203

### INTRODUCTION

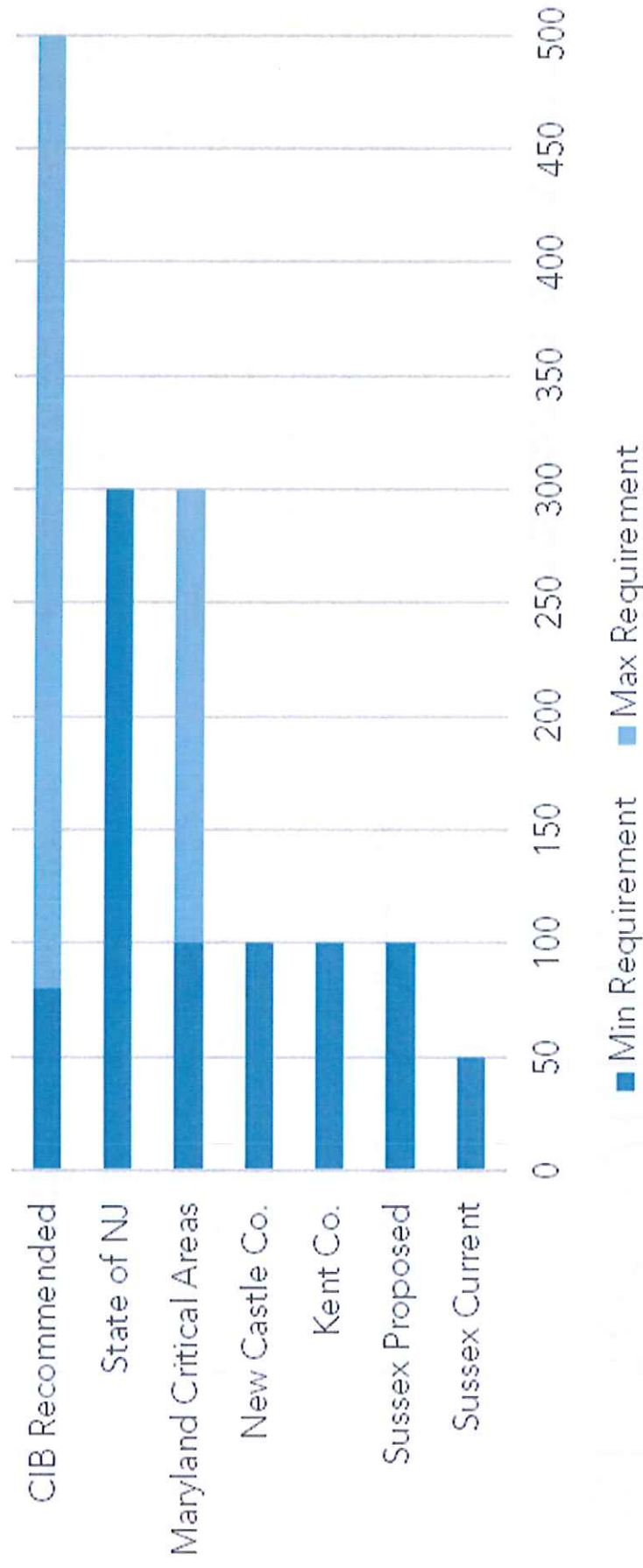
The Environmental Protection Agency (USEPA, 2013) recently reported that 55% of the river and stream length in the United States (U.S.) is in poor condition. Streamside disturbance and poor riparian vegetation cover were the most widespread stressors, reported in 20 and 24%, respectively, of the streams and rivers in the study. Streamside forests have

historically formed the natural interface between hillslope and aquatic processes for most watersheds worldwide. This was particularly true in North America, where even streams in grassland prairies were apparently bordered by forest (West and Runk, 2004). Removal of those natural streamside forests greatly alters the physical, chemical, and biological dynamics of streams, as well as the structure and function of their ecosystems (Hyros, 1975; Gregory *et al.*, 1991; Sweeney, 1993; Naiman and Décamps,

<sup>1</sup>Paper No. JAWRA-13-01024 of the *Journal of the American Water Resources Association* (JAWRA). Received April 19, 2013; accepted January 6, 2014. © 2014 American Water Resources Association. Discussions are open until six months from print publication.

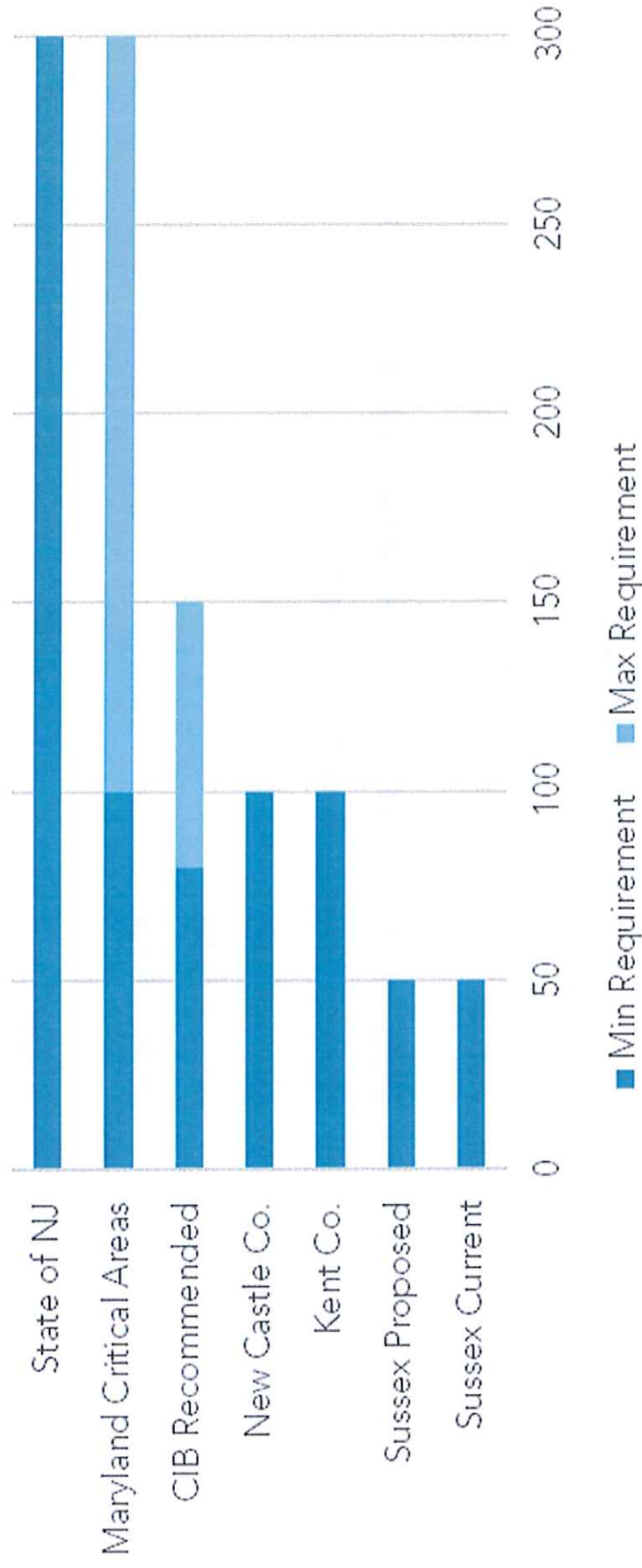
<sup>2</sup>Stream Ecologists, Stream Water Research Center, 870 Spencer Road, Avondale, Pennsylvania 19011 (E-Mail: Sweeney@streamcenter.org).

## Tidal Wetlands & Waters Buffer Widths



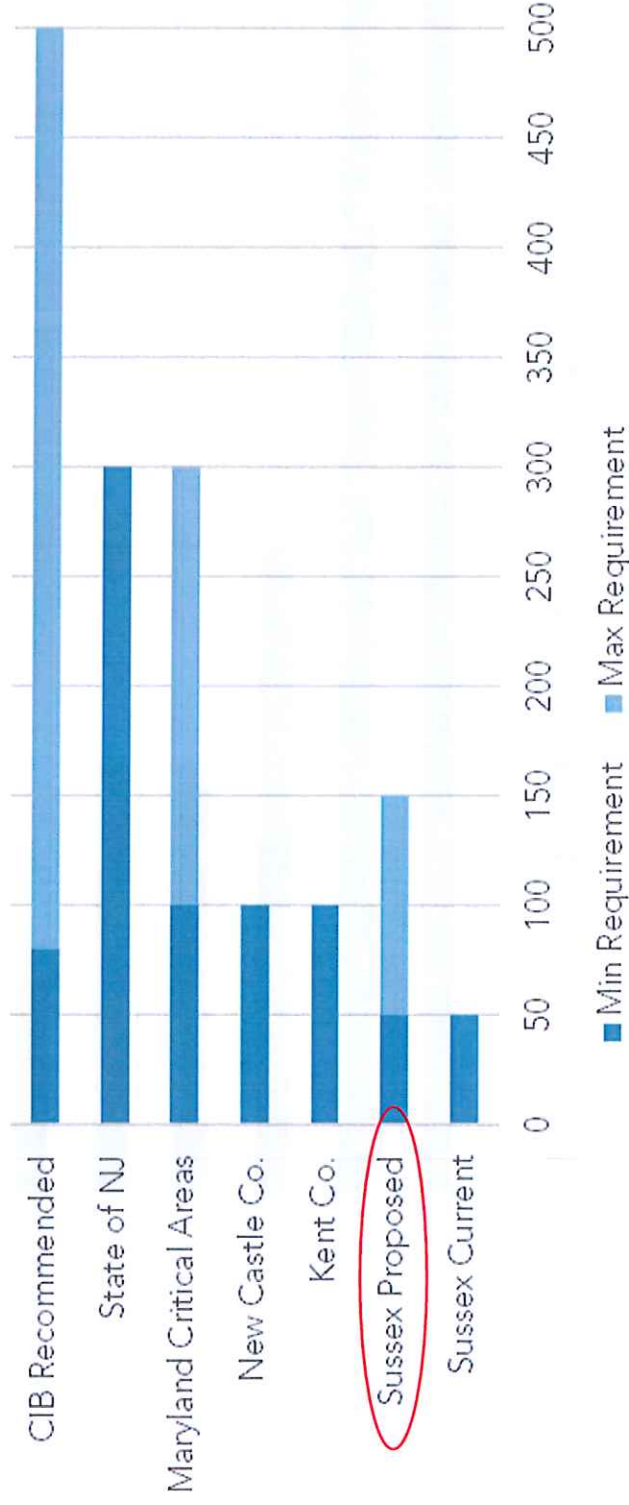


## Perennial Stream Buffer Widths



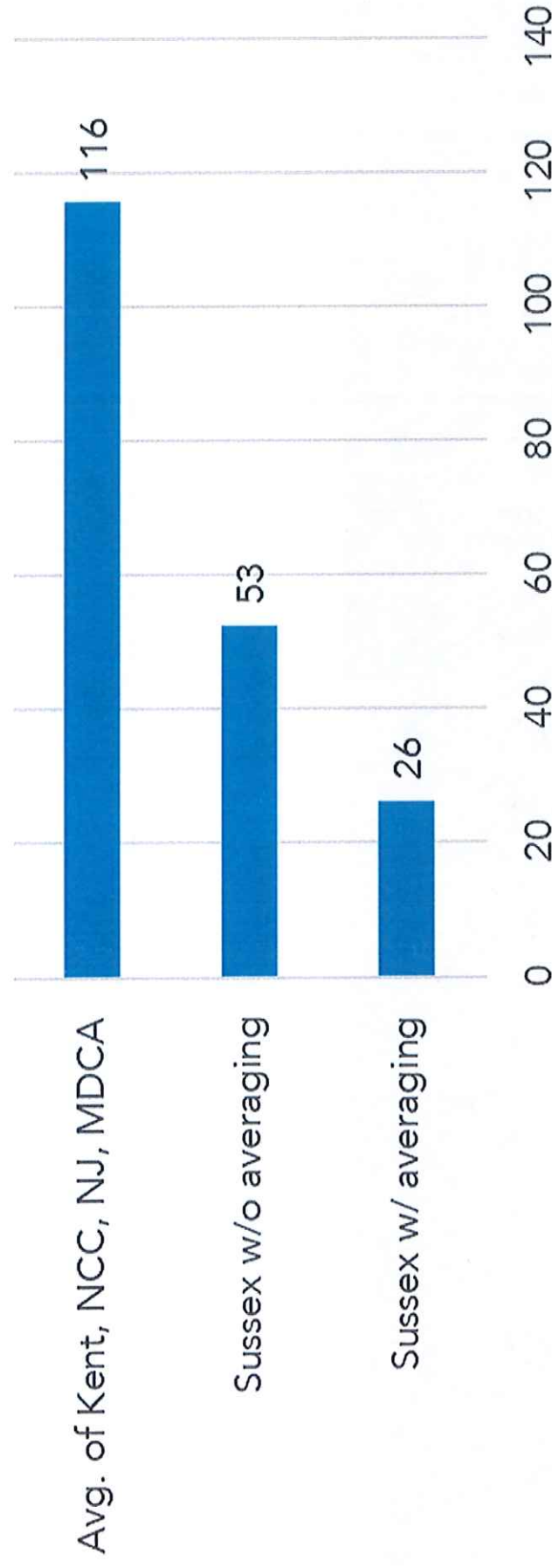
# Buffer Averaging Allowed for Design Flexibility

Tidal Wetlands & Waters Buffer with Averaging





## Average Minimum Buffer Widths Required by Jurisdiction Across Resource Types



Sussex is as Proposed but does not include Options for Sussex Ordinance (Section G.)  
NCC = New Castle County, DE; MDCA = Maryland Critical Areas

## Wetlands and Waterways Buffer Policy Comparison

| Character-istic          | Sussex Co. Crnt.     | Sussex Co. Prpsd.        | CIB Reco-mends     | Kent Co.           | New Castle Co.     | State of NJ                         | State of MD Critical Areas. |
|--------------------------|----------------------|--------------------------|--------------------|--------------------|--------------------|-------------------------------------|-----------------------------|
| Veg. Type                | Natural              | Forest or meadow*<br>*** | Natural/<br>Forest | Natural/<br>Forest | Natural/<br>Forest | Existing Veg. or Natural/<br>Forest | Natural/<br>Forest          |
| Protects Existing Forest | Yes, but not enfrcd. | No                       | Yes                | Yes                | Yes                | Yes                                 | Yes                         |
| Reveg. with Trees        | Yes, not enfrcd.     | No                       | Yes                | Yes                | Yes                | Yes                                 | Yes                         |



# Requested Amendments to the Proposed Ordinance

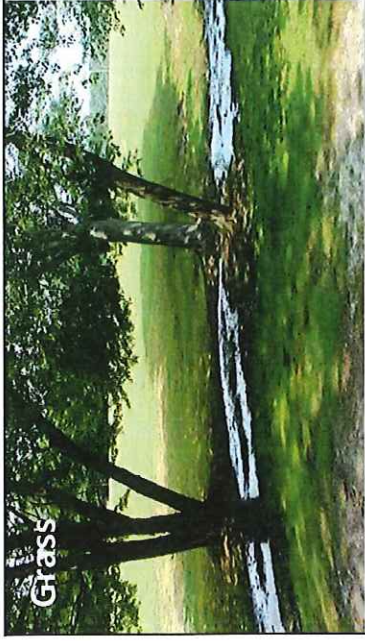
- Requirement for protecting and restoring forest in Resource Buffer Standards (Section D. begins at line 701.)
- Removal of Resource Buffer Options (Section G. begins at line 781)
- Clarify Maintenance of Drainage Conveyance
- Specify enforcement and penalties

# Buffers should be forested

*'Forests are the most beneficial land use for protecting water quality, due to their ability to capture, filter, and retain water, as well as air pollution from the air. Forests are also essential to the provision of clean drinking water to over 10 million residents of the watershed and provide valuable ecological services and economic benefits including carbon sequestration, flood control, wildlife habitat, and forest products'.*

-- Chesapeake Bay Executive Council, 2006



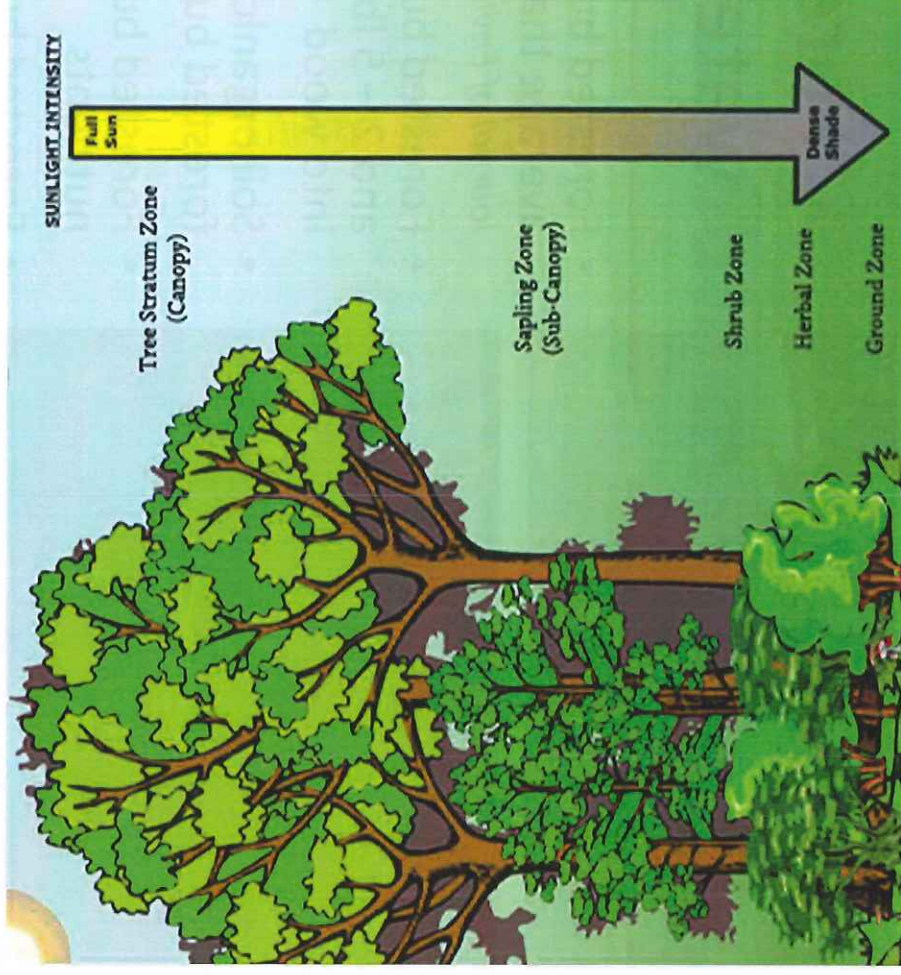


# Forests provide better water quality protection

- Forested buffers remove 36% more nitrogen on average than grassed buffers (*Mayer et al. 2007 Journal of Environmental Quality*)
- Forested buffers take up 11 – 37 lbs of nitrogen and 2 – 5 lbs of phosphorus per acre per year into wood
- Soil organic matter is over twice as high in forested buffers
- Forested buffers improve instream processing of nutrients
- Forested buffers support wildlife habitat and don't contribute pollution



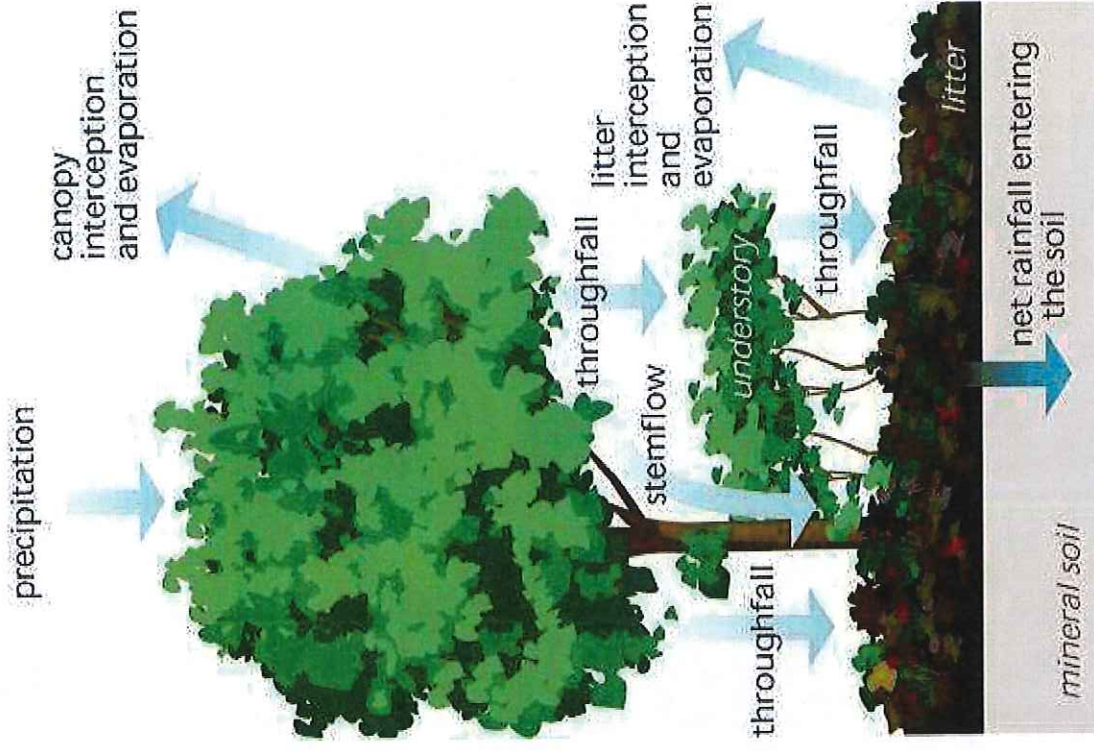
## FOREST STRUCTURE



## Native forests are essential for habitat

- The amount of forest in an estuary's watershed, particularly near the water, has significant positive influence on the health of the estuary's baygrasses, crabs, and marsh birds (*Li et al. 2007. Estuaries and Coasts. 30, 840-854; and references therein*)
  - Each layer provides habitat niches for wildlife and physical buffering
- Native species essential to support the foodweb

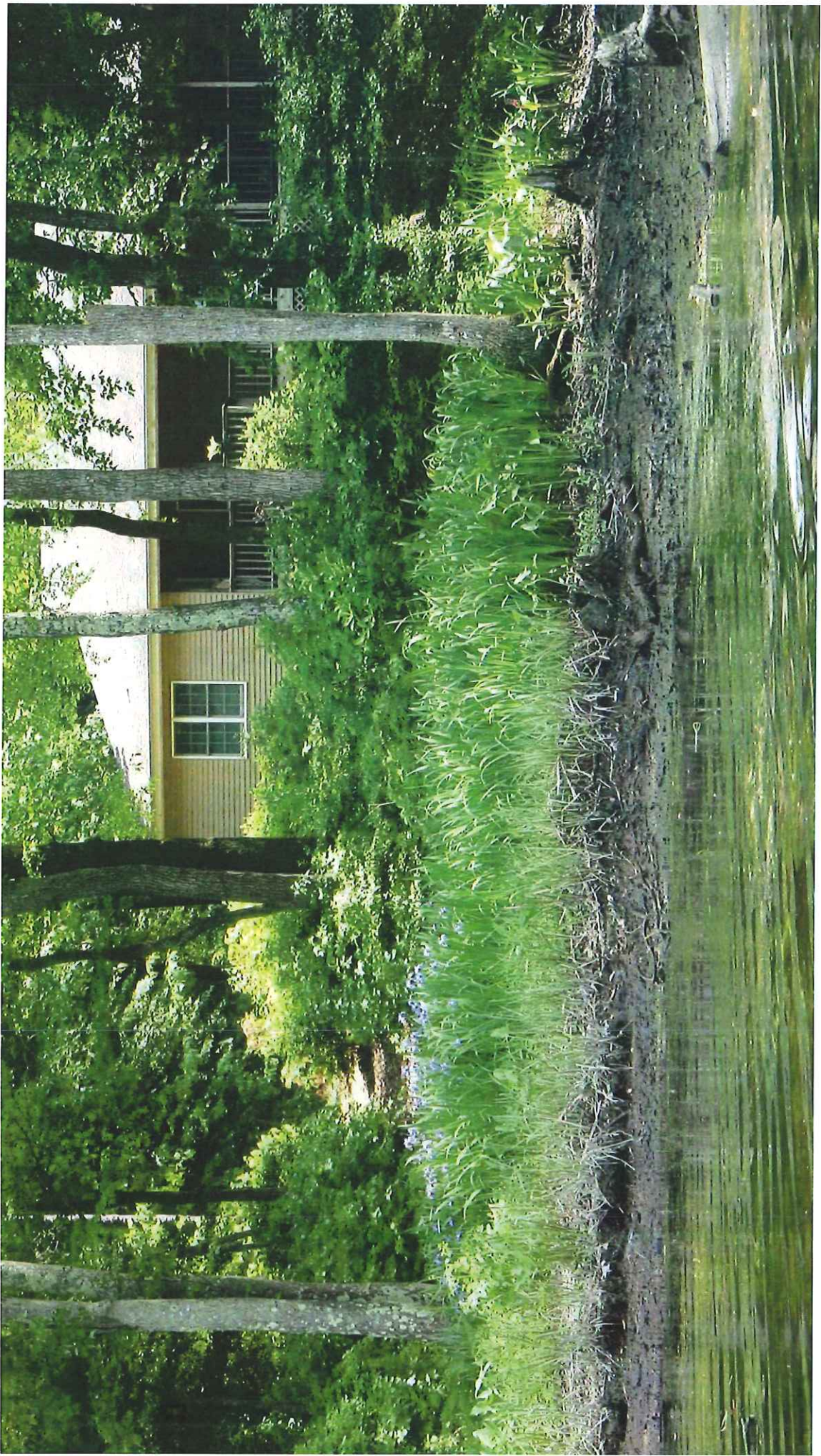




# Forests control the flow of water

- Huge biomass
- Intercepts precipitation
- Increases evaporation and transpiration
- Forest floor/leaf litter acts as giant sponge shelters insects
- Reduces runoff
- Large root systems provide infiltration channels







# Protection and Restoration of Forest

- Eliminate non-forest buffer standard and require forest in all buffer areas except where otherwise permitted by activities list.
- Buffers without forest at time of application must submit native species planting plan and invasive species control plan to restore native forest to defined standard and time period
  - similar in approach to forested and/or landscape buffer strip code
  - Include forest maintenance requirement in management plan
  - diversity of Delaware natives trees and shrubs required
  - planting and survival standards by stock size
  - Natural revegetation allowed within 25 feet of mature native forest

# Resource Buffer Options Description

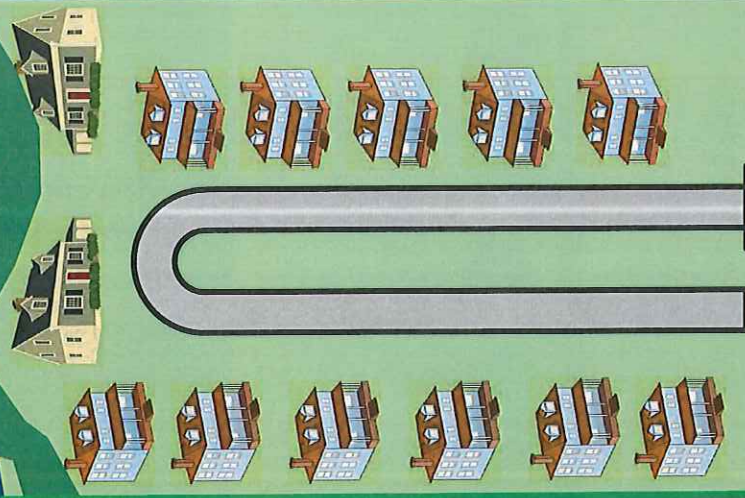
- Retaining forest in a buffer allows reduction of buffer width by half.
- Retaining forest in a buffer allows reduction of development perimeter buffer.
- Retaining forest connected to but not within buffer allows reduction in buffer width by half.
- Retaining forest connected to but not within buffer allows reduction of development perimeter buffer.
- Preserving wider wetland buffers allows reduction in development perimeter buffers.



## *Tidal Water*

100' Tidal Water Forested Buffer

50' Tidal Water Forested Buffer  
(req'd under previous code)



### **Option 1. a.**

*When preservation of a forest within the Resource Buffer in existence for at least five years prior to application is achieved, then a corresponding area reduction of either the Resource Buffer Zone B along the entire or part of that Resource; or the Forested and/or Landscaped Buffer required (Chp 99) in areas adjacent to like zoned land is permitted*

Developing Property

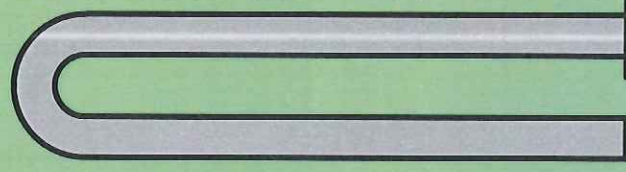
Existing Development

20' Property Perimeter Buffer  
(Forested and/or Landscaped Buffer)



## *Tidal Water*

50' Tidal Water Forested Buffer  
(req'd under previous code)



20' Property Perimeter Buffer  
(Forested and/or Landscaped Buffer)

### **Option 1. b.**

*When Preservation of a natural forest connected to (but not within) a Resource Buffer in excess of the requirements is achieved by adding the area to Zone B, then a corresponding area reduction of either non-Forest Resource Buffer Zone B on the same Resource, or Forested and/or Landscaped Buffer required in Ch. 99 in areas adjacent to like-zoned land is permitted.*

Developing Property

Existing Development



## *Tidal Water*

100' Tidal Water Forested Buffer

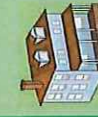
20' Additional Forested or non-forested buffer

### **Option 1. c.**

*When the provision of Resource Buffer area in excess of the requirements is achieved, then a corresponding area reduction of the Forested and/or Landscaped Buffer required in Chp 99 in areas adjacent to like-zoned land is permitted.*

Developing Property

50' Tidal Water Forested Buffer  
(req'd under previous code)



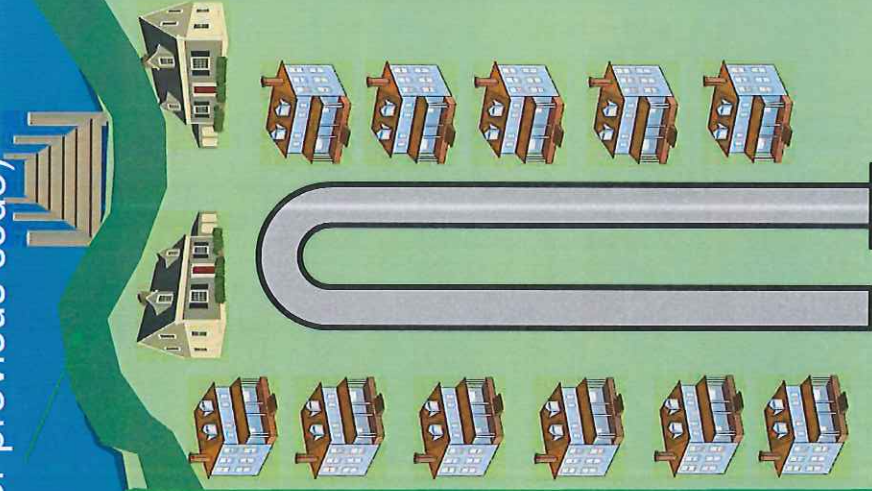
Existing Development



## Tidal Water

100' Tidal Water Forested Buffer

50' Tidal Water Forested Buffer  
(req'd under previous code)



### Option 1. a.

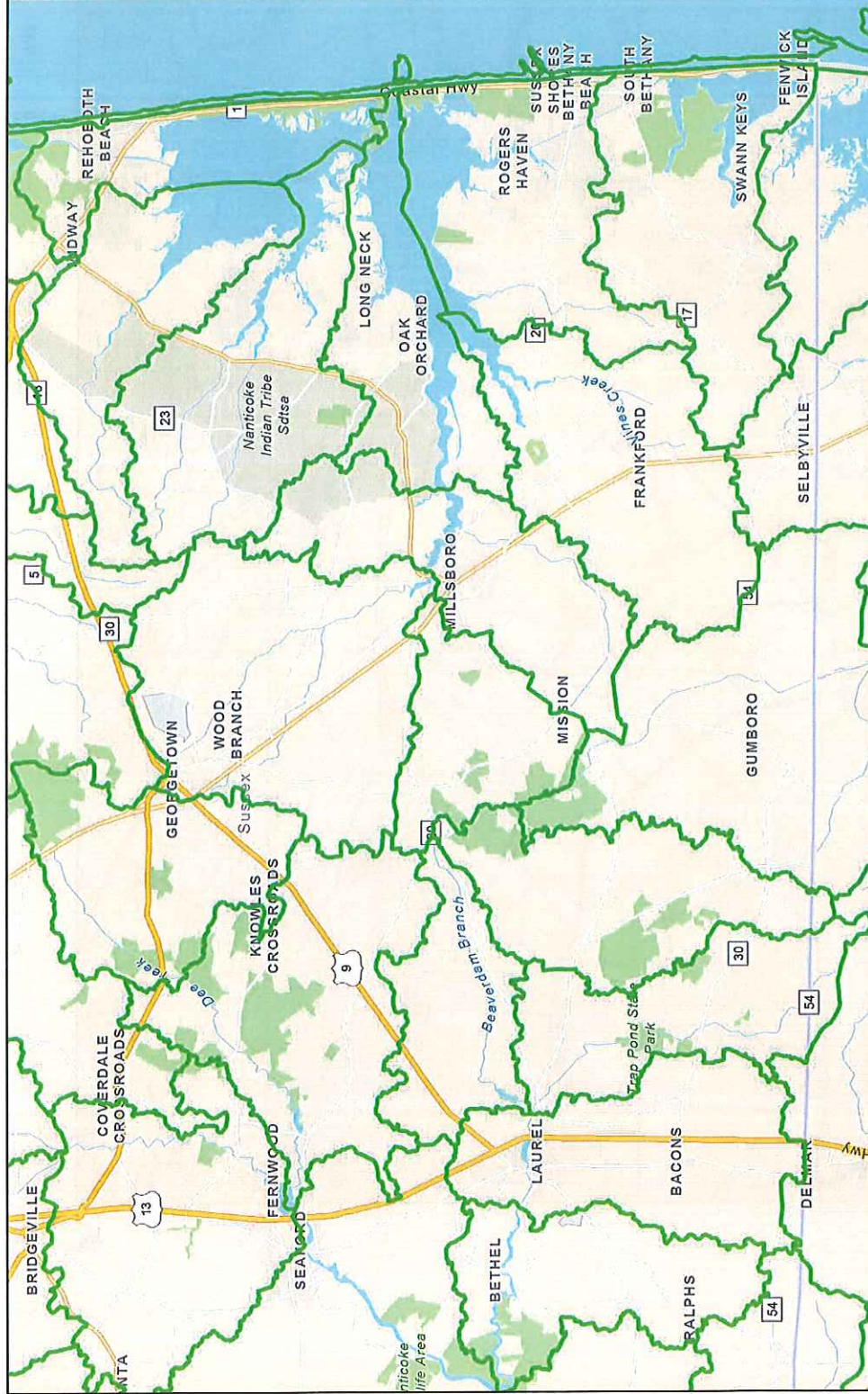
When the creation of an off-site Resource Buffer is protected under a perpetual conservation easement, then a 75 percent corresponding area reduction of the Resource Buffer Zones A and/or B is the same Resource within the development is permitted. The upland line of that new off-site Resource Buffer and perpetual conservation easement shall be considered the edge of the Resource for locating a Resource Buffer in the event that the off-site land is developed in the future. The perpetual conservation easement shall be for the benefit of a conservation organization approved by Sussex County, and it must be located within the same twelve-digit hydrologic unit code as defined by the United States Geological Survey as the proposed development.

Developing Property

Existing Development



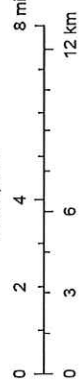
# HUC - 12 Watersheds



1/8/2022

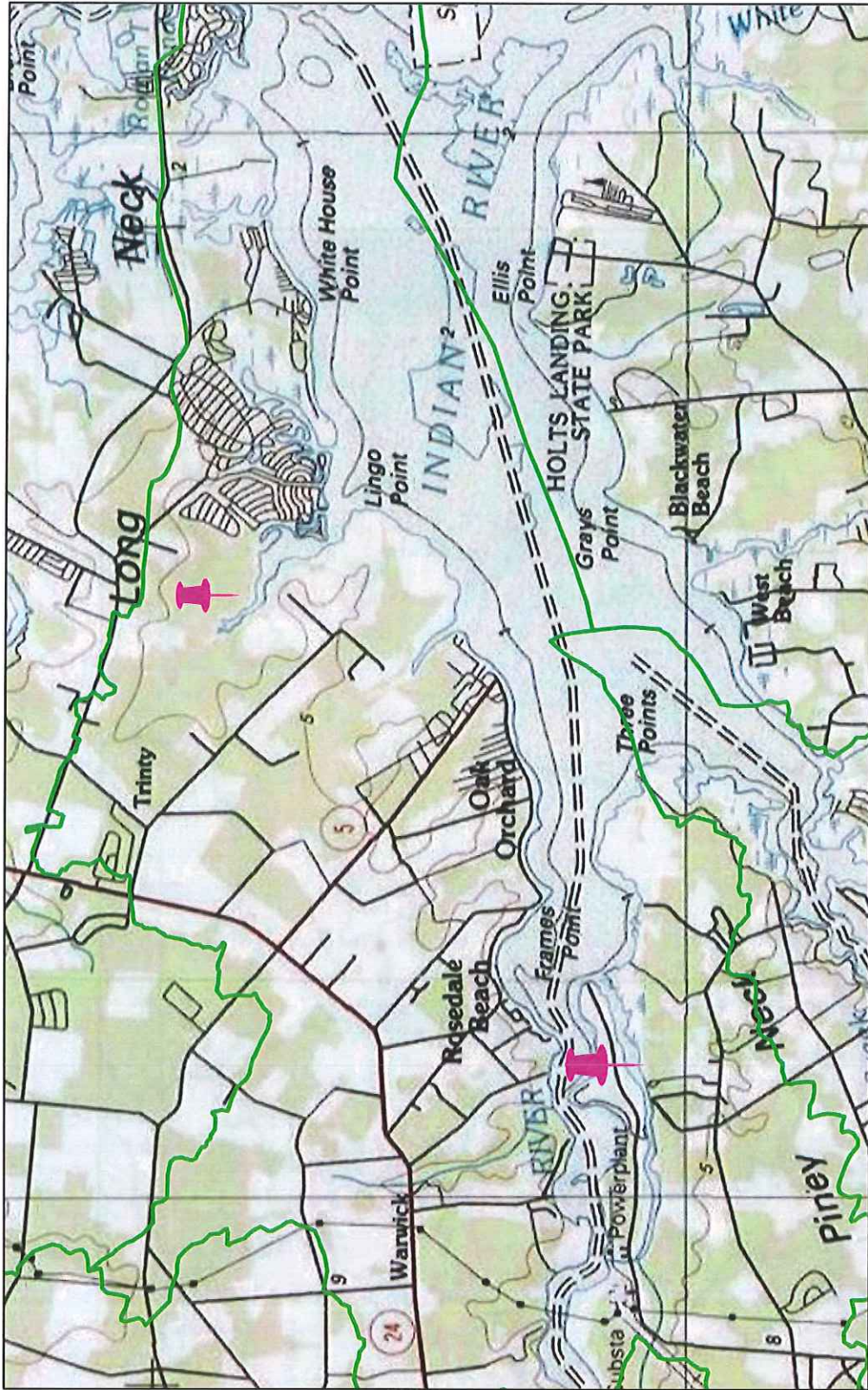
HUC 12

1:288,414



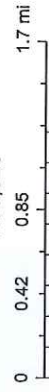
U.S. Geological Survey, County of Sussex, DE, Delaware FirstMap, VITA.





1/8/2022

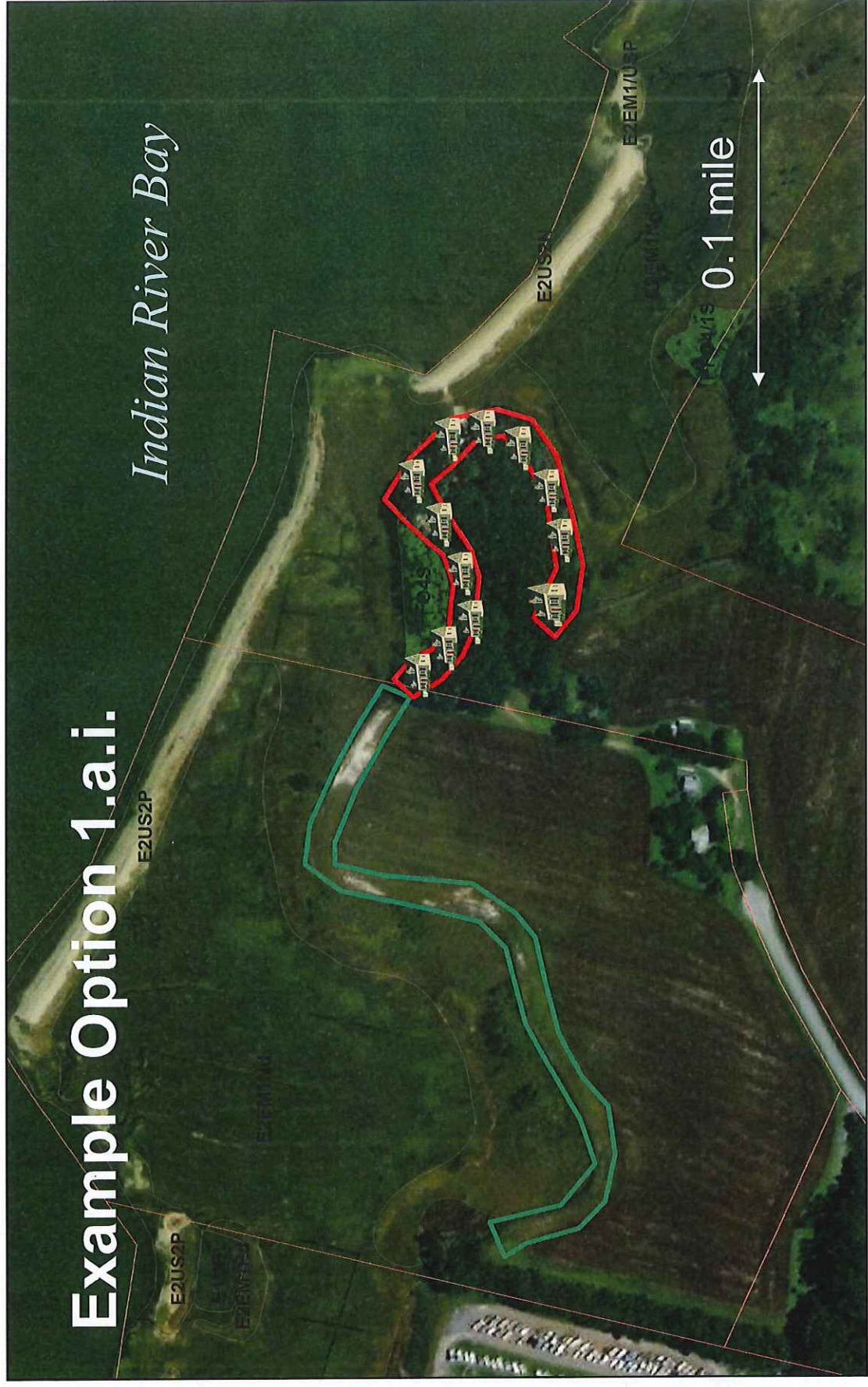
1:65,528



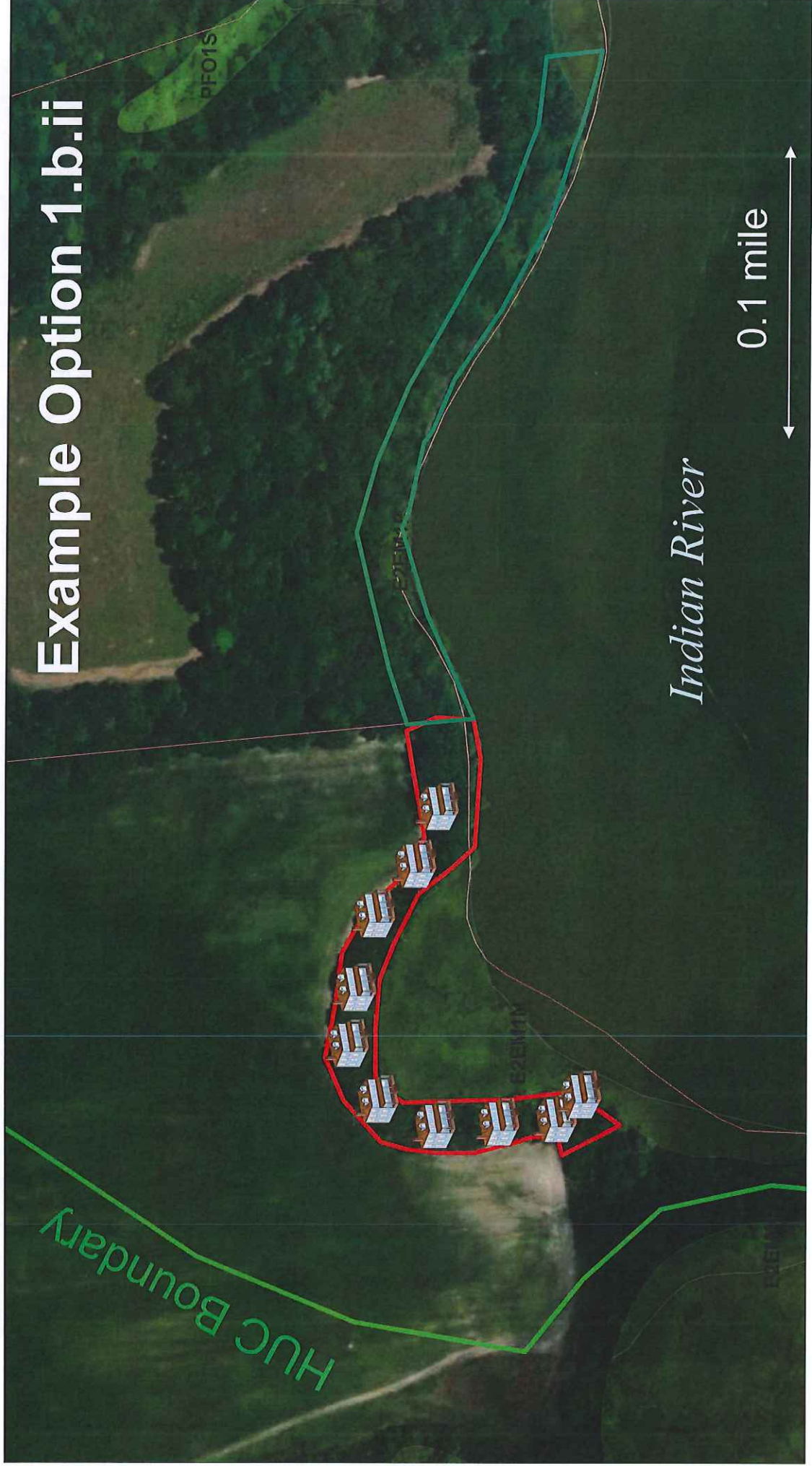


# Example Option 1.a.i.

*Indian River Bay*



# Example Option 1.b.ii







# Remove Resource Buffer Options

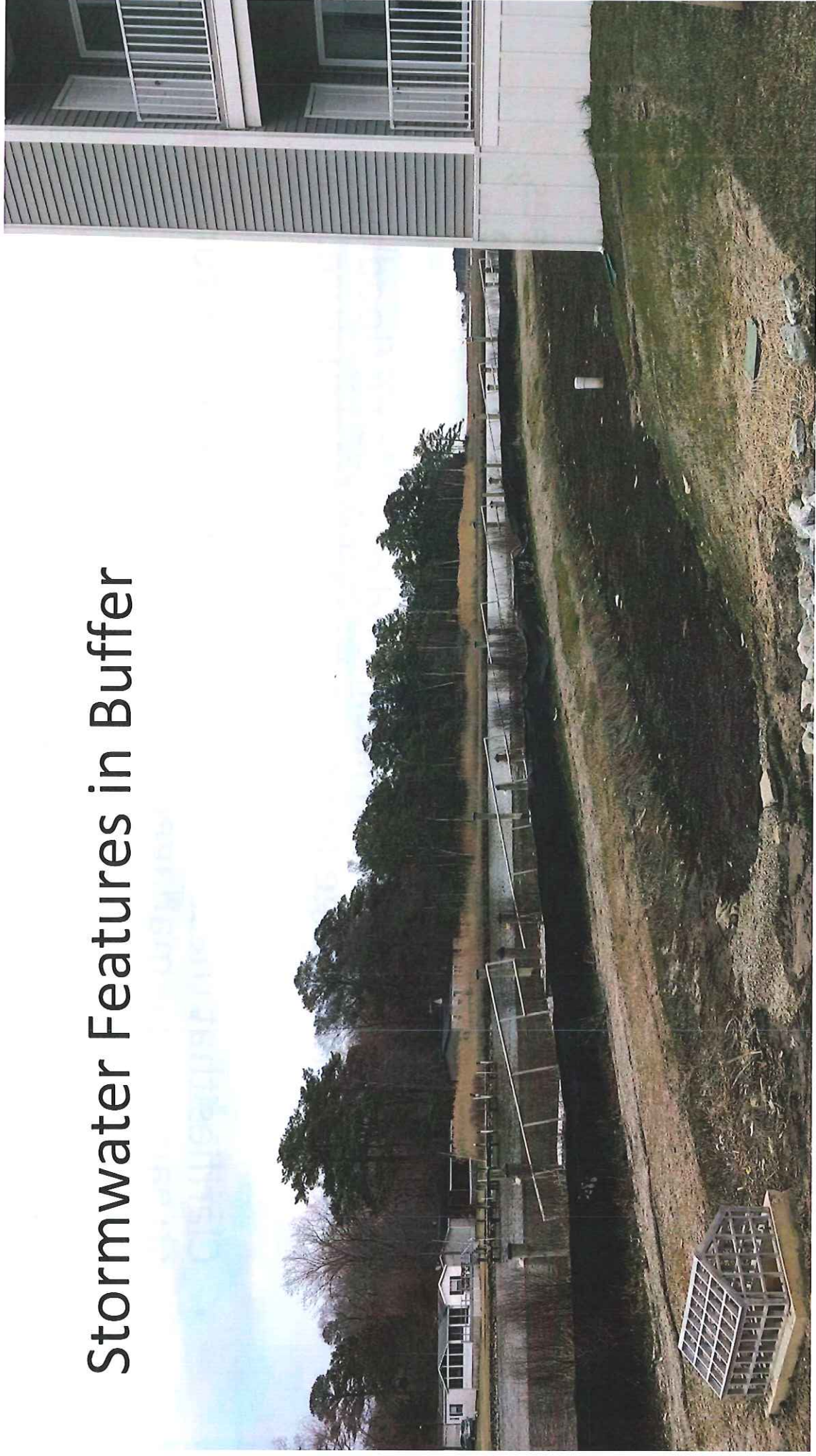
- Need for flexibility in site design provided by buffer averaging.
- Options should not reduce width of buffers which are already on the low end of effectiveness.
- Options should not reduce the effectiveness of another ordinance with a separate purpose (perimeter buffer) to attempt to create an effective waterway and wetland buffer ordinance.



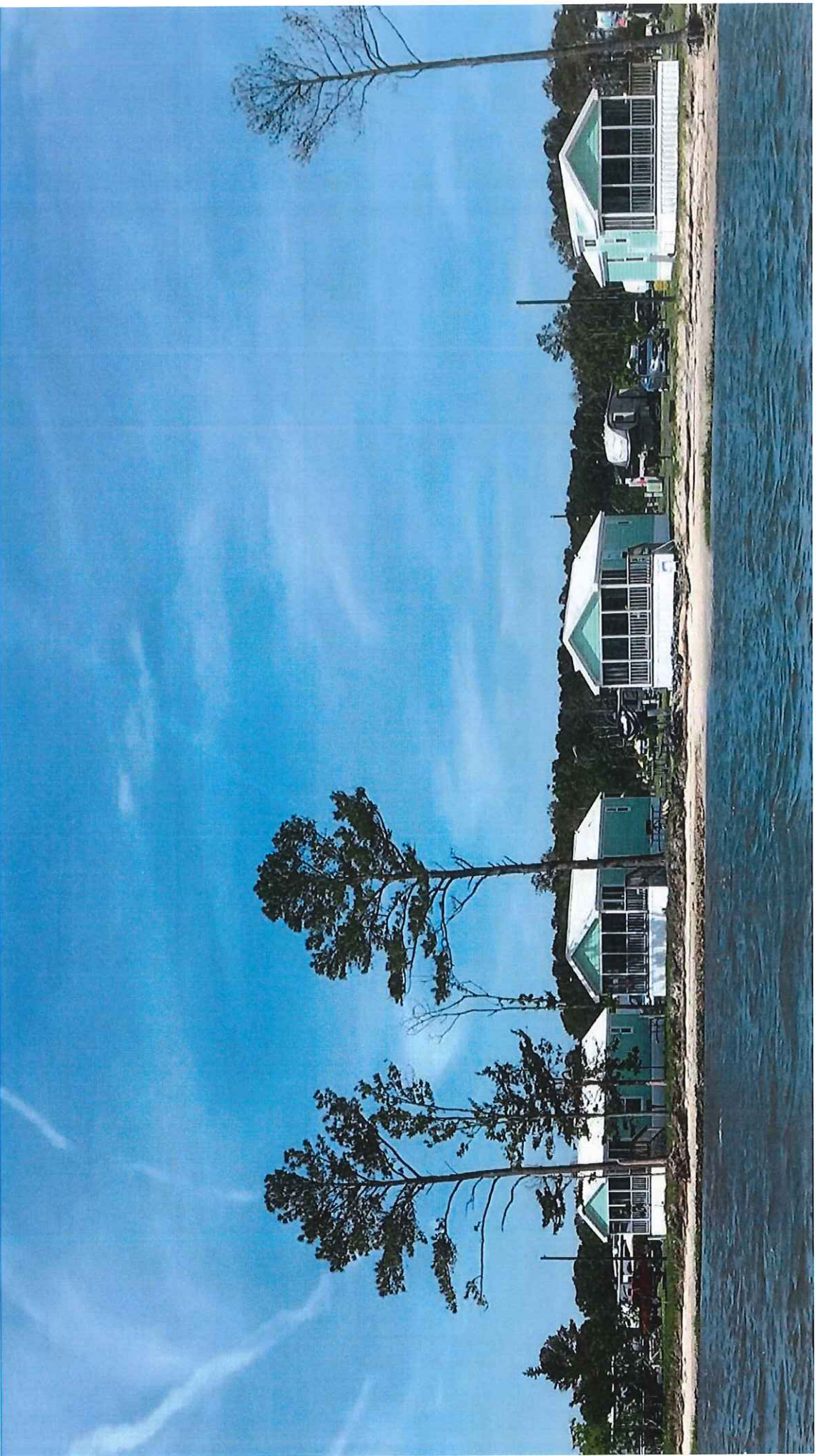
## Clarification of Maintenance of Drainage Conveyances

- Page 27, Line 763. "The location of any stream blockages such as debris jams, fallen or unstable trees, beaver dams or similar impediments to conveyance..."
- Add... "that have a high likelihood of causing flooding resulting in damage to property and infrastructure."
- Clarifies that these are natural and beneficial features of streams to be managed appropriately.
- Define "positive conveyance."

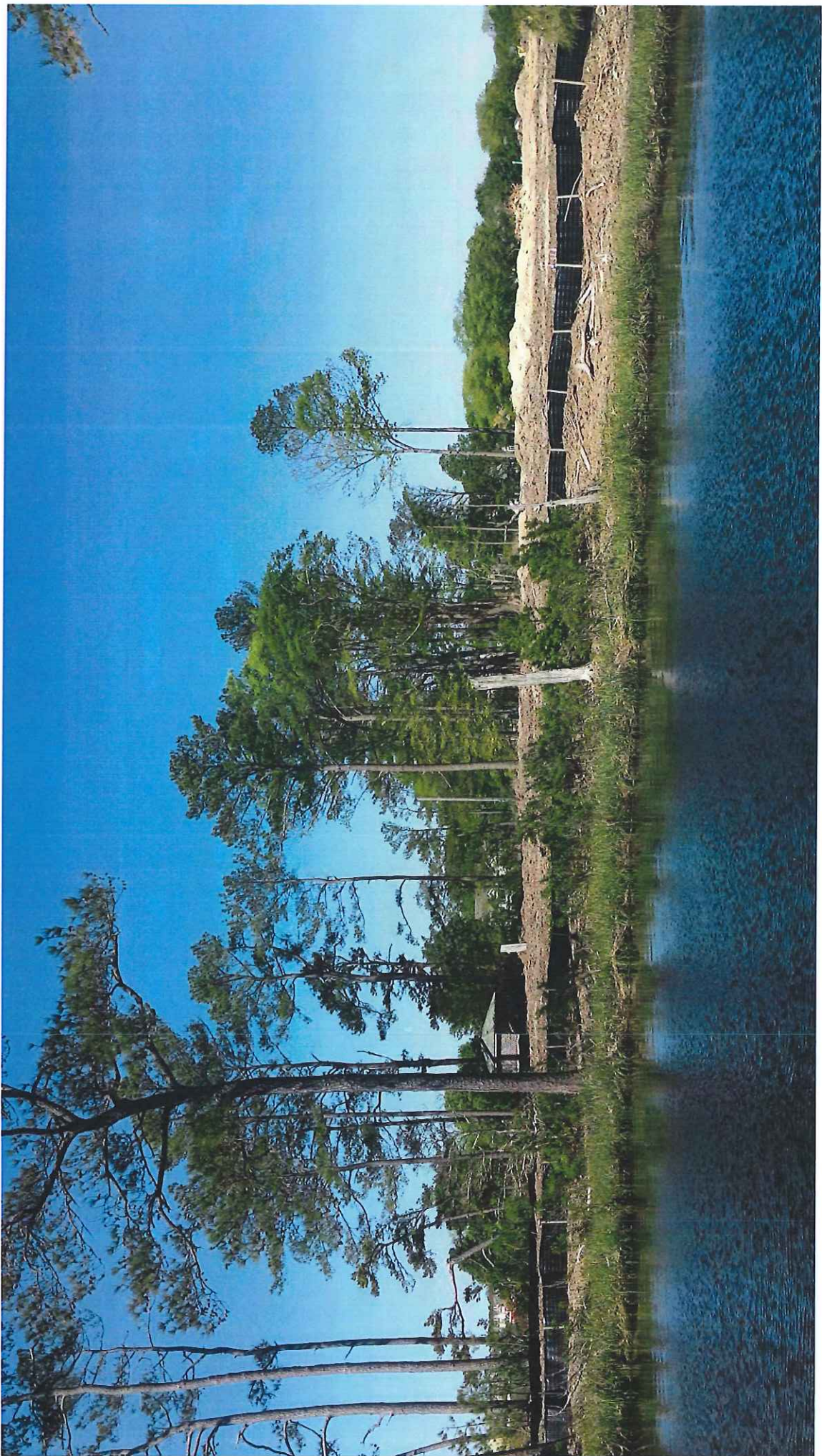
# Stormwater Features in Buffer



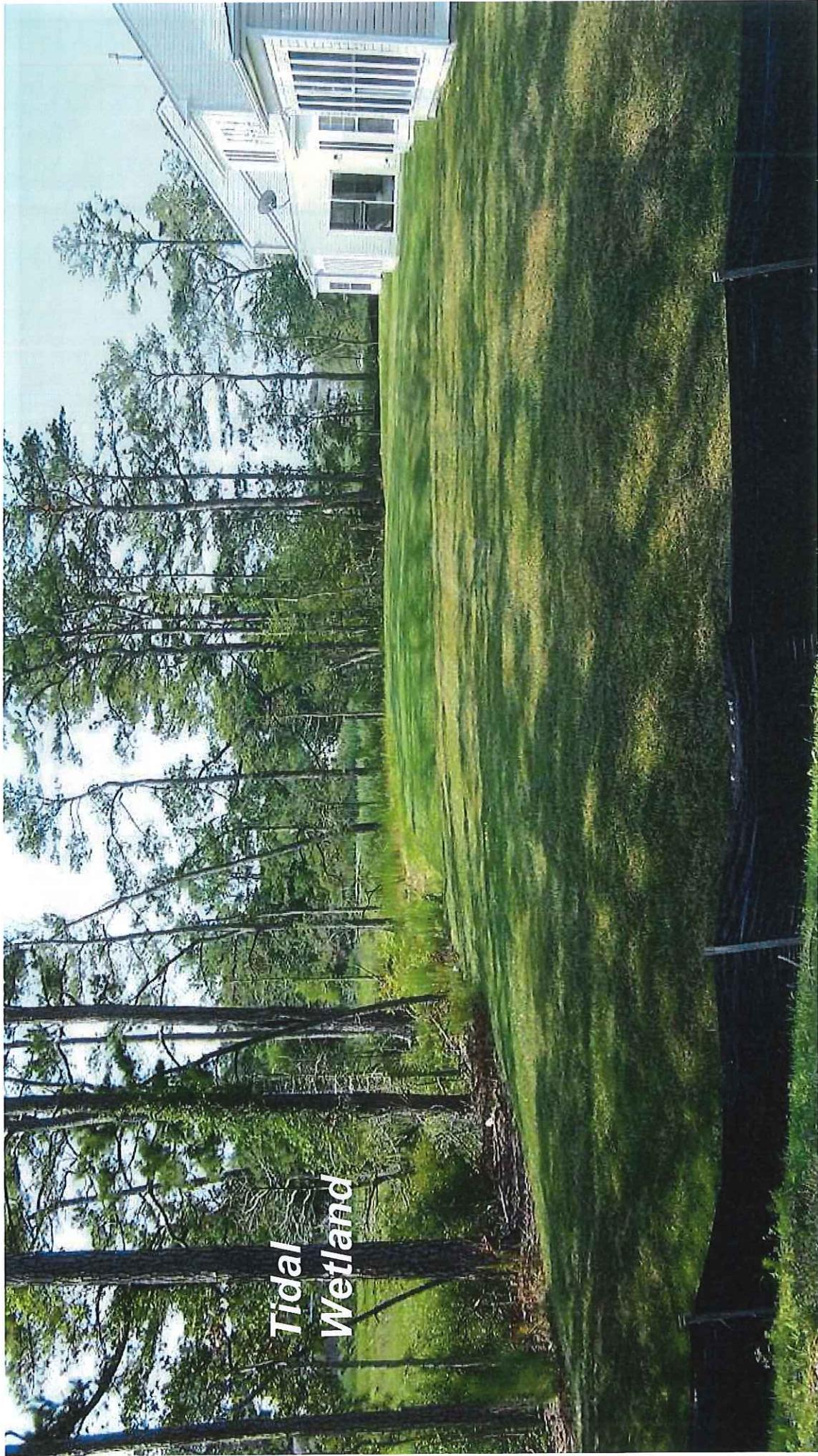












*Tidal  
Wetland*



# *White Creek watershed pollution due to lack of buffers*











## Jesse Lindenberg

---

**From:** E Lee <eulmlee@gmail.com>  
**Sent:** Monday, January 10, 2022 3:51 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley; Todd F. Lawson; Robin Griffith; Planning and Zoning  
**Subject:** Buffer Ordinance - Comments

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Good afternoon,

Thank you for this chance for the public comments.

As far as I know, the revised draft became available to the public only on 1/5/2022 when it was published online with the agenda, and I don't think 5-6 days were enough time for the public to review this very important ordinance.

After reading and listening to both CIB and SARG's expert opinions, I fully support all their points including the following:

- The Buffer Option can in effect nullify this new ordinance that is replacing § 115-193. A question comes to mind whether this is added, after the Wetlands/Buffer Working Group's work was done, to provide ways for the developers to sidestep the buffer requirements. **Please remove 'Buffer Option' from the ordinance.**
- And, thank you for removing the 'Selective Tree Cutting.' However, **we have to prevent developers from cutting down trees before submitting the application.**
- Buffer widths proposed are the absolute minimum and must be increased since Sussex is lying very low and the impact of the flooding can be much bigger than in the higher grounds. The fact that the beaches have been replenished with sand regularly to keep the size of those beaches proves that the sea and the bay water are the natural forces that will slowly swallow up Sussex's low-lying areas. I hear the current Riverdale area is about a half of what it used to be before the 1962 Nor'easter. My point is, much of whatever buffer we preserve today may be lost to the water sooner or later. For that reason, **we need to preserve wider buffers today.**

Now, I will jump to my other issues that I had brought up to P&Z while they were collecting comments for the revision of the ordinance draft. Some may consider these minor, but the minuscule things add up over time and are also the reasons for intensified public's distrust and suspicions on the intentions of the parties drafting the ordinances.

### 1. I have to ask, why delete '[and]' and add 'in' in line 531 of the draft?

Please read the paragraph of §115-25 F. (3) (a) - copied below. If anything should be changed, the two seemingly redundant sentences should be combined and the term 'reasonable' should be defined in detail so as not to encourage unnecessary disputes.

We all know by now that the lawyers will pick and tear each word to their advantage while the public has no attorneys to turn to. So, does this change ('in' instead of 'and') give room for the lawyers to argue their points?

## §115-25 Height, Area and Bulk

### F. Review procedures for cluster development

...

(3) The Planning & Zoning Commission shall determine that the following requirements are met before approving any preliminary plan and such application shall be reviewed on an expedited basis.

(a) The cluster development sketch plan and the preliminary plan of the cluster subdivision provides for a total environment and design which are superior, [and] in the reasonable judgment of the Planning Commission, to that which would be allowed under the regulations for the standard option. For the purposes of this subsection a proposed cluster subdivision which provides for a total environment and design which are superior to that allowed under the standard option subdivision is one which, in the reasonable judgment of the Planning Commission meets all of the following criteria:

## 2. Why is this ordinance changing the Sizes of Major vs. Minor Subdivisions?

This change was made by inserting (in lines 97-110) the number of lots for Major and Minor Subdivision definitions and removing (in lines 265-267) the number from the §99-7 Preliminary Conference. This way, it takes much scrutiny to find what change is proposed.

In short, this proposal is changing the maximum size of a minor subdivision from '4' to '5'; a major subdivision from '5 and more' to '6 and more.'



Why did this become part of the new Wetlands/Buffer Ordinance? This seemingly unrelated change was never discussed in the introduction of the ordinance.

**Why does it matter?** This change is a way to shift more authority to the P&Z by skirting the public comments and hearings - per **§99-7 (c) below**. Stream's Edge on Robinsonville Rd is one example: After the major subdivision was denied due to the brownfield treatment issue, the developer got 4 approved by the P&Z Director in 2020 and another 4 in 2021 without getting any attention from the public!

Please explain the need for this proposed change or remove it.

### MAJOR SUBDIVISION

Any subdivision of land creating six or more new Lots [involving a proposed new street or the extension of an existing street].

...

### MINOR SUBDIVISION

Any subdivision creating five or less Lots [fronting on an existing street and not involving any new street] and not adversely affecting the development of the remainder of the parcel or adjoining property and not in conflict with any provisions or portion of the County Comprehensive Plan, Official Map, Zoning Ordinance, or this chapter. Only one such subdivision shall be approved per year per parcel. The maximum number of lots created in the minor subdivision process shall not exceed four plus one for each 10 acres of original parcel size.

### §99-7 Preliminary Conference.

...

C. If the Director determines that the proposed subdivision represents a minor subdivision of a parcel, existing as of the effective date of this amended provision, on a street other than a major arterial roadway, and if the Director determines that review by the Commission is not necessary or desirable, he may waive the requirement of preparing a preliminary plat and may authorize the preparation of a record plat for purposes of recordation. He may, however, request review assistance from other concerned agencies prior to authorizing preparation of the plat. Lots in any minor subdivision plat approved by the Director, without review by the Commission, shall have a minimum area of 3/4 of an acre and a minimum width of 150 feet and shall

utilize entrances as approved by the Delaware Department of Transportation. [Such a minor subdivision shall be limited to four lots per parcel, as well as one additional lot for each 10 acres of parcel size, with a maximum of four subdivided lots approved for recordation per calendar year.]

The future of Sussex is here, NOW!

Has Sussex County ever appreciated its environmental assets? Does Sussex County have any desire to preserve its pristine water and scenic beauty for its residents or are they up for sale for a few who can afford the high prices of the view and the water access at the expense of the destruction of what makes Sussex, Sussex? The time to take action is now! Once gone, we will never be able to reclaim the previous glory days of 'Sussex County, the gem of the Mid-Atlantic.'

More importantly, the wetlands and buffers, along with trees and forests, are Sussex County's lifeline and the frontline defense against natural calamities that will surely visit us one day. I mean this is for Sussex County's survival.

What is Sussex going to look like? Its fate depends on what we do now.

Eul Lee (Lewes)



## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:43 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Proposed Buffer Ordinance

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**From:** Nancy Jones <njladyone@verizon.net>  
**Sent:** Sunday, January 9, 2022 7:52 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; jlriely@sussexcountyde.gov  
**Subject:** Proposed Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Greetings Counselors, I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. I would like to provide you with the following comments: 1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed. 2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas. 3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, water activities, and wildlife habitat. 4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective. Thank you for your consideration.

Nancy Jones  
23788 Samuel Adams Circle  
Millsboro, DE 19966



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## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:42 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer ordinance

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**From:** M Schertzer <mshirtsir@gmail.com>  
**Sent:** Monday, January 10, 2022 6:45 AM  
**To:** Doug Hudson  
**Subject:** Buffer ordinance

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Any ordinance allowing builders to expand their greed should be rejected wholesale !

Thank you  
Marty Schertzer  
63 Bryan Drive  
Rehoboth Beach

Sent from my own cell phone!

Sent from my own cell phone!

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## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:41 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Sussex Buffer Ordinance Concerns

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**From:** Ryan Gerrick <gerrickryan@gmail.com>  
**Sent:** Monday, January 10, 2022 8:35 AM  
**To:** Doug Hudson; Cynthia Green; John Rieley; Mark Schaeffer; Michael H. Vincent  
**Subject:** Sussex Buffer Ordinance Concerns

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**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Good Morning,

I am writing with concerns regarding the buffer ordinance on the agenda for tomorrow (9am Tuesday 1/11/2022).

The ordinance, in its current state, should not be approved as it does not protect our God-given natural environment.

These 4 items below must be addressed prior to consideration of approval:

1. Invalid Buffer Option added without working group approval (lines 781-880 in the revised draft) - this section can negate the whole purpose of this ordinance and was added after the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.
2. Width of Buffer is insufficient - environmental groups recommending wider widths have been ignored. Sussex County, the lowest county on the east coast, will end up with the least buffer compared to surrounding areas.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this is ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. Lacking Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.

Thank you for your time and consideration. Looking forward to a productive results-oriented meeting tomorrow.

Regards,  
Ryan Gerrick

Millsboro, DE



## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:40 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Ann Nist <outlook\_7B897C8413535606@outlook.com>  
**Sent:** Monday, January 10, 2022 8:40 AM  
**To:** Doug Hudson  
**Subject:** Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Hello Mr. Hudson,

I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. As a local resident, I am concerned with the expansion and development without regard for the environment or the infrastructure. I would like to provide you with the following comments:

1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed.
2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective.

Please consider the impact on current residents, wildlife, and the environment before implementing changes to increase the population density.

Thank you,  
Ann Nist  
Stonewater Creek  
Millsboro, DE 19966

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## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:35 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Karen DeSantis <kadesantis@comcast.net>  
**Sent:** Monday, January 10, 2022 10:07 AM  
**To:** Doug Hudson  
**Cc:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; John Rieley  
**Subject:** Buffer Ordinance

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Dear Council Member Hudson,

I am writing to thank you and the council for your consideration of strengthening Buffer Zone ordinances to better protect our environment and waterways. I live near Bald Eagle Creek which connects to the Rehoboth Bay. The house in which I live was built in 1976 and neighbors who have lived in our area since that time have seen and continue to see marshes filled in with fill dirt and water levels rise and flood streets with no outlet other than the creek that is causing the flood. We, too, have seen the beating and wildlife in and around the creek has taken due to the lack of planning and protections from run-off and increasing water levels. I know we can't change history, but we can improve the future. I respectfully ask your help by responding to the Buffer Ordinance in the agenda for January 11. Specifically:

1. Buffer widths should be at least 100' for both small and larger streams, with no exceptions.
2. Keep trees as a buffer- Require replanting of trees, not just grasses (forest buffer) before construction is complete.
3. Enforcement and Penalties - penalties should be strong enough and enforcement swift enough to deter non-compliance before the damage is done.

I am willing to pay increased taxes to help pay for additional staff to monitor and enforce the new policies.

Thank you for the work you do in supporting our community and thank you for your consideration.

Sincerely,  
Karen DeSantis  
112 Kingsbridge Road  
Rehoboth Beach, DE 19971

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## Jamie Whitehouse

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**From:** Robin Griffith  
**Sent:** Monday, January 10, 2022 1:23 PM  
**To:** Michael H. Vincent; John Rieley; Cynthia Green; Doug Hudson; Mark Schaeffer  
**Cc:** Jamie Whitehouse  
**Subject:** FW: Contact Form: Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

Forwarding ...

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**From:** Scott Shaughnessy <noreply@forms.email>  
**Sent:** Monday, January 10, 2022 12:55 PM  
**To:** Robin Griffith <rgriffith@sussexcountype.gov>  
**Subject:** Contact Form: Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

Name: Scott Shaughnessy  
Email: [shaughn40@msn.com](mailto:shaughn40@msn.com)  
Phone: 3022787380  
Subject: Urging revisions to current proposed Ordinance on wetlands and water resources and buffers  
Message: Scott Shaughnessy  
36486 Warwick Drive  
Rehoboth Beach, DE  
19971  
[Shaughn40@msn.com](mailto:Shaughn40@msn.com)

January 10, 2022

cc:/ Clerk of the Council, Robin Griffith

Councilman Douglas Hudson  
Sussex County Council  
2 The Circle, P.O. Box 589  
Georgetown, DE 19947

RE: Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

Dear Sir:

I am writing to let you know that while I support approving an update to Sussex County's wetlands and water resources and buffers rules, the current version of the proposed Ordinance sent over for Council's review by Planning & Zoning needs further amendment. I understand the Council has the proposed Ordinance on its agenda for Tuesday, January 11.

The proposed Ordinance stipulates:

- Considering strategies for preserving environmental areas from development and the protection of wetlands and waterways; and
- Recognizing the Inland Bays, their tributaries and other waterbodies as valuable open space areas of ecological importance ... and this Ordinance carries out that Strategy;

- That Sussex County should encourage development practices and regulations that support natural resource protection... and this Ordinance carries out that goal;
- Reviewing appropriate sections of Sussex County's zoning and subdivision codes to determine if amendments are needed that will better help protect groundwater, waterways, sensitive habitat areas and other critical natural lands in Sussex County... and this Ordinance carries out that Strategy.

These are the principles, goals, and strategies at the heart of this proposed Ordinance.

However, there are a few sections in the current proposed Ordinance on wetlands and water resources and buffers that counter-act the achievement of the above-noted principles, goals and strategies.

The following should be amended:

(1) Any provisions (see, in particular, Section G) that permit entities or individuals to average the buffer width on a relevant property. Currently, the proposed Ordinance allows width averaging to adjust the required Resource Buffer widths. The buffer widths as stated in Ordinance line 672 Table 1 "Resource Buffer Widths" should not be allowed to be altered. No entity or individual should be permitted to alter or encroach on a buffer area beyond the limits set in the Ordinance line 672 Table 1 "Resource Buffer Widths."

If encroachment or alteration beyond those limits is allowed – e.g., through width averaging – then we are defeating the purpose of setting these limits and thereby undermining/weakening the achievement of the above-noted principles, goals, and strategies. No buffer width averaging and no options to reduce set buffer widths, please!

(2) Resource Buffer Standards Section 10.D that makes allowance of non-forest meadow. We should be rewriting this section to require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities. The science upholds the superior benefits of trees and natural vegetation bring to buffers and watershed. If this section, as currently written, is allowed to stand, there is nothing to prevent an owner, prior to sale, or an entity or new owner, prior to submitting the site plan or prior to development, from clearing trees and vegetation in a buffer zone with impunity and creating a meadow or grass lawns.

This defeats the achievement of the above-noted principles, goals, and strategies. This should not be allowed. Buffer areas in every case should be planted with trees and native vegetation, please!

(3) Most crucial of all, add a section on specific enforcement provisions and penalties for non-compliance. Currently, there is no language in the proposed Ordinance about fines, penalties, sanctions or other consequences of unlawful conduct or non-compliance. Why? If there is no effective means of deterring violators, if violators suffer no consequences, if violators of the new rules feel they can disregard, ignore, or act contrary to the letter and spirit of the Ordinance, what's the point of writing these rules? If there is no penalty or fine or other sanction for violating the rules, then these are just words on paper. If there is no vigorous, effective, consistent response spelled out in the new rules in respect of misconduct or non-compliance, then what is to prevent or deter that non-compliance or misconduct? And if that is the case, what good are these rules in terms of achieving the above-noted principles, goals, and strategies?

If our County authorities are unable to stipulate substantially deterrent fines or penalties for non-compliance, then County Council should write into the Ordinance a provision enabling "citizen suits" by private persons injured by unlawful conduct/non-compliance or who have evidence of unlawful conduct/non-compliance to seek relief in the courts, in effect, allowing private persons to obtain a court order compelling a violator to obey the law and to pay a monetary penalty to the county government. In some situations, violators might also be required to fund environmental restoration.

Stipulate clearly and unequivocally in the proposed Ordinance the consequences of non-compliance/misconduct in respect of the Ordinance, please!



Thank you for considering the issues I have raised and rewriting the proposed Ordinance's provisions to take these issues on board.

Kind regards,

Scott Shaughnessy

CC: Council President Michael Vincent; Clerk of the Council Robin Griffith





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:22 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Changes to the Buffer Ordinances

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**From:** Vicki Littell <[vicki@shorelinehomesct.com](mailto:vicki@shorelinehomesct.com)>  
**Sent:** Monday, January 10, 2022 11:04 AM  
**To:** Doug Hudson  
**Subject:** Changes to the Buffer Ordinances

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Dear Mr. Hudson,

I am writing to you about the changes to the proposed Buffer Ordinance . Unfortunately I cannot attend Tuesday's meeting. So I hope you will take these thoughts into consideration. Why would Sussex County change it's Buffer regulations to be more liberal than other counties, especially now when we are experiencing rises in population, sea level, wildlife and global warming issues?

Delaware is a great state with beautiful natural resources. We need to be pragmatic, and allow for growth, housing, but not at the expense now or in the future of the State's present constituency or resources. My main concern is this low lying peninsula needs careful concern about flooding, water and wildlife preservation.

The Buffers are very important to the function of ALL our environment. Allowing narrower or especially optional buffers does not serve this purpose.

Our forests and trees absorb water and CO2 and are necessary for both climate change, and flood control, especially should there be more catastrophic hurricanes, as there have been by our sister states. Replanting and planting generous buffers with NATIVE plants . This is imperative for water levels, quality and habitats.

As our County population grows is it even more important than before that we allow building but with CAREFUL and WISE consideration to not only smart spending by builders, but to the large long term and possible catastrophic issues which would cost our State not only dollars, but serious unfortunate changes.

Thank you for your consideration.

Vicki C. Littell  
35043 Cadbury Circle EAsT  
Lewes 19958

[Vicki@ShorelineHomesCT.com](mailto:Vicki@ShorelineHomesCT.com)

---  
**Vicki C. Littell**  
**vicki@shorelinehomesct.com**  
**203 640 9132**



## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:21 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Tom Handlin <handlin1@yahoo.com>  
**Sent:** Monday, January 10, 2022 11:05 AM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; jltrieley@sussexcountyde.gov  
**Subject:** Buffer Ordinance

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Needless to say, changes to regulations is always a touchy subject especially regarding developers. It seems that we, the general public are forgotten in this mix, as developers have the money, contacts, know-how to accomplish their goals.

I am contacting you now with concerns about the buffer ordinance agenda item for 9am on Tuesday, 1/11/22.

The ordinance, in its current state, leans far too much in favor of developers' interests.

These items in particular need to be addressed prior to approval:

1. Invalid Buffer Option added without working group approval (lines 781-880 in the revised draft) - this section can negate the whole purpose of this ordinance and was added after the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.

2. Width of Buffer is insufficient - environmental groups recommending wider widths have been ignored. Sussex County will end up with the least buffer compared to surrounding areas.

3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this is ignored. It is important we protect our water quality, water activities, and wildlife habitat.

4. Lacking Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.

Thank you for your time and consideration.

Tom Handlin  
Stonewater Creek  
302-994-8163



## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:14 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: date correction - Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

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**From:** Scott Shaughnessy <noreply@forms.email>  
**Sent:** Monday, January 10, 2022 12:56 PM  
**To:** Doug Hudson  
**Subject:** Contact Form: date correction - Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

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Name: Scott Shaughnessy  
Email: shaughn40@msn.com  
Phone: 3022787380  
Subject: date correction - Urging revisions to current proposed Ordinance on wetlands and water resources and buffers  
Message: Scott Shaughnessy  
36486 Warwick Drive  
Rehoboth Beach, DE  
19971  
Shaughn40@msn.com

January 10, 2022

Councilman Douglas Hudson  
Sussex County Council  
2 The Circle, P.O. Box 589  
Georgetown, DE 19947

RE: Urging revisions to current proposed Ordinance on wetlands and water resources and buffers

Dear Sir:

I am writing to let you know that while I support approving an update to Sussex County's wetlands and water resources and buffers rules, the current version of the proposed Ordinance sent over for Council's review by Planning & Zoning needs further amendment. I understand the Council has the proposed Ordinance on its agenda for Tuesday, January 11.

The proposed Ordinance stipulates:

- Considering strategies for preserving environmental areas from development and the protection of wetlands and

waterways; and

- Recognizing the Inland Bays, their tributaries and other waterbodies as valuable open space areas of ecological importance ... and this Ordinance carries out that Strategy;
- That Sussex County should encourage development practices and regulations that support natural resource protection... and this Ordinance carries out that goal;
- Reviewing appropriate sections of Sussex County's zoning and subdivision codes to determine if amendments are needed that will better help protect groundwater, waterways, sensitive habitat areas and other critical natural lands in Sussex County... and this Ordinance carries out that Strategy.

These are the principles, goals, and strategies at the heart of this proposed Ordinance.

However, there are a few sections in the current proposed Ordinance on wetlands and water resources and buffers that counter-act the achievement of the above-noted principles, goals and strategies.

The following should be amended:

(1) Any provisions (see, in particular, Section G) that permit entities or individuals to average the buffer width on a relevant property. Currently, the proposed Ordinance allows width averaging to adjust the required Resource Buffer widths. The buffer widths as stated in Ordinance line 672 Table 1 "Resource Buffer Widths" should not be allowed to be altered. No entity or individual should be permitted to alter or encroach on a buffer area beyond the limits set in the Ordinance line 672 Table 1 "Resource Buffer Widths."

If encroachment or alteration beyond those limits is allowed – e.g., through width averaging – then we are defeating the purpose of setting these limits and thereby undermining/weakening the achievement of the above-noted principles, goals, and strategies. No buffer width averaging and no options to reduce set buffer widths, please!

(2) Resource Buffer Standards Section 10.D that makes allowance of non-forest meadow. We should be rewriting this section to require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities. The science upholds the superior benefits of trees and natural vegetation bring to buffers and watershed. If this section, as currently written, is allowed to stand, there is nothing to prevent an owner, prior to sale, or an entity or new owner, prior to submitting the site plan or prior to development, from clearing trees and vegetation in a buffer zone with impunity and creating a meadow or grass lawns.

This defeats the achievement of the above-noted principles, goals, and strategies. This should not be allowed. Buffer areas in every case should be planted with trees and native vegetation, please!

(3) Most crucial of all, add a section on specific enforcement provisions and penalties for non-compliance. Currently, there is no language in the proposed Ordinance about fines, penalties, sanctions or other consequences of unlawful conduct or non-compliance. Why? If there is no effective means of deterring violators, if violators suffer no consequences, if violators of the new rules feel they can disregard, ignore, or act contrary to the letter and spirit of the Ordinance, what's the point of writing these rules? If there is no penalty or fine or other sanction for violating the rules, then these are just words on paper. If there is no vigorous, effective, consistent response spelled out in the new rules in respect of misconduct or non-compliance, then what is to prevent or deter that non-compliance or misconduct? And if that is the case, what good are these rules in terms of achieving the above-noted principles, goals, and strategies?

If our County authorities are unable to stipulate substantially deterrent fines or penalties for non-compliance, then County Council should write into the Ordinance a provision enabling "citizen suits" by private persons injured by unlawful conduct/non-compliance or who have evidence of unlawful conduct/non-compliance to seek relief in the courts, in effect, allowing private persons to obtain a court order compelling a violator to obey the law and to pay a



monetary penalty to the county government. In some situations, violators might also be required to fund environmental restoration.

Stipulate clearly and unequivocally in the proposed Ordinance the consequences of non-compliance/misconduct in respect of the Ordinance, please!

Thank you for considering the issues I have raised and rewriting the proposed Ordinance's provisions to take these issues on board.

Kind regards,

Scott Shaughnessy

CC: Council President Michael Vincent; Clerk of the Council Robin Griffith





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Monday, January 10, 2022 1:13 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Loretta Shapero <lshapero@hotmail.com>  
**Sent:** Monday, January 10, 2022 1:01 PM  
**To:** Doug Hudson  
**Subject:** Buffer Ordinance

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Dear Councilmember Hudson:

I am writing to respectfully request that you oppose the proposed buffer ordinance, currently set on the 1/11/2021 agenda. As a preliminary matter, it seems premature for the Council to address the issue of buffers locally while State officials have been directed to begin coordinating with federal agencies to within the year "identify the structure necessary for a state nontidal wetlands program to shift permitting authority from the federal level to the state." It would seem that waiting for the State's report would alone be a basis for postponing consideration of this ordinance.

Additionally, the buffer option provision was added AFTER the working group disbanded. This provision in effect provides incentives for developers to bypass the ordinance. To allow such a significant addition to be inserted post-working group raises a question about the fairness of the ordinance's development. In light of these two issues, I encourage the Council to set aside the ordinance until such time as the State's direction on wetlands and buffers has been developed and ALL significant provisions have been reviewed by a working group representing a variety of stakeholders.

Another important concern pertains to the size of the buffers allowed. I am told that a number of environmental groups recommended wider buffers than are included in the ordinance. I have also learned that if the proposed buffers are approved, Sussex County will end up with the smallest buffers of all surrounding areas. Adequate buffers are crucial to the environmental health and beauty of this area, and should be widened as recommended and be at least consistent with those in other parts of the State.

Additionally, it is crucial that any ordinance require the replanting of the forest buffer. The Delaware Center for the Inland Bays (CIB) has explained at Planning & Zoning Commission hearings why replanting of the forest buffer is imperative to protect water quality, water activities and wildlife habitat in this County. I urge you to reject any ordinance without this requirement.

Finally, as with most any law, it is important that this ordinance include meaningful enforcement provisions and penalties for violation. Without adequate enforcement provisions, this ordinance will have a little to no "teeth" to assure compliance, especially when applied against any "deep pocket" violators.

Your consideration of these comments is respectfully appreciated.

Loretta Shapero  
22237 Arbor Circle  
Milton, DE 19968



January 9, 2022

## SUSSEX COUNTY COUNCIL MEMBERS

RE: Proposed Buffer Ordinance No. 21-10

An updated buffer ordinance presents you with the opportunity to shore up and support Comp Plan goals. It is critical that Sussex County has an updated buffer ordinance, but the current proposed version of the legislation includes loopholes that *weaken the purpose* of the buffer ordinance. I ask you to pass the ordinance *with these four amendments to re-vitalize the effort to best protect our waterways*:

*Amendments:*

1. *Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.*
2. *Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.*
3. *Remove in its entirety Section G., the Resource Buffer Options.*
4. *Add a section on specific enforcement provisions and penalties for noncompliance.*

Better buffers will protect Sussex County's wetland resources, help improve the current poor water quality, prevent and protect against flooding and hazards associated with climate change, and increase economic value by providing additional open space. Making this buffer ordinance more robust and preventing loopholes for developers, is the best way to protect Sussex County waterways during a time of immense development pressure.

Respectfully submitted



Patti Drago

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cc: Todd Lawson, Sussex County Administrator  
cc: Jamie Whitehouse, Director, Planning & Zoning

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## Jamie Whitehouse

---

**From:** Arleen Harris <sirrahrad@gmail.com>  
**Sent:** Saturday, January 8, 2022 8:42 AM  
**To:** Jamie Whitehouse  
**Subject:** Ordinance No. 21-19

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Dear Sir,

Hope this email finds you well. As a concerned citizen and one who understands the importance of protecting our environment with this ordinance, I humbly ask that you make it even better by adding these four amendments suggested by the Delaware Nature Society Advocacy Group. They are as follows:

**Amendments:**

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G., the Resource Buffer Options.
4. Add a section on specific enforcement provisions and penalties for noncompliance.

Have a wonderful day. Stay safe.

Respectfully,  
Arleen Harris

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## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:11 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Ordinance No. 21-10 - Buffer Ordinance

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**From:** D B <nextlevel.db@gmail.com>  
**Sent:** Saturday, January 8, 2022 10:12 AM  
**To:** Doug Hudson  
**Subject:** Ordinance No. 21-10 - Buffer Ordinance

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Councilman Hudson:

It is critical that Sussex County has an updated buffer ordinance, but the current proposed version of the legislation includes loopholes that weaken the purpose of the buffer ordinance. I'm asking for your help asking Sussex County Council to pass the ordinance (Ordinance No. 21-10) with four specific amendments to re-vitalize the effort to best protect our environment:

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G., the Resource Buffer Options.
4. Add a section on specific enforcement provisions and penalties for noncompliance.

The current wording of the ordinance would be the least restrictive along the east coast. Sussex County's current trend is unsustainable and draconian.

Best,

Dave Breen  
31224 Ringtail Drive  
Lewes, DE 19958

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## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:10 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Ordinance No. 21-10: Updated Buffer Requirements for Waterways.

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**From:** Sue Claire Harper <secmate47@gmail.com>  
**Sent:** Saturday, January 8, 2022 10:29 AM  
**To:** Doug Hudson; Mark Schaeffer  
**Subject:** Ordinance No. 21-10: Updated Buffer Requirements for Waterways.

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Dear Councilmen,

For reasons thoroughly explained by Delaware Center for the Inland Bays Executive Director, Chris Bason in his most recent 01/07/2022 Letter to the Editor of the Cape Gazette [LINK](#), I urgently request that County Council pass Ordinance No. 21-10 with the following four amendments Chris outlined in order to re-vitalize the effort to best protect our waterways!

**Amendments:**

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G., the Resource Buffer Options.
4. Add a section on specific enforcement provisions and penalties for noncompliance.

With the passage of this ordinance, and the inclusion of the revisions outlined, you have the potential to help reverse the decades of neglect perpetrated by your Council predecessors, resulting in the abysmal water quality which so profoundly affects Sussex's inland waterways today. I thank you in advance for serving the best interests of not only your current constituents, but for Sussex's future generations as well.

Sincerely,  
Sue Claire Harper  
3 Suffolk Rd.  
Rehoboth Beach, DE 19971





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:09 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Ordinance No. 21-10: Updated Buffer Requirements for Waterways.

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**From:** Pat Newcomb <pan230oh@gmail.com>  
**Sent:** Saturday, January 8, 2022 10:43 AM  
**To:** Doug Hudson; Mark Schaeffer  
**Subject:** Ordinance No. 21-10: Updated Buffer Requirements for Waterways.

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Dear Councilmen Schaeffer and Hudson,

For reasons thoroughly explained by Delaware Center for the Inland Bays Executive Director, Chris Bason in his most recent 01/07/2022 Letter to the Editor of the Cape Gazette [LINK](#), I wish to add my voice to those who are urgently requesting that County Council **pass Ordinance No. 21-10** with the following **four amendments** Chris outlined in order to re-vitalize the effort to best protect our waterways!

**Amendments:**

- Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
- Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
- Remove in its entirety Section G., the Resource Buffer Options.
- Add a section on specific enforcement provisions and penalties for noncompliance.

With the passage of this ordinance, and the inclusion of the revisions outlined, you have the potential to help reverse decades of neglect resulting in the abysmal water quality which so profoundly affects Sussex's inland waterways today. I thank you in advance for serving the best interests of not only your current constituents, but for Sussex's future generations as well.

Sincerely,  
Patricia Newcomb  
11 Sabrina Drive (Midway)  
Rehoboth Beach, DE 19971





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:12 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: Buffer ordinance - please read

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**From:** Christina Darby <noreply@forms.email>  
**Sent:** Saturday, January 8, 2022 9:45 AM  
**To:** Doug Hudson  
**Subject:** Contact Form: Buffer ordinance - please read

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Name: Christina Darby  
Email: chrisdarby@att.net  
Phone: 302-629-4321  
Subject: Buffer ordinance - please read

Message: The proposed buffer ordinance is critical to the health of our waterways, our homes, our livelihoods. However, the current proposal contains some serious flaws that if implemented in its present form would only further negate any responsible environmental progress. Progress does not mean taking one step forward and three steps back. The numbers regarding lost acreage and the facts of the importance of forested buffers are well documented. 1434 acres of Sussex County's wetlands were lost from 1992 to 2007. At that rate, another 1147 acres were lost from 2007 to 2019. Salt marshes decreased from 10,838 acres in 1938 to 7300 acres in 2007. Delaware is literally disappearing. Despite wide spread increases in flooding, homes are continuing to be built in flood prone areas. This makes no sense. The best protection from flooding and decreasing pollution is an adequate forested buffer width. The buffer widths in the current proposal are sadly lacking. If members of County Council neglect to consider the full picture of the degradation and loss of our land, County Council will have no more County left to Council





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:13 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffers topic Tuesday Jan 11

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**From:** Amber Clark <amberclark0820@gmail.com>  
**Sent:** Saturday, January 8, 2022 3:32 AM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Buffers topic Tuesday Jan 11

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Hello

I am a resident of Stonewater Creek. I think we should revise the buffer ordinance, increasing the width, as described in the proposed plan. <https://www.inlandbays.org/wp-content/uploads/Buffer-Fact-Sheets-and-Supporting-Information-031720.pdf>

Thank you  
Amber

Sent from my iPhone





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Saturday, January 8, 2022 11:15 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: BUFFER ORDINANCE JAN 11

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**From:** brkeep <brkeep@comcast.net>  
**Sent:** Friday, January 7, 2022 4:06 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** BUFFER ORDINANCE JAN 11

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To Whom It May Concern:

The manner in which the buffer ordinance is written will not sufficiently preserve buffers, rather gives incentives to builders to build on buffers. I live adjacent to Baywood property. Recently half of the buffer between us and Baywood property was mined and stripped of all trees. This action has caused flooding in my backyard.

I am concerned about the proposed inadequate buffer ordinance which is lacking the following four points:

1. **Buffer Option** - This can negate the whole purpose of this ordinance and was added to the ordinance AFTER the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.
2. **Width of Buffer** - environmental groups recommending wider widths have been ignored. Sussex County (the lowest county on the east coast) will end up with the least buffer compared to surrounding areas.
3. **Replanting of Forest Buffer** - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this was ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. **Enforcement or Penalties** - Without this important tool to police the ordinance, this ordinance will not be effective.

Regards,  
Carolyn A. Catton  
31551 Riverwood Road  
Millsboro, DE 19966





## Jamie Whitehouse

---

**From:** Jerry <jerrybegood@gmail.com>  
**Sent:** Saturday, January 8, 2022 7:59 PM  
**To:** Mark Schaeffer; Lopez, Ernesto B (LegHall); Schwartzkopf, Peter (LegHall); Jamie Whitehouse; steve@stevesmyk.com; BriggsKing, Ruth (LegHall); Newsroom; Ron MacArthur; Robin Griffith; John Rieley  
**Subject:** Fwd: FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS  
**Attachments:** image008.jpg

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All,  
Unless we protect our environment now with stringent measures we'll be paying dearly in the near future.  
Recommending one methodology then halving it, over compensating the opposite is nothing less than insulting to your constituents.  
We need an APFO ordinance NOW, not later NOW!

Jerry LaForgia Lewes

Tune out 'Woke' political racial subliminal messaging

----- Forwarded message -----

**From:** Jerry <jerrybegood@gmail.com>  
**Date:** Sat, Jan 8, 2022, 7:32 PM  
**Subject:** Fwd: FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS  
**To:** Shirley Wiesendanger <psweez1@yahoo.com>, <jimrodgers06@gmail.com>, Jane Lewis <JCLStorm@yahoo.com>, Michael Varonka <mjvaronka@gmail.com>, Roger Lewis <rogerle12@yahoo.com>

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**Date:** Sat, Jan 8, 2022, 7:12 PM  
**Subject:** FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS  
**To:** JOHN & JOANNE TOWNSLEY <townsj@icloud.com>, Jerry <jerrybegood@gmail.com>

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**From:** sargnow@gmail.com [mailto:sargnow@gmail.com]  
**Sent:** Saturday, January 08, 2022 10:36 AM  
**To:** sargnow@gmail.com  
**Subject:** FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS

## **HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS**

After the recent nearly 3 years of study, discussion, and debate, and guided by the 2018 Comprehensive Plan, the Sussex County Council is holding a Public Hearing on a proposed Ordinance Amendment to consider the modernization of the 32 year old § 115-193 Buffer Zones for Wetlands and Tidal and Perennial Nontidal Waters Ordinance. The proposed ordinance amendment is focused on improved protection of property values and safety of its residents by requiring more extensive natural buffers between new residential developments and its wetlands and waters as well as substantial enhancements to ensure that Sussex County's drainage network is improved now and maintained in the future. Considered by many as the potential for the most monumental environmental legislation in the history of Sussex County, this action places significant responsibility on the shoulders of our elected Council.

The Council Public Hearing is scheduled for Tuesday, January , 11, 2022 at 10:30 am @ the County Chambers in Georgetown.

The agenda can be viewed @ <https://sussexcountye.gov/sites/default/files/agendas/011122%20Final.pdf>

### **AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7, 1 99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO.**

The complete proposed Ordinance Amendment can be accessed at the link below;

<https://sussexcountye.gov/sites/default/files/packets/Sussex%20County%20-%20Drainage%20and%20Resource%20Buffer%20-%20Recommended%20by%20the%20PC%2012.15.2021.pdf>

It is SARG's position that the Council has been stalwart over the past three years in recognizing the need to employ key County Comprehensive Plan strategies for preserving environmental areas and encouraging development practices and regulations that support natural resource protection. These efforts included a significant investment in an outside consultant to facilitate a Buffer Wetland Workgroup comprised of outside professionals and County staff as well as managing the review process through past and present pandemic conditions. The workgroup focused on defining the purpose, function, and benefits of proper buffers to;

- Protect the Resources and their associated functions
- Improve/protect water quality via sediment filtration, reduce impact of nutrient loading on Resources, moderate water temperature, and enhance infiltration and stabilization of channel banks
- Provide wildlife habitat via nesting, breeding, and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge
- Enhance and/or maintain the flood plain storage functionality via reduction of flood conveyance velocities as well as dissipation of stormwater discharge energy.



The workgroup through a consensus building process arrived at both qualitative and quantitative measures for buffer widths and permitted and non-permitted uses as well as an understanding for the irregularities of natural resource areas and the need for the incorporation of a buffer averaging approach to provide flexibility in site design for prospective landowners and developers.

After achieving a level of consensus, recommendations were delivered to the Council in September of 2019 at which time the workgroup's work was paused to the pandemic. Since that time work continued primarily at the County level. As with many initiatives especially ones of this magnitude there is always the influence of special interests without the benefit of the consensus process. As a member of the Wetland Buffer Workgroup and in consultation with other workgroup participants, there is clear agreement that certain provisions in today's 12/17/2021 Proposed Amendment do not have the benefit of the consensus approach and in fact place in jeopardy even to the point of potentially taking a number of steps backward.

In a recent interview in the Cape Gazette, Chris Bason, Wetland Group member and Director for the Delaware Center for the Inland Bays shared his concerns:

" Forests provide the best protection against pollution and are essential wildlife habitat. But the ordinance allows forests to be cut down up to the time that an application for development is submitted. Trees do not need to be planted back in the buffer when the site is developed and the buffer can be maintained as grass.

The second step backward is a series of allowances to reduce the widths of the buffers. For example, if an existing forest in a buffer is maintained, then the width of a buffer can be cut in half. This eliminates gains in the width provided for buffers of tidal wetlands and waters, and reduces minimum buffer widths on larger streams to 25 feet. In the same fashion, the buffers may be reduced or eliminated around the new development's property boundary; which buffers existing residents, not waterways, from new construction.

Finally, buffers can be reduced or eliminated in exchange for creating buffer easements in areas far from the development itself.

The good news is that these issues can simply be resolved so that the ordinance fulfills its purposes. First, if a buffer is not forested at the time the development application is submitted, it must be replanted to a forest before construction is complete. This provides an economic incentive for developers to keep the trees, and it is what other nearby jurisdictions have required for a long time. Second, buffer widths must be maintained at their newly increased widths, plain and simple, and options to reduce buffer width dropped. Finally, clear language on how the ordinance will be enforced by the County needs to be added to ensure buffers will be maintained; this is not always the case currently.

The benefits that the County's wetlands and waterways provide are critical to its economy and the wellbeing of its residents. Providing adequate protection now will help to clean up our waters, protect our wildlife, and reduce the impacts of flooding on new and existing communities."

Please do your part to not allow the needed progress with environmental protection and preservation to be hijacked!

**Let your Council person know;**

- If you believe that the proposed new and improved buffer widths should be enforced without any potential for reductions other than buffer averaging

- If you believe that deforested areas in buffers should be replanted with trees
- If you believe that developers should not be permitted to reduce or eliminate Forest/Landscape buffers between new and existing developments Lines 781- 806
- If you believe that a developer should not be able to reduce buffers in a new development in exchange for an off site easement buffer that may be miles away from the proposed development 808-871
- If you believe that the proposed ordinance amendment is unnecessarily overly complicated
- If you believe that the potential for any combination of buffer averaging and buffer options/incentives could result in buffers that are more inadequate than what we currently have today must be eliminated
- If you believe that the proposed amendment would be an absolute nightmare to administer
- If you believe that any offsite buffer easement would be unmanageable for future HOA'

**Share your concerns regarding**

**AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7, 1 99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO.**

**By**

- **Attending the Tuesday January 11, 2022 Council Meeting Council Chambers, Sussex County Administrative Office Building, 2 The Circle, Georgetown, Delaware**

**or**

- **Listening and watching the public hearing on line and when prompted share your comments by following the instructions below:**

**The meeting will be streamed live @**

**<https://sussexcountyde.gov/council-chamber-broadcast>**

**The County provides a dial-in number for the public to comment during the appropriate time of the meeting. Note, the on-line stream experiences a 30-second delay.**



Any person who dials in should listen to the teleconference audio to avoid the on-line stream delay.

To join the meeting via telephone, please dial:

Conference Number: 1-302-394-5036

Conference Code: 570176

Members of the public joining the meeting on the telephone will be provided an opportunity to make comments under the Public Comment section of the meeting and during the respective Public Hearing.

or

- Go the County website link below and email County Council Members

<https://sussexcountyde.gov/county-council>

- Write and send a Letter to the Editor of your local and regional newspaper

Please forward this email to friends, neighbors and to members of organizations to get the word out!

Thanks in advance for your concerns and support!





## Jamie Whitehouse

---

**From:** Jerry <jerrybegood@gmail.com>  
**Sent:** Sunday, January 9, 2022 10:56 AM  
**To:** Mark Schaeffer  
**Cc:** Shirley Wiesendanger; Michael Varonka; LAURA MARROLLI; ladyjuliet77@gmail.com; Jane Lewis; Roger Lewis; Constituent Relations Team; Constituent Relations Team; Office of U.S. Senator Christopher Coons; Senator Carper  
**Subject:** Re: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Thanks Mark, hopefully the repeated rhetoric will result in successful fruition to the dilemma we all face in Sussex County.

*The rapid destruction of our natural habitats ,permeable land as well as the environmental dangers associated with it putting our residents in dire jeopardy.*

It's well overdue we place "Health over Wealth" people over profit, following the **science** provided by Inland bays.

*Once again the adoption of an A.P.F.O. ordinance would be a great step forward solving our ever increasing infrastructure needs and costs associated with it.*

Keep in mind the theme of our October protest ...'**Enough is enough**'.

Best Regards,

Jerry LaForgia Lewes

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On Sun, Jan 9, 2022, 10:24 AM Mark Schaeffer <[mschaeffer@sussexcountysde.gov](mailto:mschaeffer@sussexcountysde.gov)> wrote:

Jerry,  
Thank you for your email.

I met with Chris of Inland Bays earlier this week in order to review deficiencies in the proposed buffer ordinance. I don't believe any action will be taken Tuesday as I suspect there may be a number of modifications suggested as to how the ordinance is written.

I can understand the strong language in your email, but please don't lose sight of the fact that the ordinance to be discussed Tuesday is light years ahead of where we are today.

Please call me anytime.

Mark G. Schaeffer  
Sussex County Council  
District 3

Email: [mschaeffer@sussexcountyde.gov](mailto:mschaeffer@sussexcountyde.gov)  
Phone: 302-855-7743  
Cell: 302-423-4801

---

**From:** Jerry <[jerrybegood@gmail.com](mailto:jerrybegood@gmail.com)>

**Sent:** Saturday, January 8, 2022 7:59:00 PM

**To:** Mark Schaeffer <[mschaeffer@sussexcountyde.gov](mailto:mschaeffer@sussexcountyde.gov)>; Lopez, Ernesto B (LegHall) <[Ernesto.Lopez@delaware.gov](mailto:Ernesto.Lopez@delaware.gov)>; Schwartzkopf, Peter (LegHall) <[Peter.Schwartzkopf@delaware.gov](mailto:Peter.Schwartzkopf@delaware.gov)>; Jamie Whitehouse <[jamie.whitehouse@sussexcountyde.gov](mailto:jamie.whitehouse@sussexcountyde.gov)>; Steve <[steve@stevesmyk.com](mailto:steve@stevesmyk.com)> <[steve@stevesmyk.com](mailto:steve@stevesmyk.com)>; BriggsKing, Ruth (LegHall) <[ruth.briggsking@delaware.gov](mailto:ruth.briggsking@delaware.gov)>; Newsroom <[newsroom@capegazette.com](mailto:newsroom@capegazette.com)>; Ron MacArthur <[ronm@capegazette.com](mailto:ronm@capegazette.com)>; Robin Griffith <[rgriffith@sussexcountyde.gov](mailto:rgriffith@sussexcountyde.gov)>; John Rieley <[jlriley@sussexcountyde.gov](mailto:jlriley@sussexcountyde.gov)>  
**Subject:** Fwd: FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS

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All,  
Unless we protect our environment now with stringent measures we'll be paying dearly in the near future.  
Recommending one methodology then halving it, over compensating the opposite is nothing less than insulting to your constituents.  
We need an APFO ordinance NOW, not later NOW!

Jerry LaForgia Lewes

Tune out 'Woke' political racial subliminal messaging

----- Forwarded message -----

**From:** Jerry <[jerrybegood@gmail.com](mailto:jerrybegood@gmail.com)>

**Date:** Sat, Jan 8, 2022, 7:32 PM

**Subject:** Fwd: FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS

**To:** Shirley Wiesendanger <[psweez1@yahoo.com](mailto:psweez1@yahoo.com)>, <[jimrodgers06@gmail.com](mailto:jimrodgers06@gmail.com)>, Jane Lewis <[JCLStorm@yahoo.com](mailto:JCLStorm@yahoo.com)>, Michael Varonka <[mjvaronka@gmail.com](mailto:mjvaronka@gmail.com)>, Roger Lewis <[rogerle12@yahoo.com](mailto:rogerle12@yahoo.com)>

----- Forwarded message -----

**Date:** Sat, Jan 8, 2022, 7:12 PM

**Subject:** FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS

**To:** JOHN & JOANNE TOWNSLEY <[townsj@icloud.com](mailto:townsj@icloud.com)>, Jerry <[jerrybegood@gmail.com](mailto:jerrybegood@gmail.com)>

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**From:** [sargnow@gmail.com](mailto:sargnow@gmail.com) [mailto:[sargnow@gmail.com](mailto:sargnow@gmail.com)]

**Sent:** Saturday, January 08, 2022 10:36 AM

**To:** [sargnow@gmail.com](mailto:sargnow@gmail.com)

**Subject:** FW: HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS



## ***HISTORIC WETLANDS BUFFER REFORMS WEAKENED BY PROPOSED OPTIONS***

After the recent nearly 3 years of study, discussion, and debate, and guided by the 2018 Comprehensive Plan, the Sussex County Council is holding a Public Hearing on a proposed Ordinance Amendment to consider the modernization of the 32 year old § 115-193 Buffer Zones for Wetlands and Tidal and Perennial Nontidal Waters Ordinance. The proposed ordinance amendment is focused on improved protection of property values and safety of its residents by requiring more extensive natural buffers between new residential developments and its wetlands and waters as well as substantial enhancements to ensure that Sussex County's drainage network is improved now and maintained in the future. Considered by many as the potential for the most monumental environmental legislation in the history of Sussex County, this action places significant responsibility on the shoulders of our elected Council.

The Council Public Hearing is scheduled for **Tuesday, January , 11, 2022 at 10:30 am** @ the County Chambers in Georgetown.

The agenda can be viewed @ <https://sussexcountyde.gov/sites/default/files/agendas/011122%20Final.pdf>

**AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7, 1 99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO.**

The complete proposed Ordinance Amendment can be accessed at the link below;

<https://sussexcountyde.gov/sites/default/files/packets/Sussex%20County%20-%20Drainage%20and%20Resource%20Buffer%20-%20Recommended%20by%20the%20PC%2012.15.2021.pdf>

It is SARG's position that the Council has been stalwart over the past three years in recognizing the need to employ key County Comprehensive Plan strategies for preserving environmental areas and encouraging development practices and regulations that support natural resource protection. These efforts included a significant investment in an outside consultant to facilitate a Buffer Wetland Workgroup comprised of outside professionals and County staff as well as managing the review process through past and present pandemic conditions. The workgroup focused on defining the purpose, function, and benefits of proper buffers to;

- Protect the Resources and their associated functions
- Improve/protect water quality via sediment filtration, reduce impact of nutrient loading on Resources, moderate water temperature, and enhance infiltration and stabilization of channel banks
- Provide wildlife habitat via nesting, breeding, and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge

- Enhance and/or maintain the flood plain storage functionality via reduction of flood conveyance velocities as well as dissipation of stormwater discharge energy.

The workgroup through a consensus building process arrived at both qualitative and quantitative measures for buffer widths and permitted and non-permitted uses as well as an understanding for the irregularities of natural resource areas and the need for the incorporation of a buffer averaging approach to provide flexibility in site design for prospective landowners and developers.

After achieving a level of consensus, recommendations were delivered to the Council in September of 2019 at which time the workgroup's work was paused to the pandemic. Since that time work continued primarily at the County level. As with many initiatives especially ones of this magnitude there is always the influence of special interests without the benefit of the consensus process. As a member of the Wetland Buffer Workgroup and in consultation with other workgroup participants, there is clear agreement that certain provisions in today's 12/17/2021 Proposed Amendment do not have the benefit of the consensus approach and in fact place in jeopardy even to the point of potentially taking a number of steps backward.

In a recent interview in the Cape Gazette, Chris Bason, Wetland Group member and Director for the Delaware Center for the Inland Bays shared his concerns:

" Forests provide the best protection against pollution and are essential wildlife habitat. But the ordinance allows forests to be cut down up to the time that an application for development is submitted. Trees do not need to be planted back in the buffer when the site is developed and the buffer can be maintained as grass.

The second step backward is a series of allowances to reduce the widths of the buffers. For example, if an existing forest in a buffer is maintained, then the width of a buffer can be cut in half. This eliminates gains in the width provided for buffers of tidal wetlands and waters, and reduces minimum buffer widths on larger streams to 25 feet. In the same fashion, the buffers may be reduced or eliminated around the new development's property boundary; which buffers existing residents, not waterways, from new construction.

Finally, buffers can be reduced or eliminated in exchange for creating buffer easements in areas far from the development itself.

The good news is that these issues can simply be resolved so that the ordinance fulfills its purposes. First, if a buffer is not forested at the time the development application is submitted, it must be replanted to a forest before construction is complete. This provides an economic incentive for developers to keep the trees, and it is what other nearby jurisdictions have required for a long time. Second, buffer widths must be maintained at their newly increased widths, plain and simple, and options to reduce buffer width dropped. Finally, clear language on how the ordinance will be enforced by the County needs to be added to ensure buffers will be maintained; this is not always the case currently.

The benefits that the County's wetlands and waterways provide are critical to its economy and the wellbeing of its residents. Providing adequate protection now will help to clean up our waters, protect our wildlife, and reduce the impacts of flooding on new and existing communities."

Please do your part to not allow the needed progress with environmental protection and preservation to be hijacked!

**Let your Council person know;**



- If you believe that the proposed new and improved buffer widths should be enforced without any potential for reductions other than buffer averaging
- If you believe that deforested areas in buffers should be replanted with trees
- If you believe that developers should not be permitted to reduce or eliminate Forest/Landscape buffers between new and existing developments Lines 781- 806
- If you believe that a developer should not be able to reduce buffers in a new development in exchange for an off site easement buffer that may be miles away from the proposed development 808-871
- If you believe that the proposed ordinance amendment is unnecessarily overly complicated
- If you believe that the potential for any combination of buffer averaging and buffer options/incentives could result in buffers that are more inadequate than what we currently have today must be eliminated
- If you believe that the proposed amendment would be an absolute nightmare to administer
- If you believe that any offsite buffer easement would be unmanageable for future HOA'

#### **Share your concerns regarding**

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**By**

- **Attending the Tuesday January 11, 2022 Council Meeting Council Chambers, Sussex County Administrative Office Building, 2 The Circle, Georgetown, Delaware**

**or**

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Conference Code: 570176

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- Write and send a Letter to the Editor of your local and regional newspaper

Please forward this email to friends, neighbors and to members of organizations to get the word out!

Thanks in advance for your concerns and support!









## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:37 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer ordinance

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**From:** Carmela Skillman <caskillman@gmail.com>  
**Sent:** Saturday, January 8, 2022 4:01 PM  
**To:** Mark Schaeffer  
**Subject:** Buffer ordinance

Opposition  
Exhibit

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Please revise the buffer ordinance to sufficiently preserve buffers, specifically so that developers and builders cannot bypass the ordinance. Since Sussex county is low lying, it is important to establish wider widths and replant the forest buffer to protect our wildlife and human inhabitants and tourism industry. These ordinances should be enforceable so they can be effective.

Let us not be short-sighted in this endeavor.

--  
*Carmela*





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:38 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: Proposed Amendment to the Buffer Ordinance

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**From:** Mary Sturges Dodge <noreply@forms.email>  
**Sent:** Saturday, January 8, 2022 3:51 PM  
**To:** Doug Hudson  
**Subject:** Contact Form: Proposed Amendment to the Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Name: Mary Sturges Dodge  
Email: msdodge@udel.edu  
Phone: 302-299-7070

Subject: Proposed Amendment to the Buffer Ordinance

Message: I am writing to request that you reject the proposed amendment and ask that it be revised to satisfy its stated goals of protecting land and wildlife, not only for the present, but also for the future. Sussex County is uniquely vulnerable to land and habitat loss as it is low with regard to sea level, and is in fact sinking while sea levels are rising. This requires that you and other stewards of the bounty that we enjoy here exercise responsible and forward thinking decision making on this and related issues. Unfortunately, despite time and effort spent on the proposed amendment by thoughtful and well meaning volunteers, the result falls far short of its goals. Specifically, it does not match nearby similar areas in the required width of buffers, under some conditions it allows developers to further reduce them, it does not require replacement of removed trees or other landscaping with native species, and at times permits no replacement at all, and lastly, it is complex and cumbersome, making it difficult to interpret and enforce. We are counting on you to protect both natural and developed assets. Please don't let us down.

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Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:43 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Sussex County Council Meeting: BUFFER ORDINANCE Comments

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Exhibit

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**From:** Bart DiMaso <bdimaso@yahoo.com>  
**Sent:** Saturday, January 8, 2022 3:43 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Sussex County Council Meeting: BUFFER ORDINANCE Comments

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Greetings Counselors,

I understand that the **Buffer Ordinance** is on the agenda for the January 11th, 2022 council meeting. I would like to provide you with the following comments:

1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed. 2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas. 3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.

4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective.

Thank you for your consideration.

Bart DiMaso  
20684 Brookfield LN  
Stonewater Creek Community  
Millsboro, DE 19966



## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:44 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer ordinance

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**From:** Barbara German <btgerman@icloud.com>  
**Sent:** Saturday, January 8, 2022 3:03 PM  
**To:** Doug Hudson  
**Subject:** Buffer ordinance

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Dear Representative:

The manner in which the buffer ordinance is written will not sufficiently preserve buffers, rather gives incentives to builders to build on buffers. I am concerned about the proposed inadequate buffer ordinance which is lacking the following four points:

1. Buffer Option - This can negate the whole purpose of this ordinance and was added to the ordinance AFTER the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.
2. Width of Buffer - environmental groups recommending wider widths have been ignored. Sussex County (the lowest county on the east coast) will end up with the least buffer compared to surrounding areas.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this was ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.

Thank you for taking time out of your busy schedule to read my email and act on this issue.

Regards,

Barbara German  
15154 Coultlands Reach  
Milton, DE 19968

Sent from my iPhone





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:49 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer ordinance

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**From:** Barbara German <btgerman@icloud.com>  
**Sent:** Saturday, January 8, 2022 3:02 PM  
**To:** Doug Hudson  
**Subject:** Buffer ordinance

CAUTION: This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Dear Representative:

The manner in which the buffer ordinance is written will not sufficiently preserve buffers, rather gives incentives to builders to build on buffers. I am concerned about the proposed inadequate buffer ordinance which is lacking the following four points:

1. Buffer Option - This can negate the whole purpose of this ordinance and was added to the ordinance AFTER the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.
2. Width of Buffer - environmental groups recommending wider widths have been ignored. Sussex County (the lowest county on the east coast) will end up with the least buffer compared to surrounding areas.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this was ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.

Thank you for taking time out of your busy schedule to read my email and act on this issue.

Regards,

Barbara German  
15154 Coultlands Reach  
Milton, DE 19968

Sent from my iPhone





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:53 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Proposed County Buffer Ordinance

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**From:** Patrica Reilly <pdreilly52@yahoo.com>  
**Sent:** Saturday, January 8, 2022 2:13 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Proposed County Buffer Ordinance

CAUTION: This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Dear Sir/Madam

I am writing to you all today to express my views regarding the Proposed County Buffer Ordinance. Sussex County is undergoing extraordinary growth and development. We need to protect the watersheds and wildlife in our county. It is my belief that if we allow the development of lands there needs to be protection of our natural resources including wildlife. I have seen first hand the diminished wildlife in my area with the expansion of the Baywood Development there is approximately 30 feet from my property line to the cleared area by Baywood. We used to see deer, fox, rabbits and other animals, not any more. The buffers need to be increased not only for the animals but to protect our very precious water supply and to reduce flooding in the areas.

I know first hand what indiscriminate development can do to any area. My former home in Connecticut was located 350 feet up from a lake. Development was allowed to occur all along the direct shoreline with only 25 feet of buffer from the shore, which resulted in the decline of the watershed. There were numerous fish kills resulting from the damage to the eco system due to the development. A once beautiful lake is now struggling to regain it's abundance of wildlife and clear clean water. The town has spent millions of dollars to try to correct the problem.

My concern is that if we do not curtail and fix this problem now, we will pay dearly for it in the future. Please fix the Ordinance to protect our wetlands and waterways and make Sussex County Delaware a vibrant place to live and enjoy our resources for generations to come.

Thank you in advance for hearing my concerns,  
Sincerely,  
Patricia D. Reilly  
Millsboro, DE

Sent from my iPad





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:54 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: Sussex County proposed buffer ordinance No. 21-10

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**From:** Lewis R Podolske <noreply@forms.email>  
**Sent:** Saturday, January 8, 2022 12:42 PM  
**To:** Doug Hudson  
**Subject:** Contact Form: Sussex County proposed buffer ordinance No. 21-10

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Name: Lewis R Podolske  
Email: LPodolske@aol.com  
Phone: 302-933-0145

Subject: Sussex County proposed buffer ordinance No. 21-10

Message: As Sussex County homeowners, we support the amendments to the proposed ordinance recommended by the Center for the Inland Bays as follow:

Amendments:

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G., the Resource Buffer Options.
4. Add a section on specific enforcement provisions and penalties for noncompliance.

These changes are needed to address the long-term impacts of pollution in the Inland Bays which have resulted in almost all of the waterways being polluted to unhealthy levels. It is long past time for Sussex County to take its responsibilities for the health and safety of county residents seriously.





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 9:54 AM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffers!

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**From:** LJ Ratkus <ljr.delaware@gmail.com>  
**Sent:** Saturday, January 8, 2022 12:22 PM  
**To:** Doug Hudson  
**Subject:** Buffers!

CAUTION: This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

STOP already!!! Please take every step preserve the maximum buffers in Sussex County from building infringement! We are already suffering through a massive amount of development. PLEASE preserve the maximum buffer space possible!

Loretta Ratkus  
38 Sandalwood Dr.  
Rehoboth Beach (but I'm in Sussex County)  
703-201-1687

Sent from my iPhone





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 1:34 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** David Bednar <davidbednar@mac.com>  
**Sent:** Sunday, January 9, 2022 12:03 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Cc:** davidbednar@mac.com  
**Subject:** Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Greetings Counselors, I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. I would like to provide you with the following comments: 1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed. 2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas. 3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, water activities, and wildlife habitat. 4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective. Thank you for your consideration.

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Stay Safe, Stay Strong  
David L. Bednar, CFSP  
302-947-4102  
email: [davidbednar@mac.com](mailto:davidbednar@mac.com)  
Website: [anythingbutcaskets.com](http://anythingbutcaskets.com)  
[www.advpromoadv.com](http://www.advpromoadv.com)  
<http://www.expressfuneralfunding.com>  
<https://www.messengerstationery.com/>

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**EXPRESS**  
FUNERAL FUNDING  
A MESSENGER FAMILY CO.



## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 1:35 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer considerations

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**From:** Childers, Thomas <childeta@drexel.edu>  
**Sent:** Sunday, January 9, 2022 11:41 AM  
**To:** Mark Schaeffer; Cynthia Green; John Rieley; Doug Hudson  
**Cc:** Hall, John  
**Subject:** Buffer considerations

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Dear Counselors:

Serious matters related to buffers are coming to the attention of the Sussex County Counselors on Tuesday.

1. Buffer Option - This can negate the whole purpose of this ordinance and was added to the ordinance AFTER the working group disbanded and therefore was not approved by the working group. This section provides **incentives for developers to bypass this ordinance**. Buffer Zones should not be optional. They should be required and not be allowed to be bypassed. 2. Width of Buffer - Environmental groups recommending wider widths have been ignored. Sussex County (the lowest county on the east coast) will end up with the least buffer on the east coast. Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups.

These increased buffers also need to be **enforced**.

Several counselors understand these points but we need universal support.

3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this is ignored. Replanting of forest buffer is imperative to protect our water quality, water activities, and wildlife habitat. 4. Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.





## Jamie Whitehouse

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**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 1:42 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Mediacom <bagill@mchsi.com>  
**Sent:** Sunday, January 9, 2022 1:40 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Buffer Ordinance

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The proposed buffer ordinance will not sufficiently protect our waterways and preserve essential buffers. The options given to builders in essence provides incentives and my understanding is the these options were added AFTER the working group was disbanded and therefore was not approved by the working group. These options should be removed (Buffer Option, Width of Buffer, Replanting of Forest Buffer) and Enforcement and Penalties should be added to make it effective. Also, the unplanned growth of development is adding to traffic problems and harming the quality of life. Builders should be required to improve roads and other infrastructure in order to build.

Sincerely,

William Gill  
432 Tunbridge Ct.  
Millsboro, DE 19966





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 2:37 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Contact Form: Re: Ordinance to amend Chs. 99 and 115 regarding wetland and water resources and their buffers

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**From:** Jay Martin <noreply@forms.email>  
**Sent:** Sunday, January 9, 2022 2:32 PM  
**To:** Doug Hudson  
**Subject:** Contact Form: Re: Ordinance to amend Chs. 99 and 115 regarding wetland and water resources and their buffers

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Name: Jay Martin  
Email: ubuubok@comcast.net  
Phone: 410-873-2942  
Subject: Re: Ordinance to amend Chs. 99 and 115 regarding wetland and water resources and their buffers  
Message: Dear Council Member Hudson,

The Friends of the Nanticoke River is a bi-state organization dedicated to conserving the Nanticoke River and its watershed. We commend the Council for proposing an ordinance that clearly recognizes the importance and value of natural buffers between new residential developments and wetlands and waterways for protecting property and environmental resources. The proposal for a buffer ordinance is an important environmental policy step in protecting our land and the health of our citizens.

The proposed ordinance clearly lays out the critical importance of revising the County Code to "encourage development practices and regulations that support natural resource protection," to "protect groundwater, waterways, sensitive habitat areas and other critical natural lands in Sussex County," to include "strategies for preserving environmental areas from development," and to "recognize the Inland Bays, their tributaries and other waterbodies as valuable open space areas of ecological importance."

Much of the proposed ordinance does indeed provide measures to achieve the above goals. However, if adopted in its current form, much of the above protection will fail to materialize.

By permitting the removal of forests up to the time that an application for development is submitted, and by not requiring that trees be replanted in the buffer upon development, much of the conservation value of the buffer will be lost. Manipulation of the buffer width places serious limits on the effectiveness of the measure.

Most concerning, the provision outlined in Sec. G for buffer trading options will simply allow building closer to the water resource. The objective of protecting the resource will be eliminated, and the ordinance will accomplish only protecting the monetary return of the development process. It is extremely costly to manage conservation easements, and that cost would need to be covered by the County where land trusts or other conservation organizations hold the easement.

The assumption that conserving buffer areas off site would add protection to the water resource is flawed; in many cases such areas may already be unlikely to be developed.

We urge you to give careful consideration to four proposed amendments:

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G, the Resource Buffer Options.
4. Add a section on specific enforcement provisions and meaningful penalties for noncompliance.

We thank the Council for its work to improve the resource integrity of Sussex County's waterways, and for your consideration of these comments.

Sincerely,

Jay Martin, President  
410-873-2942  
ubuubok@comcast.net



## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 2:38 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** David Bryan <davebryan00@gmail.com>  
**Sent:** Sunday, January 9, 2022 2:05 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Dear Sirs:

I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. I would like to provide you with the following comments:

The proposed buffer ordinance will not sufficiently preserve buffers, but rather gives incentives to builders to build on buffers. The four points in the draft that need to be addressed before council approval are as follows:

1. Buffer Option - This can negate the whole purpose of this ordinance and was added to the ordinance AFTER the working group disbanded and therefore, was not approved by the working group. This section provides incentives for developers to bypass this ordinance.
2. Width of Buffer - environmental groups recommending wider widths have been ignored. Sussex County (the lowest county on the east coast) will end up with the least buffer compared to surrounding areas. Several councilmen understand this point but it needs to be reinforced by public comment.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this is ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.
4. Enforcement or Penalties - Without this important tool to police the ordinance, this ordinance will not be effective.

Your help is needed to revise the buffer ordinance prior to being accepted by Sussex County.

Best Regards,

David Bryan

16645 Shoal Rd

Lewes

(302) 291-2708

[davebryan00@gmail.com](mailto:davebryan00@gmail.com)





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 2:38 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** David McDonald <david\_mcd@comcast.net>  
**Sent:** Sunday, January 9, 2022 2:02 PM  
**To:** Doug Hudson  
**Subject:** Buffer Ordinance

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Douglas B. Hudson  
Sussex County Council District 4

Mr. Hudson:

I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. I would like to offer the following comments:

1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed.
2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas.
3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, wildlife habitat and waterborne recreational activity. Additionally, replanting must exclude known invasive species and rely on native plants.
4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective.

Thank you for your consideration.

David McDonald  
313 Laurel St.  
Rehoboth Beach





## Jamie Whitehouse

---

**From:** Doug Hudson  
**Sent:** Sunday, January 9, 2022 2:39 PM  
**To:** Jamie Whitehouse  
**Subject:** Fwd: Buffer Ordinance

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**From:** Deborah Shultz <dpshultz@gmail.com>  
**Sent:** Sunday, January 9, 2022 2:01 PM  
**To:** Michael H. Vincent; Cynthia Green; Mark Schaeffer; Doug Hudson; John Rieley  
**Subject:** Buffer Ordinance

**CAUTION:** This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe. Contact the IT Helpdesk if you need assistance.

Greetings, Counselors:

I understand that the Buffer Ordinance is on the agenda for the January 11th, 2022 council meeting. I would like to provide you with the following comments:

1. Buffer Option - Buffer Zones should not be optional. They should be required and not be allowed to be bypassed.

2. Width of Buffer - Sussex County Buffer Zones should be increased to match or exceed the required buffers in Kent and New Castle Counties as well as the recommendations of environmental groups. These increased buffers also need to be enforced. Failure to increase buffer widths will result in Sussex County (currently requiring the smallest buffer on the east coast) with the smallest buffer zones compared to surrounding areas.

3. Replanting of Forest Buffer - CIB's Chris Bason has explained in detail why this is important at the P&Z public hearing, but this has been ignored. This is imperative to protect our water quality, water activities, and wildlife habitat.

4. Enforcement and Penalties - Without these important tools to police the ordinance, this ordinance will not be effective.

Thank you for your consideration.

Sincerely yours,

Deborah Shultz

31427 Riverwood Road

Millsboro, DE 19966

[dpshultz@gmail.com](mailto:dpshultz@gmail.com)



## Jamie Whitehouse

---

**From:** Robin Griffith  
**Sent:** Monday, January 10, 2022 8:47 AM  
**To:** Michael H. Vincent; John Rieley; Cynthia Green; Doug Hudson; Mark Schaeffer  
**Cc:** Jamie Whitehouse  
**Subject:** FW: Contact Form: Buffer Ordinance

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JAN 10 2022

**From:** Zita Dresner <noreply@forms.email>  
**Sent:** Saturday, January 8, 2022 8:46 AM  
**To:** Robin Griffith <rgriffith@sussexcountye.gov>  
**Subject:** Contact Form: Buffer Ordinance

SUSSEX COUNTY  
PLANNING & ZONING

..

Name: Zita Dresner  
Email: [zzd100@aol.com](mailto:zzd100@aol.com)  
Phone: 302-644-2749  
Subject: Buffer Ordinance  
Message: To the Sussex County Councilmembers:

It is critical that Sussex County has an updated buffer ordinance, but the current proposed version of the legislation includes loopholes that weaken the purpose of the buffer ordinance. The current buffer ordinance will not protect Sussex County's wetland resources, significantly improve the current poor water quality, prevent and protect against flooding and hazards associated with climate change, or increase economic value by providing additional open space. To achieve these goals, the buffer ordinance must be amended in the following ways:

1. Increase buffer width of perennial non-tidal rivers and streams from 50 to 100 feet to be consistent with science-based recommendations for minimum buffer width.
2. Remove allowance of non-forest meadow from the Resource Buffer Standards Section 10.D. and require the maintenance of existing forest and replanting of non-forested areas with trees and shrubs to specific densities.
3. Remove in its entirety Section G., the Resource Buffer Options.
4. Add a section on specific enforcement provisions and penalties for noncompliance.

These amendments are needed to make the proposed buffer ordinance stronger and more effective in protecting waterways by preventing loopholes for developers during a time of immense development pressure.

Sincerely,

Zita Dresner  
Lewes





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ExhibitDelaware Interfaith  
Power & Light  
A Religious Response to Climate Change

To: Sussex County Planning &amp; Zoning Commission, Sussex County Staff

From: Dr Randi Johnson, Delaware Interfaith Power &amp; Light - Board Member, Retired USDA

Date: January 9, 2022

Re: Comments on "AN ORDINANCE TO AMEND CHAPTER 99,....."

We at Delaware Interfaith Power and Light (DelPL) commend the county for looking at it's current policy on riparian buffers to help it better achieve the purpose of protecting wetlands and waterways in Sussex County. Water quality is an important issue for Sussex County. DelPL's goal is the preservation of a healthy and sustainable planet in light of climate change; protecting our wetlands and water resources is a key component of this goal.


It is important that our waterways and wetlands become more resilient as we experience increases in extreme precipitation events and a rising sea level. The proposal before the commission may be an improvement over the current zoning requirements but has several issues that must be addressed before it can achieve the goal of protecting our waterways and wetlands. We at DelPL concur with the comments made by Chris Bason with the Delaware Center for the Inland Bays and wish to emphasize some particular concerns.

- The full buffer widths in Table 1 are small given the peer-reviewed research, recommendations of other States, and the USDA NRCS recommendations (especially if wildlife habitat is a goal). These proposed widths get even smaller if one uses buffer averaging and/or the exceptions in subsection G. These alterations will probably be used to reduce the effort needed to meet code rather than improve the quality of a buffer by addressing where additional efforts may be needed. These provisions could therefore significantly reduce the impact of the buffers. We should expect more severe precipitation events (from climate change) and increased storm water (from increasing development in Sussex County) in the future and plan accordingly.
- "Section G. Resource Buffer Options" is especially concerning. The loopholes available to a developer will allow one to essentially ignore a wetland or waterway if they can use an off-site resource buffer in its place. This will leave crucial wetlands and waterways at risk because a lower-cost/different-site option can be chosen.
- The development and maintenance of these buffers is also a concern. Given the proposed changes, one could remove the native vegetation and disturb the soil in a riparian area before one requested a permit. Most all of Delaware would be forested if left undisturbed. Forests are the final successional stages here and would provide the most-stable riparian ecosystem. They should be the goal of a buffer, not a meadow which would be less effective and less resilient. By allowing someone to cut a buffer before applying for a permit would set the process back years, if not decades and also disturb the soil structure. By disturbing the soil structure, the soil has reduced infiltration and is prone to erosion, thus reducing site quality before any "restoration" efforts can begin. We would suggest that forested buffers be the objective and find some way to protect existing native forest vegetation.

- Most new homeowners in Sussex County have no clue what it takes to establish and maintain riparian buffers. Often the developer has not even established a proper buffer and the thought of maintenance is on no one's radar. HOAs are then left with this surprised burden without the knowledge, infrastructure, or financial resources to deal with them adequately. It is important that this ordinance has more specificity in what needs to be done and supplied by developers.
- As a homeowner, I know it is important to know what was on the land before my home was here. I have come across too many stories of water issues because it was not clear what the conditions were before the development and are now hidden under a home. I would therefore like all plans to include both ephemeral and intermittent streams to alert home buyers.

Thank you for this opportunity to comment of these proposed changes. We at DelPL applaud your efforts to keep Sussex County healthy and vibrant.

Sincerely



Randi Johnson, Ph.D

Board Member, Delaware Interfaith Power & Light  
<https://delawareipl.org/>

Retired USDA  
Ocean View DE 19970  
[randi22043@gmail.com](mailto:randi22043@gmail.com)